

THE RING PROGRAMMING LANGUAGE

```
changeringoperator + plus
changeringkeyword SEE PRINT

Print 5 plus 5

changeringoperator plus +
changeringkeyword PRINT SEE
```

Syntax
Flexibility

```
Load "gameengine.ring"

func main
    oGame = New Game
    {
        title = "My First Game"
        sprite
        {
            type = GE_TYPE_PLAYER
            x=400 y=400 width=100 height=100
            file = "images/player.png"
            transparent = true
            Animate=false
            Move=true
            Scaled=true
        }
    }
```

Declarative
Programming

```
# Natural Code
new program {
    Accept 2 numbers then print the sum
}

# Natural Code Implementation
class program
    # Keywords
    Accept=0 numbers=0 then=0 print=0 the=0 sum=0

    # Execution
    func braceexprval x
        value = x
    func getnumbers
        for x=1 to value
            see "Enter Number (" + x + ") :" give nNumber
            aNumbers + nNumber
        next
    func getsum
        nSum = 0
        for x in aNumbers nSum+= x next
        see "The Sum : " + nSum
    private
        value=0 aNumbers=[]
```

Natural
Language
Programming

The Complete Reference

Ring Documentation

Release 1.13

Ring Team

Sep 15, 2020

CONTENTS

1 Applications developed in a few hours	1
1.1 Quotes about Ring	1
1.2 FetchStockData Application	8
1.3 Google API Shortener Application	9
1.4 Video-Music-Player Application	10
1.5 Fifteen Puzzle Game	10
1.6 Analog Clock	12
1.7 Squares Puzzle Game	13
1.8 Samples in this book	13
1.9 Innovative	20
1.10 Practical	21
2 Introduction	23
2.1 Motivation	23
2.2 Ring and other languages	24
2.3 History	24
2.4 Features	25
2.5 License	28
3 Using Ring Notepad	29
3.1 Ring Notepad - Main Window	29
3.2 Creating and running your first Console Application	30
3.3 Creating and running your first GUI/WebAssembly/Mobile Application	32
3.4 Creating and running your first Web Application	34
3.5 Creating and running your first Desktop/Mobile Game	35
3.6 The Main File in the Project	36
3.7 The File Menu	37
3.8 The Edit Menu	38
3.9 The View Menu	39
3.10 The Program Menu	40
3.11 The Browser Menu	41
3.12 The Tools Menu	41
3.13 The Distribute Menu	41
3.14 The Help Menu	42
4 Getting Started - First Style	43
4.1 Hello World	43
4.2 Run the program	43
4.3 Create Executable File	43
4.4 Not Case-Sensitive	43

4.5	Multi-Line literals	44
4.6	Getting Input	44
4.7	No Explicit End For Statements	44
4.8	Using ? to print expression then new line	44
4.9	Writing Comments	45
5	Getting Started - Second Style	46
5.1	Hello World	46
5.2	Run the program	46
5.3	Create Executable File	46
5.4	Not Case-Sensitive	46
5.5	Multi-Line literals	47
5.6	Getting Input	47
5.7	No Explicit End For Statements	47
5.8	Writing Comments	47
6	Getting Started - Third Style	49
6.1	Hello World	49
6.2	Run the program	49
6.3	Create Executable File	49
6.4	Not Case-Sensitive	50
6.5	Multi-Line literals	50
6.6	Getting Input	50
6.7	No Explicit End For Statements	51
6.8	Writing Comments	51
7	Variables	52
7.1	Dynamic Typing	52
7.2	Deep Copy	53
7.3	Implicit Conversion	53
8	Operators	54
8.1	Arithmetic Operators	54
8.2	Relational Operators	54
8.3	Logical Operators	55
8.4	Bitwise Operators	55
8.5	Assignment Operators	55
8.6	Misc Operators	56
8.7	Operators Precedence	56
9	Control Structures - First Style	57
9.1	Branching	57
9.2	Looping	58
9.3	Using The Step option with For in	60
9.4	Using For in to modify lists	60
9.5	Do Again Loop	60
9.6	Exit Command	61
9.7	Exit from two loops	61
9.8	Loop Command	61
9.9	Short-circuit evaluation	62
9.10	Comments about evaluation	63
10	Control Structures - Second Style	64
10.1	Branching	64
10.2	Looping	65

10.3 Exceptions	67
11 Control Structures - Third Style	68
11.1 Branching	68
11.2 Looping	69
11.3 Exceptions	72
12 Getting Input	73
12.1 Give Command	73
12.2 GetChar() Function	73
12.3 Input() Function	74
13 Functions - First Style	75
13.1 Define Functions	75
13.2 Call Functions	76
13.3 Declare parameters	76
13.4 Send Parameters	76
13.5 Main Function	77
13.6 Variables Scope	77
13.7 Return Value	78
13.8 Recursion	78
14 Functions - Second Style	79
14.1 Define Functions	79
14.2 Call Functions	80
14.3 Declare parameters	80
14.4 Send Parameters	80
14.5 Main Function	81
14.6 Variables Scope	81
14.7 Return Value	82
14.8 Recursion	82
15 Functions - Third Style	83
15.1 Define Functions	83
15.2 Call Functions	84
15.3 Declare parameters	84
15.4 Send Parameters	84
15.5 Main Function	85
15.6 Variables Scope	85
15.7 Return Value	86
15.8 Recursion	86
16 Program Structure	87
16.1 Source Code File Sections	87
16.2 Using Many Source Code Files	87
16.3 Load Package	88
16.4 Load Again	89
17 Lists	90
17.1 Create Lists	90
17.2 Add Items	91
17.3 Get List Size	91
17.4 Delete Item From List	91
17.5 Get List Item	92
17.6 Set List Item	92

17.7	Search	92
17.8	Sort	93
17.9	Reverse	94
17.10	Insert Items	94
17.11	Nested Lists	95
17.12	Copy Lists	95
17.13	First-class lists	95
17.14	Using Lists during definition	96
17.15	Passing Lists to Functions	96
17.16	Access List Items by String Index	97
17.17	Passing Parameters or Arguments Using List	97
17.18	Passing Parameters or Argumnents Using List Array	98
17.19	Return Parameters as List or Hash Table	98
17.20	Creating a Multi-Dimensional Array using List	99
17.21	Swap Items	101
18	Strings	102
18.1	String Literals	102
18.2	Get String Length	102
18.3	Convert Letters Case	102
18.4	Access String Letters	103
18.5	Left() Function	103
18.6	Right() Function	104
18.7	Trim() Function	104
18.8	Copy() Function	104
18.9	Lines() Function	104
18.10	Substr() Function	105
18.11	Find substring	105
18.12	Get substring from position to end	105
18.13	Get Number of Characters From Position	105
18.14	Transform Substring To Another Substring	106
18.15	strcmp() Function	106
18.16	str2list() and list2str() Functions	106
18.17	Merge binary characters	107
19	Date and Time	109
19.1	Clock() Function	109
19.2	ClocksPerSecond() Function	109
19.3	Time() Function	110
19.4	Date() Function	110
19.5	TimeList() Function	110
19.6	AddDays() Function	112
19.7	DiffDays() Function	112
19.8	EpochTime() Function	112
20	Check Data Type and Conversion	114
20.1	Check Data Type	114
20.2	IsString() Function	114
20.3	IsNumber() Function	115
20.4	IsList() Function	115
20.5	Type() Function	115
20.6	IsNULL() Function	115
20.7	Check Character	116
20.8	IsAlNum() Function	116

20.9	IsAlpha() Function	117
20.10	IsCntrl() Function	117
20.11	IsDigit() Function	117
20.12	IsGraph() Function	117
20.13	IsLower() Function	118
20.14	IsPrint() Function	118
20.15	IsPunct() Function	118
20.16	IsSpace() Function	119
20.17	IsUpper() Function	119
20.18	IsXdigit() Function	119
20.19	Conversion	119
20.20	Number() Function	120
20.21	String() Function	120
20.22	Ascii() Function	120
20.23	Char() Function	121
20.24	Hex() Function	121
20.25	Dec() Function	121
20.26	Str2hex() Function	121
20.27	Hex2str() Function	122
21	Mathematical Functions	123
21.1	List of functions	123
21.2	Example	124
21.3	Random() Function	125
21.4	SRandom() Function	126
21.5	Unsigned() Function	126
21.6	Decimals() Functions	127
21.7	Using _ in numbers	128
21.8	Using f after numbers	128
22	Files	129
22.1	Read() Function	130
22.2	Write() Function	130
22.3	Dir() Function	130
22.4	Rename() Function	131
22.5	Remove() Function	131
22.6	Fopen() Function	131
22.7	Fclose() Function	132
22.8	Fflush() Function	132
22.9	Freopen() Function	132
22.10	Tempfile() Function	133
22.11	Tempname() Function	133
22.12	Fseek() Function	133
22.13	Ftell() Function	134
22.14	Rewind() Function	134
22.15	Fgetpos() Function	134
22.16	Fsetpos() Function	134
22.17	Clearerr() Function	134
22.18	Feof() Function	135
22.19	Ferror() Function	135
22.20	Perror() Function	135
22.21	Fgetc() Function	135
22.22	Fgets() Function	135
22.23	Fputc() Function	136

22.24 Fputs() Function	136
22.25 Ungetc() Function	136
22.26 Fread() Function	136
22.27 Fwrite() Function	136
22.28 Fexists() Function	137
22.29 Example	137
22.30 Numbers and Bytes	139
23 System Functions	140
23.1 System() Function	141
23.2 SysGet() Function	141
23.3 IsMSDOS() Function	141
23.4 IsWindows() Function	141
23.5 IsWindows64() Function	142
23.6 IsUnix() Function	142
23.7 IsMacOSX() Function	142
23.8 IsLinux() Function	142
23.9 IsFreeBSD() Function	142
23.10 IsAndroid() Function	143
23.11 Example	143
23.12 Windowsnl() Function	143
23.13 Get Command Line Arguments	144
23.14 Get Active Source File Name	145
23.15 PrevFileName() Function	145
23.16 CurrentDir() Function	146
23.17 ExeFileName() Function	146
23.18 ChDir() Function	146
23.19 ExeFolder() Function	146
23.20 Version() Function	146
23.21 Shutdown() Function	147
24 Eval() and Debugging	148
24.1 Try/Catch/Done	148
24.2 Eval() Function	149
24.3 Raise() Function	149
24.4 Assert() Function	150
25 Demo Programs	151
25.1 Language Shell	151
25.2 Main Menu	152
26 ODBC Functions	155
26.1 odbc_init() Function	155
26.2 odbc_drivers() Function	156
26.3 odbc_datasources() Function	156
26.4 odbc_close() Function	156
26.5 Print List of ODBC Drivers	156
26.6 Print List of ODBC Data Sources	157
26.7 odbc_connect() Function	158
26.8 odbc_disconnect() Function	158
26.9 Open and Close Connection	158
26.10 odbc_execute() Function	159
26.11 odbc_colcount() Function	159
26.12 odbc_fetch() Function	159
26.13 odbc_getdata() Function	159

26.14 Execute Query and Print Result	159
26.15 odbc_tables() Function	160
26.16 odbc_columns() Function	161
26.17 odbc_autocommit() Function	161
26.18 odbc_commit() Function	162
26.19 odbc_rollback() Function	162
26.20 Transactions and Using Commit and Rollback	162
26.21 Save and Restore images	163
27 MySQL Functions	164
27.1 MySQL_Info() Function	164
27.2 MySQL_Init() Function	165
27.3 MySQL_Error() Function	165
27.4 MySQL_Connect() Function	165
27.5 MySQL_Close() Function	165
27.6 MySQL_Query() Function	166
27.7 Create Database	166
27.8 Create Table and Insert Data	166
27.9 MySQL_Insert_ID() Function	167
27.10 MySQL_Result() Function	168
27.11 MySQL_Next_Result() Function	168
27.12 Print Query Result	168
27.13 MySQL_Columns() Function	169
27.14 MySQL_Result2() Function	170
27.15 MySQL_Escape_String() Function	170
27.16 Save Image inside the database	171
27.17 Restore Image From The Database	171
27.18 MySQL_AutoCommit() Function	172
27.19 MySQL_Commit() Function	172
27.20 MySQL_Rollback() Function	172
27.21 Transaction Example	172
28 SQLite Functions	174
28.1 sqlite_init() function	174
28.2 sqlite_open() function	174
28.3 sqlite_execute() function	174
28.4 sqlite_close() function	174
28.5 Example	175
29 PostgreSQL Functions	177
29.1 Loading the library	177
29.2 Examples	177
29.3 RingPostgreSQL Constants	180
29.4 RingPostgreSQL Functions	181
30 Security and Internet Functions	185
30.1 MD5() Function	185
30.2 SHA1() Function	186
30.3 SHA256() Function	186
30.4 SHA512() Function	187
30.5 SHA384() Function	187
30.6 SHA224() Function	188
30.7 Encrypt() Function	188
30.8 Decrypt() Function	188
30.9 Encryption and Decryption Example	188

30.10 File Hash	189
30.11 Randbytes() Function	190
30.12 Download() Function	190
30.13 SendEmail() Function	190
31 Object Oriented Programming (OOP)	191
31.1 Classes and Objects	191
31.2 Access Objects Using Braces	193
31.3 Composition	194
31.4 Setter and Getter	195
31.5 Private Attributes and Methods	196
31.6 Operator Overloading	197
31.7 Inheritance	199
31.8 Dynamic Attributes	200
31.9 Packages	201
31.10 Printing Objects	202
31.11 Find() and List of Objects	202
31.12 Sort() and List of Objects	203
31.13 Using Self.Attribute and Self.Method()	205
31.14 Using This.Attribute and This.Method()	205
31.15 Using This in the class region as Self	206
31.16 Default value for object attributes	207
32 Functional Programming	208
32.1 Pure Functions	208
32.2 First-class Functions	209
32.3 Higher-order Functions	210
32.4 Anonymous and Nested Functions	210
32.5 Equality of functions	212
33 Reflection and Meta-programming	213
33.1 locals() Function	214
33.2 globals() Function	214
33.3 functions() Function	215
33.4 cfunctions() Function	215
33.5 islocal() Function	216
33.6 isglobal() Function	216
33.7 isfunction() Function	217
33.8 iscfunction() Function	217
33.9 packages() Function	218
33.10 ispackage() Function	218
33.11 classes() Function	219
33.12 isclass() Function	220
33.13 packageclasses() Function	220
33.14 ispackageclass() Function	221
33.15 classname() Function	221
33.16 objectid() Function	222
33.17 isobject() Function	222
33.18 attributes() Function	222
33.19 methods() Function	223
33.20 isattribute() Function	223
33.21 isprivateattribute() Function	224
33.22 ismethod() Function	224
33.23 isprivatemethod() Function	225

33.24 addattribute() Function	225
33.25 addmethod() Function	226
33.26 getattribute() function	228
33.27 setattrtute() function	229
33.28 mergemethods() Function	230
33.29 packagename() Function	231
34 Declarative Programming using Nested Structures	232
34.1 Creating Objects inside Lists	232
34.2 Composition and Returning Objects and Lists by Reference	233
34.3 Executing code after the end of object access	235
34.4 Declarative Programming on the top of Object-Oriented	235
34.5 More beautiful Code	237
35 Natural Language Programming	238
35.1 History	238
35.2 Example	238
35.3 Change the Ring Keyword ‘And’	239
35.4 Change the Ring Operator ‘+’	241
35.5 Change the ‘=’ operator to ‘is’	241
35.6 Using Eval() with our Natural Code	242
35.7 BraceStart and BraceEnd Methods	244
35.8 BraceExprEval Method	244
35.9 Real Natural Code	245
35.10 BraceError() Method	245
35.11 Clean Natural Code	246
36 Using the Natural Library	249
36.1 Natural Library - Demo Program	249
36.2 Defining Commands	252
36.3 Natural Library - Operators	254
36.4 Defining commands using classes	255
37 Scope Rules for Variables and Attributes	257
37.1 Three Scopes	257
37.2 Defining Variables and Variables Access	257
37.3 How Ring find the variable?	258
37.4 Using Object.Attribute	258
37.5 The Self Object	258
37.6 How Ring Define Variables and Attributes	259
37.7 Conflict between Global Variables and Class Attributes	259
37.8 Conflict between Class Attributes and Local Variables	261
37.9 Using Braces to access objects inside Class Methods	262
37.10 Accessing the class attributes from braces inside class methods	264
37.11 Creating a Class for each Window in GUI applications	265
37.12 Conflict between self inside braces and self in the class region	267
37.13 Using braces to escape from the current object scope	270
37.14 The For Loops uses the local scope	271
37.15 Summary of Scope Rules	271
38 Scope Rules for Functions and Methods	274
38.1 How Ring find the Functions and Methods?	274
38.2 Example about Sharing Names between Functions and Methods	275
38.3 Calling a function sharing the name with a method in the current class	276

39 Syntax Flexibility	278
39.1 Change Language Keywords	278
39.2 Change Language Operators	279
39.3 Load Syntax Files	280
39.4 Using “()” around the function parameters	281
39.5 Using Semi-colon after and between statements	282
39.6 Using \$ and @ in the start of the variable name	282
39.7 Using the ‘elseif’ keyword as ‘but’ in if statement	283
39.8 Using the ‘else’ keyword as ‘other’ in switch statement	283
39.9 Using the ‘end’ keyword in different control structures	283
39.10 Using braces to start and end different control structures	284
39.11 Using ‘put’ and ‘get’ as ‘see’ and ‘give’	285
39.12 Using ‘case’ as ‘on’ in switch statements	286
39.13 Using ‘def’ as ‘func’ in functions/methods definition	286
39.14 Using braces { } in Packages/Classes/Functions	286
39.15 Using ‘end’ keyword after Packages/Classes/Functions	287
39.16 Using ‘endpackage’/‘endclass’/‘endfunc’ keywords after Packages/Classes/Functions	287
39.17 Ignore new lines after keywords	288
40 Introduction to the Type Hints Library	289
40.1 Why Type Hints?	289
40.2 Example	289
40.3 User Types	290
40.4 Using Types inside Code	290
40.5 Rules	291
41 The Trace Library and the Interactive Debugger	292
41.1 Loading the Trace library	292
41.2 Trace All Events	292
41.3 Trace control flow between functions	293
41.4 Pass Error	293
41.5 Interactive Debugger	293
41.6 Execute Program Line by Line	294
41.7 BreakPoint	294
41.8 Disable BreakPoints	294
41.9 Using the Interactive Debugger	295
42 Embedding Ring in Ring	297
42.1 Embedding Ring in Ring without sharing the State	297
42.2 Serial Execution of Programs	298
42.3 ring_state_setvar()	298
42.4 ring_state_new() and ring_state_mainfile()	299
42.5 Runtime Errors when Embedding Ring in Ring	300
42.6 ring_state_filetokens() function	301
43 Stdlib Functions	303
43.1 Puts() function	303
43.2 Print() function	303
43.3 Print2Str() Function	304
43.4 GetString() function	304
43.5 GetNumber() function	304
43.6 AppPath() function	304
43.7 JustFilePath() function	305
43.8 JustFileName() function	305
43.9 Value() function	306

43.10 Times() function	306
43.11 Map() function	306
43.12 Filter() function	307
43.13 Split() function	307
43.14 SplitMany() function	307
43.15 Capitalized() function	308
43.16 IsSpecial() function	308
43.17 IsVowel() function	308
43.18 LineCount() function	309
43.19 Factorial() function	309
43.20 Fibonacci() function	309
43.21 IsPrime() function	310
43.22 Sign() function	310
43.23 List2File() function	310
43.24 File2List() function	311
43.25 StartsWith() function	311
43.26 EndsWith() function	311
43.27 GCD() function	312
43.28 LCM() function	312
43.29 SumList() function	312
43.30 ProdList() function	313
43.31 EvenOrOdd() function	313
43.32 Factors() function	313
43.33 IsPalindrome() function	314
43.34 IsLeapYear() function	314
43.35 BinaryDigits() function	314
43.36 MatrixMulti() function	315
43.37 MatrixTrans() function	315
43.38 DayOfWeek() function	315
43.39 Permutation() function	316
43.40 ReadLine() function	316
43.41 SubString() function	316
43.42 ChangeString() function	317
43.43 Sleep() function	317
43.44 IsMainSourceFile() function	318
43.45 DirExists() function	318
43.46 MakeDir() function	318
43.47 Fsize() function	319
43.48 TrimAll() function	319
43.49 TrimLeft() function	319
43.50 TrimRight() function	319
43.51 EpochTime() function	319
43.52 SystemCmd() Function	320
43.53 ListAllFiles() Function	320
43.54 SystemSilent() Function	320
43.55 OSCreateOpenFolder() Function	320
43.56 OSCopyFolder() Function	321
43.57 OSDeleteFolder() Function	321
43.58 OSCopyFile() Function	321
43.59 OSDeleteFile() Function	321
43.60 OSRenameFile() Function	321
43.61 List2Code() Function	322
43.62 Str2ASCIIList()	322
43.63 ASCIIList2Str()	322

43.64 IsListContainsItems()	323
43.65 IsBetween()	323
43.66 TimeInfo()	323
44 Stdlib Classes	325
44.1 StdBase Class	326
44.2 String Class	326
44.3 List Class	328
44.4 Stack Class	330
44.5 Queue Class	331
44.6 HashTable Class	331
44.7 Tree Class	332
44.8 Math Class	334
44.9 DateTime Class	337
44.10 File Class	339
44.11 System Class	340
44.12 Debug Class	340
44.13 DataType Class	341
44.14 Conversion Class	343
44.15 ODBC Class	343
44.16 MySQL Class	345
44.17 SQLite Class	346
44.18 PostgreSQL Class	347
44.19 Security Class	349
44.20 Internet Class	349
45 Desktop, WebAssembly and Mobile Development using RingQt	350
45.1 The First GUI Application	350
45.2 The Events Loop	352
45.3 Using Layout	352
45.4 Using the QTextEdit Class	353
45.5 Using the QListWidget Class	355
45.6 Using QTreeView and QFileSystemModel	357
45.7 Using QTreeWidget and QTreeWidgetItem	358
45.8 Using QComboBox Class	360
45.9 Creating Menubar	361
45.10 Context Menu	363
45.11 Creating Toolbar	364
45.12 Creating StatusBar	366
45.13 Using QDockWidget	367
45.14 Using QTabWidget	368
45.15 Using QTableWidget	370
45.16 Using QProgressBar	371
45.17 Using QSpinBox	371
45.18 Using QSlider	372
45.19 Using QDateEdit	373
45.20 Using QDial	374
45.21 Using QWebView	377
45.22 Using QCheckBox	378
45.23 Using QRadioButton and QButtonGroup	380
45.24 Adding Hyperlink to QLabel	381
45.25 QVideoWidget and QMediaPlayer	382
45.26 Using QFrame	384
45.27 Display Image using QLabel	385

45.28 Menubar and StyleSheet Example	387
45.29 QLineEdit Events and QMessageBox	388
45.30 Other Widgets Events	390
45.31 Using the QTimer Class	392
45.32 Using QProgressBar and Timer	393
45.33 Display Scaled Image using QLabel	394
45.34 Using the QFileDialog Class	395
45.35 Drawing using QPainter	396
45.36 Printing using QPrinter	398
45.37 Using QPrintPreviewDialog	399
45.38 Creating More than one Window	402
45.39 Playing Sound	403
45.40 Using the QColorDialog Class	403
45.41 Using qLCDNumber Class	405
45.42 Movable Label Example	406
45.43 QMessageBox Example	407
45.44 Using QInputDialog Class	408
45.45 Dialog Functions	409
45.46 KeyPress and Mouse Move Events	410
45.47 Moving Objects using the Mouse	411
45.48 Inheritance from GUI Classes	415
45.49 Using QDesktopWidget Class	416
45.50 Rotate Text	417
45.51 Change Focus	419
45.52 Regular Expressions	420
45.53 Simple Client and Server Example	421
45.54 Dynamic Objects	423
45.55 Weight History Application	425
45.56 Notepad Application	429
45.57 The Cards Game	444
45.58 Classes and their Methods to use the default events	450
45.59 Methods to use Events with Events Filter	453
45.60 The Difference between Qt and RingQt	454
45.61 RingQt Classes and their Qt Documentation	455
45.62 New Classes names - Index Start from 1	455
45.63 Creating Reports using the WebLib and the GUILib	456
46 Using the Form Designer	459
46.1 The Designer Windows	460
46.2 The Toolbox	460
46.3 The Properties	460
46.4 Running Forms	461
46.5 Events Code	462
46.6 Keyboard Shortcuts	464
46.7 Menubar Designer	464
46.8 Window Flags	465
46.9 Entering Items	466
46.10 Using Layouts	466
46.11 More Samples and Tests	466
47 Graphics Programming using RingQt3D	467
47.1 Drawing Cube	467
47.2 Drawing Torus	469
47.3 Drawing Sphere	470

47.4	Drawing Cylinder	472
47.5	Drawing Cone	474
47.6	Drawing Plane	476
47.7	Texture	478
47.8	Key Press	480
47.9	Object Picker	482
47.10	Frame Action	485
47.11	Text 2D	488
47.12	Extruded Text	490
47.13	Model	492
47.14	Model Texture	493
47.15	Draw Office	495
47.16	Many Objects	497
47.17	Camera	500
47.18	Scence	502
48	Objects Library for RingQt Application	507
48.1	Library Usage with GUI Applications	507
48.2	Example	508
48.3	openWindowAndLink() Function	510
48.4	openWindowInPackages() Function	511
48.5	Objects Library Source Code	512
49	Multi-language Applications	513
49.1	Using String2Constant	513
49.2	Form Designer Translation	514
49.3	Forms Translation	515
50	Building RingQt Applications for Mobile	517
50.1	Download Requirements	517
50.2	Update the Android SDK	517
50.3	Install Qt for Android	518
50.4	Using Ring2EXE	518
50.5	The Qt project for your Ring application	518
50.6	Comments about developing for Android using RingQt	519
51	Building RingQt Applications for WebAssembly	521
51.1	Download Requirements	521
51.2	Using Ring2EXE	521
51.3	The Qt project for your Ring application	522
51.4	Comments about developing for WebAssembly using RingQt	522
51.5	Dialogs	523
51.6	Online Applications	524
52	Web Development (CGI Library)	525
52.1	Configure the Apache web server	525
52.2	Ring CGI Hello World Program	526
52.3	Hello World Program using the Web Library	526
52.4	Web Library Features	527
52.5	HTTP Get Example	527
52.6	HTTP POST Example	532
52.7	Upload Files	534
52.8	Cookies	538
52.9	URL Encode	539
52.10	Templates	540

52.11	HTML Special Characters	543
52.12	Hash Functions	543
52.13	Random Image	545
52.14	HTML Lists	546
52.15	HTML Tables	549
52.16	Gradient	550
52.17	Generating Pages using Objects	551
52.18	HtmlPage Class	555
52.19	Using Bootstrap Library using Functions	556
52.20	Using Bootstrap Library using Objects	558
52.21	CRUD Example using MVC	560
52.22	Users registration and Login	563
52.23	Database, ModelBase & ControllerBase classes	569
52.24	WebLib API	574
52.25	Application Class	575
52.26	Page Class	576
52.27	ScriptFunctions Class	578
52.28	StyleFunctions Class	578
52.29	WebPage Class	579
52.30	HtmlPage Class	580
53	Deploying Web Applications in the Cloud	581
53.1	Introduction	581
53.2	Usage	582
53.3	Ring source code files and permissions	582
53.4	Hello World program	583
53.5	Application Database	583
53.6	Deploying after updates	584
53.7	Local Tests	584
54	Graphics and 2D Games programming using RingAllegro	585
54.1	Drawing, Animation and Input	585
54.2	Using TrueType Fonts	592
54.3	Playing Sound Files	593
54.4	Scaling and Rotating Images	594
54.5	Display Transparent Image	595
54.6	Using Threads	596
55	Demo Project - Game Engine for 2D Games	599
55.1	Project Layers	599
55.2	Graphics Library bindings	599
55.3	Interface to graphics library	600
55.4	Game Engine Classes	600
55.5	Games Layer	601
55.6	Game Class	601
55.7	GameObject Class	602
55.8	Sprite Class	602
55.9	Text Class	603
55.10	Animate Class	603
55.11	Sound Class	604
55.12	Map Class	604
55.13	Using the Game Engine - Creating the Game Window	604
55.14	Using the Game Engine - Drawing Text	605
55.15	Using the Game Engine - Moving Text	606

55.16 Using the Game Engine - Playing Sound	608
55.17 Using the Game Engine - Animation	608
55.18 Using the Game Engine - Animation and Functions	610
55.19 Using the Game Engine - Sprite - Automatic Movement using Keyboard	611
55.20 Using the Game Engine - Sprite - Keypress event	612
55.21 Using the Game Engine - Sprite - Mouse event	613
55.22 Using the Game Engine - Sprite - State event	614
55.23 Using the Game Engine - Animate - Events	615
55.24 Using the Game Engine - Map	617
55.25 Using the Game Engine - Map Events	618
55.26 Using the Game Engine - Object and Drawing	620
55.27 Stars Fighter Game	624
55.28 Flappy Bird 3000 Game	631
55.29 Super Man 2016 Game	638
56 Building Games For Android	650
56.1 Download Requirements and Update the Android SDK	650
56.2 Project Folder	651
56.3 Building the project	652
57 Developing Games using RingRayLib	653
57.1 Introduction	653
57.2 Basic Window	653
57.3 Input Keys	654
57.4 Input Mouse	655
57.5 3D Camera	656
57.6 3D Camera Free	658
57.7 Mouse Wheel	659
57.8 Input Multi-touch	660
57.9 Camera First Person	662
57.10 3D Picking	664
57.11 Full Screen	666
57.12 Two Cubes	667
57.13 Basic Shapes	670
57.14 Draw Ring	671
57.15 Bezier Lines	674
57.16 Collision Area	675
57.17 Following Eyes	677
57.18 Colors Palette	679
57.19 Rectangle Scaling	682
57.20 Music Playing	684
57.21 Sound Loading	685
57.22 Image Drawing	687
57.23 Image Generation	688
57.24 Texture Source	690
57.25 Geometric Shapes	692
57.26 Cubic Map	694
57.27 Functions	696
58 Using RingOpenGL and RingFreeGLUT for 3D Graphics	706
58.1 Samples Source (Authors)	706
58.2 What is RingOpenGL?	706
58.3 What is RingFreeGLUT?	707
58.4 The First Window using RingFreeGLUT	707

58.5	Drawing using RingOpenGL	708
58.6	The First Triangle	710
58.7	Window Resize Event	711
58.8	Triangle Rotation	712
58.9	Keyboard Events and Colors	714
58.10	The Camera	716
58.11	Mouse Events	723
58.12	Menu Events	727
58.13	Using Fonts	734
58.14	Frames Per Second	742
58.15	Make a Cube using RingOpenGL and RingFreeGLUT	751
59	Using RingOpenGL and RingAllegro for 3D Graphics	755
59.1	3D Cube and Texture	755
59.2	Many Cubes	759
59.3	TicTacToe 3D Game	765
59.4	More 3D Samples	775
60	The Gold Magic 800 Game	778
60.1	The Game Story	778
60.2	How to play?	778
60.3	What will you learn?	778
60.4	Screen Shots	779
60.5	Source Code	780
61	Performance Tips	782
61.1	Introduction	782
61.2	Creating Lists	784
61.3	Arithmetic Operations	785
61.4	Using len() and For Loops	785
61.5	Calling Functions and Methods	786
62	Command Line Options	788
62.1	Printing Tokens	788
62.2	Printing Rules	790
62.3	Printing Intermediate Code	795
62.4	Printing Final Intermediate Code	797
62.5	CGI Support	801
62.6	No Run	802
62.7	Printing Instruction Operation Code	802
62.8	Performance	802
62.9	Generate Object File	803
62.10	Generate Embedded Object File	803
63	Distributing Ring Applications (Manual)	804
63.1	Distributing Applications for Microsoft Windows	804
63.2	Protecting the Source Code	805
63.3	The files ring.ring and ring.ringo	805
63.4	Creating Windows Installer	805
63.5	Using C/C++ Compiler and Linker	805
63.6	Distributing Applications and Games for Mobile	806
64	Distributing Ring Applications using Ring2EXE	807
64.1	Using Ring2EXE	807
64.2	How Ring2EXE works?	807

64.3	Example	808
64.4	Options	808
64.5	Building standalone console application	809
64.6	Distributing RingAllegro Applications	809
64.7	Distributing RingQt Applications	810
64.8	Distributing Applications for Mobile using RingQt	811
64.9	Distributing Applications for WebAssembly using RingQt	811
64.10	Building the Cards Game for Mobile using RingQt	811
64.11	Building the Weight History Application for Mobile using RingQt	812
64.12	Building the Form Designer for Mobile using RingQt	813
64.13	Creating the Qt resource file using Folder2qrc	815
64.14	Important Information about Ring2EXE	815
65	The Ring Package Manager (RingPM)	816
65.1	Features	816
65.2	Discovering Packages	816
65.3	Updating the RingPM Registry	817
65.4	Installing Packages	817
65.5	Printing List of Installed Packages	818
65.6	Run Package	818
65.7	Update Package	819
65.8	Remove Package	819
65.9	Deleting All Packages	819
65.10	Creating New Package	819
65.11	The Package Description File	821
65.12	Create Package in the Current Folder	822
65.13	The RingPM Registry File	825
66	Using ZeroLib	826
66.1	Introduction	826
66.2	Z() function	826
66.3	ZeroBasedList Class	826
66.4	ZeroBasedString Class	827
66.5	Source Code	828
67	FoxRing Functions Reference	829
67.1	FoxRing functions	829
67.2	frAbs() function	830
67.3	frAsc() function	830
67.4	frAddBs() function	831
67.5	frAt() function	831
67.6	frAtC() function	832
67.7	frChr() function	832
67.8	frEmpty() function	833
67.9	frFile() function	833
67.10	frFileToStr() function	833
67.11	frStr() function	834
67.12	frSetIsEmpty() function	835
67.13	frSpace() function	835
67.14	frInList() function	835
67.15	frForcePath() function	836
67.16	frAllTrim() function	836
67.17	frLTrim() function	836
67.18	frJustDrive() function	836

67.19 frJustExt() function	836
67.20 frJustStem() function	837
67.21 frRTrim() function	837
67.22 frJustPath() function	837
67.23 frForceExt() function	837
67.24 frALines() function	837
67.25 frJustFName() function	837
67.26 frPadL() function	837
67.27 frPadR() function	838
67.28 frProper() function	838
67.29 frReplicate() function	838
67.30 frLen() function	838
67.31 frStuff() function	838
67.32 frSubStr() function	839
67.33 frStrTran() function	839
67.34 frListToString() function	839
67.35 frInt() function	839
67.36 frStringToList() function	839
67.37 frIIf() function	839
67.38 frVal() function	840
67.39 frBetween() function	840
67.40 frSetSeparatorTo() function	840
67.41 frTransform() function	841
67.42 frVarType() function	841
67.43 Example	842
68 BigNumber Library	844
68.1 Loading the library	844
68.2 Examples	844
68.3 BigNumber Functions	846
68.4 BigNumber Class	846
68.5 Library Source Code	846
69 Using RingLibCurl	847
69.1 Get Request	847
69.2 Post Request	847
69.3 Facebook Login	848
69.4 Save Output to String	849
69.5 Get Stock Data From Yahoo	849
70 RingLibCurl Functions Reference	851
70.1 Introduction	851
70.2 Reference	851
71 Using RingZip	860
71.1 Create Zip File	860
71.2 Extract Zip File	860
71.3 Print Files in Zip file	860
71.4 Using RingZip Classes	861
71.5 Zip Class Reference	862
71.6 ZipEntry Class Reference	862
72 RingLibZip Functions Reference	863
72.1 Introduction	863
72.2 Reference	863

73 RingMurmurHash Functions Reference	864
73.1 MurmurHash1 functions	864
73.2 MurmurHash2 functions	864
73.3 MurmurHash3 functions	864
73.4 Example	865
74 RingConsoleColors Functions Reference	866
74.1 Introduction	866
74.2 Reference	866
75 RingAllegro Functions Reference	868
75.1 Introduction	868
75.2 Reference	868
76 Using RingLibSDL	888
76.1 Create Window	888
76.2 Display Image	888
76.3 Switch between two images	889
76.4 Draw Rectangle	889
76.5 Display PNG Images	890
76.6 Use TTF Fonts	890
76.7 Display Transparent Images	891
76.8 Close Window Event	892
76.9 Mouse Events	892
76.10 Play Sound	894
77 RingLibSDL Functions Reference	895
77.1 Introduction	895
77.2 Reference	895
78 Using RingLibuv	920
78.1 First Application using RingLibuv	920
78.2 The Events Loop	921
78.3 Server Example	921
78.4 Client Example	923
78.5 Server Example Using Classes	924
78.6 Client Example Using Classes	925
78.7 Threads Example	927
78.8 Threads Example - Using Classes	927
79 RingLibuv Functions Reference	929
79.1 Introduction	929
79.2 Reference	929
80 RingFreeGLUT Functions Reference	938
80.1 Introduction	938
80.2 Reference	938
81 RingStbImage Functions Reference	949
81.1 Introduction	949
81.2 Constants	949
81.3 Functions	950
82 RingOpenGL (OpenGL 3.2) Functions Reference	952
82.1 Introduction	952

82.2 Reference	952
83 RingQt Classes Reference	999
83.1 AbstractAxis Class	999
83.2 AbstractBarSeries Class	1002
83.3 CodeEditor Class	1003
83.4 QAbstractAspect Class	1004
83.5 QAbstractButton Class	1004
83.6 QAbstractCameraController Class	1005
83.7 QAbstractItemView Class	1005
83.8 QAbstractPrintDialog Class	1007
83.9 QAbstractScrollArea Class	1007
83.10 QAbstractSeries Class	1008
83.11 QAbstractSlider Class	1009
83.12 QAbstractSocket Class	1010
83.13 QAbstractSpinBox Class	1011
83.14 QAction Class	1012
83.15 QAllEvents Class	1014
83.16 QApplication Class	1018
83.17 QAreaLegendMarker Class	1018
83.18 QAreaSeries Class	1018
83.19 QAspectEngine Class	1020
83.20 QAxBase Class	1020
83.21 QAxObject Class	1021
83.22 QAxWidget Class	1021
83.23 QAxWidget2 Class	1022
83.24 QBarCategoryAxis Class	1022
83.25 QBarLegendMarker Class	1023
83.26 QBarSeries Class	1023
83.27 QBarSet Class	1023
83.28 QBitmap Class	1025
83.29 QBluetoothAddress Class	1025
83.30 QBluetoothDeviceDiscoveryAgent Class	1025
83.31 QBluetoothDeviceInfo Class	1026
83.32 QBluetoothHostInfo Class	1026
83.33 QBluetoothLocalDevice Class	1027
83.34 QBluetoothServer Class	1027
83.35 QBluetoothServiceDiscoveryAgent Class	1028
83.36 QBluetoothServiceInfo Class	1029
83.37 QBluetoothSocket Class	1030
83.38 QBluetoothTransferManager Class	1031
83.39 QBluetoothTransferReply Class	1031
83.40 QBluetoothTransferRequest Class	1031
83.41 QBluetoothUuid Class	1032
83.42 QBoxLayout Class	1032
83.43 QBoxPlotLegendMarker Class	1033
83.44 QBoxPlotSeries Class	1033
83.45 QBoxSet Class	1034
83.46 QBrush Class	1035
83.47 QBuffer Class	1036
83.48 QButtonGroup Class	1036
83.49 QByteArray Class	1037
83.50 QCalendarWidget Class	1038
83.51 QCamera Class	1040

83.52 QCameraImageCapture Class	1041
83.53 QCameraLens Class	1041
83.54 QCameraSelector Class	1042
83.55 QCameraViewfinder Class	1042
83.56 QCandlestickLegendMarker Class	1043
83.57 QCandlestickModelMapper Class	1043
83.58 QCandlestickSeries Class	1043
83.59 QCandlestickSet Class	1045
83.60 QCategoryAxis Class	1046
83.61 QChar Class	1047
83.62 QChart Class	1049
83.63 QChartView Class	1051
83.64 QCheckBox Class	1051
83.65 QChildEvent Class	1052
83.66 QClipboard Class	1052
83.67 QColor Class	1053
83.68 QColorDialog Class	1055
83.69 QComboBox Class	1056
83.70 QCompleter Class	1057
83.71 QCompleter2 Class	1058
83.72 QCompleter3 Class	1059
83.73 QConeGeometry Class	1059
83.74 QConeMesh Class	1060
83.75 QCoreApplication Class	1060
83.76 QCuboidMesh Class	1061
83.77 QCullFace Class	1062
83.78 QCursor Class	1062
83.79 QCylinderMesh Class	1063
83.80 QDate Class	1063
83.81 QDateEdit Class	1064
83.82 QDateTime Class	1064
83.83 QDateTimeAxis Class	1065
83.84 QDateTimeEdit Class	1066
83.85 QDepthTest Class	1067
83.86 QDesktopServices Class	1067
83.87 QDesktopWidget Class	1068
83.88 QDial Class	1068
83.89 QDialog Class	1069
83.90 QDiffuseSpecularMaterial Class	1069
83.91 QDir Class	1070
83.92 QDirModel Class	1071
83.93 QDockWidget Class	1072
83.94 QDrag Class	1073
83.95 QDragEnterEvent Class	1074
83.96 QDragLeaveEvent Class	1074
83.97 QDragMoveEvent Class	1074
83.98 QDropEvent Class	1074
83.99 QEffect Class	1075
83.100QEntity Class	1075
83.101QEvent Class	1075
83.102QExtrudedTextMesh Class	1076
83.103 QFile Class	1076
83.104 QFile2 Class	1077
83.105 QFileDevice Class	1077

83.106QFileDialog Class	1077
83.107QFileInfo Class	1080
83.108QFileSystemModel Class	1081
83.109QFirstPersonCameraController Class	1082
83.110QFont Class	1083
83.111QFontDialog Class	1085
83.112QFontMetrics Class	1085
83.113QForwardRenderer Class	1086
83.114QFrame Class	1087
83.115QFrame2 Class	1087
83.116QFrame3 Class	1087
83.117QFrameAction Class	1087
83.118QGeoAddress Class	1088
83.119QGeoAreaMonitorInfo Class	1088
83.120QGeoAreaMonitorSource Class	1089
83.121QGeoCircle Class	1089
83.122QGeoCoordinate Class	1089
83.123QGeoPositionInfo Class	1090
83.124QGeoPositionInfoSource Class	1090
83.125QGeoRectangle Class	1091
83.126QGeoSatelliteInfo Class	1091
83.127QGeoSatelliteInfoSource Class	1092
83.128QGeoShape Class	1092
83.129QGoochMaterial Class	1092
83.130QGradient Class	1093
83.131QGraphicsScene Class	1093
83.132QGraphicsVideoItem Class	1096
83.133QGraphicsView Class	1096
83.134QGridLayout Class	1098
83.135QGuiApplication Class	1099
83.136QHBarModelMapper Class	1101
83.137QHBoxLayout Class	1102
83.138QHBoxLayoutPlotModelMapper Class	1102
83.139QHCandlestickModelMapper Class	1103
83.140QHPieModelMapper Class	1104
83.141QHXYModelMapper Class	1105
83.142QHeaderView Class	1106
83.143QHorizontalBarSeries Class	1108
83.144QHorizontalPercentBarSeries Class	1108
83.145QHorizontalStackedBarSeries Class	1109
83.146QHostAddress Class	1109
83.147QHostInfo Class	1109
83.148QIODevice Class	1110
83.149QIcon Class	1111
83.150QImage Class	1111
83.151QInputAspect Class	1112
83.152QInputDialog Class	1113
83.153QJsonArray Class	1114
83.154QJsonDocument Class	1115
83.155QJsonObject Class	1115
83.156QJsonParseError Class	1116
83.157QJsonValue Class	1116
83.158QKeySequence Class	1117
83.159QLCDNumber Class	1117

83.160QLabel Class	1117
83.161QLayout Class	1118
83.162QLegend Class	1119
83.163QLegendMarker Class	1120
83.164QLineEdit Class	1121
83.165QLineSeries Class	1123
83.166QLinearGradient Class	1124
83.167QListView Class	1124
83.168QListWidget Class	1125
83.169QListWidgetItem Class	1126
83.170QLogValueAxis Class	1127
83.171QLogicAspect Class	1128
83.172QMainWindow Class	1128
83.173QMaterial Class	1130
83.174QMatrix4x4 Class	1130
83.175QMdiArea Class	1131
83.176QMdiSubWindow Class	1132
83.177QMediaObject Class	1133
83.178QMediaPlayer Class	1133
83.179QMediaPlaylist Class	1134
83.180QMenu Class	1134
83.181QMenuBar Class	1135
83.182QMesh Class	1136
83.183QMessageBox Class	1136
83.184QMetalRoughMaterial Class	1137
83.185QMimeType Class	1138
83.186QMorphPhongMaterial Class	1138
83.187QMovie Class	1139
83.188QMutex Class	1140
83.189QMutexLocker Class	1140
83.190QNetworkAccessManager Class	1141
83.191QNetworkProxy Class	1142
83.192QNetworkReply Class	1142
83.193QNetworkRequest Class	1143
83.194QNmeaPositionInfoSource Class	1143
83.195QNode Class	1144
83.196QObject Class	1144
83.197QObjectPicker Class	1145
83.198QOpenGLBuffer Class	1146
83.199QOpenGLContext Class	1147
83.200QOpenGLDebugLogger Class	1148
83.201QOpenGLFramebufferObject Class	1148
83.202QOpenGLFunctions Class	1149
83.203QOpenGLFunctions_3_2_Core Class	1153
83.204QOpenGLPaintDevice Class	1161
83.205QOpenGLShader Class	1161
83.206QOpenGLShaderProgram Class	1162
83.207QOpenGLTexture Class	1166
83.208QOpenGLTimerQuery Class	1168
83.209QOpenGLVersionProfile Class	1168
83.210QOpenGLVertexArrayObject Class	1168
83.211QOpenGLWidget Class	1169
83.212QOrbitCameraController Class	1169
83.213QPageSetupDialog Class	1170

83.214QPaintDevice Class	1170
83.215QPainter Class	1170
83.216QPainter2 Class	1173
83.217QPainterPath Class	1173
83.218QPen Class	1174
83.219QPerVertexColorMaterial Class	1175
83.220QPercentBarSeries Class	1175
83.221QPhongMaterial Class	1175
83.222QPicture Class	1176
83.223QPieLegendMarker Class	1176
83.224QPieSeries Class	1176
83.225QPieSlice Class	1178
83.226QPixmap Class	1180
83.227QPixmap2 Class	1181
83.228QPlainTextEdit Class	1181
83.229QPlaneMesh Class	1184
83.230QPoint Class	1184
83.231QPointF Class	1184
83.232QPointLight Class	1185
83.233QPolarChart Class	1185
83.234QPrintDialog Class	1185
83.235QPrintPreviewDialog Class	1186
83.236QPrintPreviewWidget Class	1186
83.237QPrinter Class	1187
83.238QPrinterInfo Class	1188
83.239QProcess Class	1189
83.240QProgressBar Class	1190
83.241QPushButton Class	1191
83.242QQmlEngine Class	1191
83.243QQmlError Class	1192
83.244QQuaternion Class	1192
83.245QQuickView Class	1193
83.246QQuickWidget Class	1194
83.247QRadioButton Class	1194
83.248QRect Class	1195
83.249QRegion Class	1196
83.250QRegularExpression Class	1197
83.251QRegularExpressionMatch Class	1198
83.252QRegularExpressionMatchIterator Class	1198
83.253QRenderAspect Class	1199
83.254QRenderPass Class	1199
83.255QScatterSeries Class	1199
83.256QSceneLoader Class	1200
83.257QScreen Class	1200
83.258QScrollArea Class	1201
83.259QScrollBar Class	1201
83.260QSerialPort Class	1202
83.261QSerialPortInfo Class	1203
83.262QSize Class	1204
83.263QSkyboxEntity Class	1204
83.264QSlider Class	1204
83.265QSphereMesh Class	1205
83.266QSpinBox Class	1205
83.267QSplashScreen Class	1206

83.268QSplineSeries Class	1206
83.269QSplitter Class	1206
83.270 QSqlDatabase Class	1207
83.271 QSqlDriver Class	1208
83.272 QSqlDriverCreatorBase Class	1209
83.273 QSqlError Class	1209
83.274 QSqlField Class	1209
83.275 QSqlIndex Class	1210
83.276 QSqlQuery Class	1210
83.277 QSqlRecord Class	1211
83.278 QStackedBarSeries Class	1212
83.279 QStackedWidget Class	1212
83.280 QStandardPaths Class	1213
83.281 QStatusBar Class	1213
83.282 QString2 Class	1214
83.283 QStringList Class	1215
83.284 QStringRef Class	1216
83.285 QSurfaceFormat Class	1217
83.286 QSystemTrayIcon Class	1219
83.287 QTabBar Class	1219
83.288 QTabWidget Class	1221
83.289 QTableView Class	1222
83.290 QTableWidget Class	1223
83.291 QTableWidgetItem Class	1226
83.292 QTcpServer Class	1227
83.293 QTcpSocket Class	1228
83.294 QTechnique Class	1228
83.295 QTest Class	1229
83.296 QText2DEntity Class	1229
83.297 QTextBlock Class	1229
83.298 QTextBrowser Class	1230
83.299 QTextCharFormat Class	1231
83.300 QTextCodec Class	1233
83.301 QTextCursor Class	1233
83.302 QTextDocument Class	1235
83.303 QTextEdit Class	1237
83.304 QTextStream Class	1239
83.305 QTextStream2 Class	1241
83.306 QTextStream3 Class	1241
83.307 QTextStream4 Class	1241
83.308 QTextStream5 Class	1241
83.309 QTextToSpeech Class	1241
83.310 QTextureLoader Class	1242
83.311 QTextureMaterial Class	1242
83.312 QThread Class	1243
83.313 QThreadPool Class	1244
83.314 QTime Class	1244
83.315 QTimer Class	1245
83.316 QToolBar Class	1245
83.317 QToolButton Class	1246
83.318 QTorusMesh Class	1247
83.319 QTransform Class	1247
83.320 QTreeView Class	1248
83.321 QTreeWidget Class	1250

83.322QTreeWidgetItem Class	1252
83.323QUrl Class	1254
83.324QUuid Class	1255
83.325QVBarModelMapper Class	1255
83.326QVBoxLayout Class	1256
83.327QVBoxLayoutModelMapper Class	1256
83.328QVCandlestickModelMapper Class	1257
83.329QVPieModelMapper Class	1258
83.330QVXYModelMapper Class	1259
83.331QValueAxis Class	1260
83.332QVariant Class	1261
83.333QVariant2 Class	1262
83.334QVariant3 Class	1262
83.335QVariant4 Class	1262
83.336QVariant5 Class	1263
83.337QVariantDouble Class	1263
83.338QVariantFloat Class	1263
83.339QVariantInt Class	1263
83.340QVariantString Class	1263
83.341QVector2D Class	1263
83.342QVector3D Class	1264
83.343QVector4D Class	1265
83.344QVectorQVoice Class	1265
83.345QVideoWidget Class	1266
83.346QVideoWidgetControl Class	1266
83.347QViewport Class	1267
83.348QVoice Class	1267
83.349QWebEngineView Class	1267
83.350QWebView Class	1268
83.351QWebView Class	1268
83.352QWidget Class	1269
83.353QWindow Class	1275
83.354QXYLegendMarker Class	1279
83.355QXYSeries Class	1279
83.356QXmlStreamAttribute Class	1281
83.357QXmlStreamAttributes Class	1281
83.358QXmlStreamEntityDeclaration Class	1282
83.359QXmlStreamEntityResolver Class	1282
83.360QXmlStreamNamespaceDeclaration Class	1282
83.361QXmlStreamNotationDeclaration Class	1282
83.362QXmlStreamReader Class	1282
83.363QXmlStreamWriter Class	1284
83.364Qt3DCamera Class	1285
83.365QI3DWindow Class	1287
83.366RingCodeHighlighter Class	1287
84 Low Level Functions	1288
84.1 callgc() function	1289
84.2 varptr() function	1289
84.3 space() function	1290
84.4 nullpointer() function	1290
84.5 object2pointer() function	1291
84.6 pointer2object() function	1291
84.7 ispointer() function	1293

84.8	<code>ptrcmp()</code> function	1293
84.9	<code>setpointer()</code> function	1294
84.10	<code>getpointer()</code> function	1294
84.11	<code>pointer2string()</code> function	1295
84.12	<code>memcpy()</code> function	1296
84.13	<code>ringvm_cfunctionslist()</code> function	1296
84.14	<code>ringvm_functionslist()</code> function	1296
84.15	<code>ringvm_classeslist()</code> function	1297
84.16	<code>ringvm_packageslist()</code> function	1298
84.17	<code>ringvm_memorylist()</code> function	1299
84.18	<code>ringvm_calllist()</code> function	1301
84.19	<code>ringvm_fileslist()</code> function	1302
84.20	<code>ringvm_settrace()</code>	1302
84.21	<code>ringvm_tracedata()</code>	1303
84.22	<code>ringvm_traceevent()</code>	1303
84.23	<code>ringvm_tracefunc()</code>	1303
84.24	<code>ringvm_scopescount()</code>	1304
84.25	<code>ringvm_evalinscope()</code>	1304
84.26	<code>ringvm_passerror()</code>	1304
84.27	<code>ringvm_hideerrmsg()</code>	1304
84.28	<code>ringvm_callfunc()</code>	1305
84.29	Example - Using the Trace Functions	1305
84.30	Example - The Trace Library	1309
84.31	<code>ringvm_see()</code> function	1312
84.32	<code>ringvm_give()</code> function	1313
84.33	<code>ringvm_info()</code> function	1313
85	Tutorial: Ring Extensions in C/C++	1314
85.1	Hello World	1314
85.2	Build the extension on different platforms	1315
85.3	Sum Two Numbers	1316
85.4	Say Hello	1317
85.5	Sum List of Numbers	1318
85.6	Increment List Items	1319
85.7	Filter List Items	1321
85.8	Replicate List Items	1323
85.9	Generate List	1325
85.10	Display List	1327
85.11	Update Table	1330
85.12	Create Table	1334
86	Extension using the C/C++ languages	1338
86.1	<code>ring_ext.h</code>	1338
86.2	<code>ring_ext.c</code>	1338
86.3	Module Organization	1339
86.4	Function Structure	1340
86.5	Check Parameters Count	1341
86.6	Display Error Message	1341
86.7	Check Parameters Type	1342
86.8	Get Parameters Values	1342
86.9	Return Value	1342
86.10	Function Prototype	1342
86.11	<code>Sin()</code> Function Implementation	1343
86.12	<code>Fopen()</code> and <code>Fclose()</code> Functions Implementation	1343

86.13 Ring API - List Functions	1344
86.14 Ring API - String Functions	1345
86.15 MySQL_Columns() Function Implementation	1346
86.16 Dynamic/Shared Libraries (DLL/So/Dylib) and LoadLib() function	1347
86.17 Using RING_API_RETMANAGEDCPOINTER()	1348
87 Embedding Ring Language in C/C++ Programs	1350
87.1 Ring State	1350
87.2 Ring State Functions	1350
87.3 Ring State Variables	1351
88 Code Generator for wrapping C/C++ Libraries	1353
88.1 Using the tool	1353
88.2 Configuration file	1353
88.3 Using the function prototype	1353
88.4 Adding code to the generated code	1355
88.5 Prefix for Functions Names	1355
88.6 Generate function to wrap structures	1356
88.7 Determine Structure Members Types	1356
88.8 Defining Constants	1356
88.9 Register New Functions	1357
88.10 Writing comments in the configuration file	1357
88.11 Executing code during code generation	1357
88.12 Enum and Numbers	1358
88.13 Filtering using Expressions	1358
88.14 Constants Type	1358
88.15 Configuration file for the Allegro Library	1359
88.16 Threads Support	1360
88.17 Code Generator Rules for Wrapping C++ Classes	1362
88.18 Using configuration file that wrap C++ Library	1362
88.19 Configuration file for the Qt Framework	1363
88.20 Static Methods	1372
88.21 Loading Files	1373
88.22 Managed Classes	1373
88.23 Configuration Files Examples	1374
89 Create your first extension	1375
89.1 Location	1375
89.2 Steps to create the extension	1375
89.3 Testing the extension	1376
90 Language Design	1377
90.1 Why Ring?	1377
90.2 Designed for a Clear Goal	1377
90.3 Simple	1377
90.4 Trying to be natural	1378
90.5 Encourage Organization	1379
90.6 Compact Syntax	1380
90.7 Define Natural Statements	1381
90.8 Define Declarative Languages	1382
90.9 Transparent Implementation	1383
90.10 Visual Implementation	1384
90.11 Smart Garbage Collector	1386
90.12 No Global Interpreter (VM) Lock - No GIL	1386
90.13 Fast Enough For Many Applications	1386

91 What is new in Ring 1.1?	1388
91.1 List of changes and new features	1388
91.2 Better Natural Language Programming Support	1388
91.3 Generate/Execute Ring Object Files (*.ringo)	1389
91.4 Syntax Flexibility and different styles for I/O and Control Structures	1389
91.5 New Functions and Changes	1391
91.6 StdLib functions and classes written in Ring	1392
91.7 RingLibSDL	1394
91.8 Demo Project - Game Engine for 2D Games	1394
91.9 RingSQLite	1395
91.10 Better Code Generator for Extensions	1396
91.11 Using Self.Attribute in the Class Region to define new attributes	1396
91.12 Using This.Attribute in nested Braces inside the Class Methods	1397
91.13 Better Documentation	1397
92 What is new in Ring 1.2?	1398
92.1 List of changes and new features	1398
92.2 New Functions	1398
92.3 Better Functions	1399
92.4 Better Ring Notepad	1400
92.5 Better RingQt	1400
92.6 Objects Library for RingQt	1401
92.7 RingLibCurl	1402
92.8 Better Call Command	1402
92.9 Using NULL instead of NULLPointer()	1402
92.10 Display Warnings Option	1403
92.11 Better Quality	1403
93 What is new in Ring 1.3?	1404
93.1 List of changes and new features	1404
93.2 Better RingQt	1404
93.3 Better Ring Notepad	1408
93.4 Ring mode for Emacs Editor	1412
93.5 Better StdLib	1412
93.6 Better Loop Exit Command	1412
93.7 New Functions	1413
93.8 Return Self by Reference	1413
93.9 Using '<' and ':' operators as 'from' keyword	1414
93.10 Embedding Ring in Ring without sharing the State	1414
93.11 RingZip Library	1415
93.12 Form Designer	1416
94 What is new in Ring 1.4?	1418
94.1 List of changes and new features	1418
94.2 Change: Basic Extensions are separated from RingVM	1418
94.3 The Natural Library	1419
94.4 New Style is added to Ring Notepad	1421
94.5 RingREPL	1422
94.6 Convert between Numbers and Bytes	1423
94.7 Better StdLib	1424
94.8 Better WebLib	1424
94.9 Better RingQt	1426
94.10 Qt Class Convertor	1426
94.11 What is new in Ring 1.4.1?	1427

95 What is new in Ring 1.5?	1431
95.1 List of changes and new features	1431
95.2 Video-Music-Player Application	1432
95.3 Windows StartUp Manager Application	1432
95.4 Calculator Application	1433
95.5 Better Ring Notepad	1434
95.6 Better StdLib	1437
95.7 Better WebLib	1438
95.8 Better RingQt	1441
95.9 Better Objects Library	1443
95.10 RingFreeGLUT Extension	1444
95.11 RingOpenGL Extension	1453
95.12 Better Code Generator for Extensions	1457
95.13 Better Documentation Generator for Extensions	1457
95.14 Ring VM - Tracing Functions	1457
95.15 Trace Library and Interactive Debugger	1462
95.16 More Syntax Flexibility	1464
95.17 Type Hints Library	1465
95.18 Better Quality	1466
95.19 What is new in Ring 1.5.1?	1466
95.20 What is new in Ring 1.5.2?	1471
95.21 What is new in Ring 1.5.3?	1472
95.22 What is new in Ring 1.5.4?	1475
96 What is new in Ring 1.6?	1477
96.1 List of changes and new features	1477
96.2 Employee Application	1478
96.3 New Tool: Ring2EXE	1478
96.4 Better Ring For Android	1478
96.5 New Tool: Folder2qrc	1480
96.6 Better Scripts for building Ring	1480
96.7 RingConsoleColors Extension	1480
96.8 RingMurmurHash Extension	1481
96.9 Better Ring Notepad	1481
96.10 Better RingQt	1483
96.11 Better StdLib	1484
96.12 Better RingVM	1484
96.13 Better RingREPL	1485
96.14 Using Tab instead of char(9)	1485
96.15 Using CR as Carriage return	1485
96.16 Using the ! operator as not	1485
96.17 Using && and operators	1486
96.18 Using ? to print expression then new line	1487
97 What is new in Ring 1.7?	1488
97.1 List of changes and new features	1488
97.2 New Command: Load Package	1488
97.3 ringvm_see() and ringvm_give() functions	1489
97.4 ring_state_new() and ring_state_mainfile() functions	1490
97.5 Better Trace Library	1490
97.6 Better Ring Notepad	1491
97.7 Better RingQt	1491
97.8 Better Ring2EXE	1492
97.9 Better RingZip	1492

97.10 Better Documentation	1492
97.11 Better Ring VM	1492
97.12 RingLibuv Extension	1493
98 What is new in Ring 1.8?	1496
98.1 List of changes and new features	1496
98.2 Better Performance	1497
98.3 Find in files Application	1497
98.4 String2Constant Application	1498
98.5 StopWatch Application	1499
98.6 More 3D Samples	1499
98.7 Compiling on Manjaro Linux	1501
98.8 Using This in the class region as Self	1502
98.9 Default value for object attributes is NULL	1503
98.10 The For Loops uses the local scope	1503
98.11 Merge binary characters	1504
98.12 FoxRing Library	1505
98.13 Better Form Designer	1506
98.14 Better Cards Game	1506
98.15 Better RingQt	1507
98.16 Better Code Generator For Extensions	1507
98.17 Better Ring Compiler and VM	1508
98.18 Notes to extensions creators	1509
99 What is new in Ring 1.9?	1510
99.1 List of changes and new features	1510
99.2 New Game : Gold Magic 800	1510
99.3 More Games	1512
99.4 Better Ring Notepad	1515
99.5 Better StdLib	1516
99.6 BigNumber Library	1517
99.7 RingPostgreSQL Extension	1519
99.8 Deploying Web applications in the Cloud	1521
99.9 Better RingQt	1521
99.10 Better Memory Management	1525
99.11 Better Code Generator for Extensions	1525
99.12 More Improvements	1526
100What is new in Ring 1.10?	1528
100.1 List of changes and new features	1528
100.2 Chess Game	1528
100.3 Minesweeper Game	1529
100.4 Knight Tour Game	1530
100.5 Game of Life Game	1531
100.6 Pong Game	1532
100.7 Snakes And Ladder Game	1533
100.8 More Games	1534
100.9 Ring Extension for Visual Studio Code	1535
100.10The Ring Package Manager (RingPM)	1536
100.11Better Tests	1537
100.12More Improvements	1537
101What is new in Ring 1.11?	1539
101.1 List of changes and new features	1539
101.2 More 3D Samples	1539

101.3 Checkers Game	1540
101.4 Sokoban Game	1541
101.5 Maze Game	1542
101.6 Snake Game	1543
101.7 Sudoku Game	1544
101.8 Desktop Screen Shot Application	1546
101.9 Text To Speech Application	1546
101.10RingRayLib Extension	1547
101.11ZeroLib Library	1549
101.12StdLib - More Functions	1550
101.13Better RingQt	1551
101.14Better Performance	1553
101.15Better Documentation	1553
101.16More Improvements	1553
102What is new in Ring 1.12?	1555
102.1 List of changes and new features	1555
102.2 Go Game	1555
102.3 ASCII Table application	1556
102.4 BMI Calculator application	1557
102.5 Calendar application	1557
102.6 Julian Day Calendar application	1558
102.7 Tutorial: Number to Words	1559
102.8 Load Again Command	1560
102.9 ring_state_filetokens() function	1561
102.10Generate Embedded Ring Object File	1562
102.11Better RingRayLib	1563
102.12More Improvements	1564
103What is new in Ring 1.13?	1566
103.1 List of changes and new features	1566
103.2 New Book by Apress	1567
103.3 Ring for WebAssembly	1568
103.4 Better Threads Support	1568
103.5 Laser Game	1569
103.6 Magic Balls Game	1570
103.7 Money Boxes Game	1571
103.8 Matching Game	1571
103.9 Pairs Game	1572
103.10Word Game	1573
103.11Tetris Game	1574
103.12Escape Game	1575
103.13Hassouna Course Samples	1576
103.14Ring support in SpaceVim	1577
103.15Better RingQt	1578
103.16Better RingRayLib	1580
103.17RingStbImage Extension	1581
103.18More Low Level Functions	1582
103.19Better Organization	1582
103.20More Improvements	1582
104Using Other Code Editors	1586
104.1 Using Notepad++	1586
104.2 Using Geany	1587

104.3 Using Atom	1588
104.4 Using Sublime Text 2	1589
104.5 Using Visual Studio IDE	1590
104.6 Using Emacs Editor	1591
104.7 Visual Studio Code	1591
104.8 SpaceVim	1592
105 Frequently Asked Questions (FAQ)	1593
105.1 Why do we need Yet Another Programming Language (YAPL)?	1593
105.2 What is the Ring Architecture?	1594
105.3 What about Memory Management in Ring?	1595
105.4 What about Data Representation in Ring?	1595
105.5 Why is Ring weakly typed?	1598
105.6 What are the advantages to using Ring over Lisp or Smalltalk?	1598
105.7 Why is Ring largely focussed on UI creation?	1598
105.8 Is Ring some sort of an improvement of PHP?	1598
105.9 What are the advantages of using Ring over native C or C++?	1599
105.10 What is the difference between Ring and Python? And is Ring Open Source?	1599
105.11 What are the advantages to using Ring over Perl, PHP, Python or Ruby?	1600
105.12 What are the advantages to using Ring over Tcl or Lua?	1600
105.13 What are the advantages to using Ring over C# or Java?	1600
105.14 The documentation says functional programming is supported, but then this happens?	1601
105.15 Why the ability to define your own languages Instead of just handing over the syntax so you can parse it using whatever code you like?	1601
105.16 Why you can specify the number of loops you want to break out of?	1602
105.17 Why Ring uses ‘See’, ‘Give’, ‘But’ and ‘Ok’ Keywords?	1602
105.18 What is the philosophy behind data types in Ring?	1602
105.19 What about the Boolean values in Ring?	1603
105.20 What is the goal of including the “Main” function in Ring?	1604
105.21 Why the list index start from 1 in Ring?	1605
105.22 Why Ring is not case-sensitive?	1605
105.23 Why the Assignment operator uses Deep Copy?	1606
105.24 Is there constructor methods in Ring?	1607
105.25 What happens when we create a new object?	1608
105.26 Can we use the attributes by accessing the Getter and Setter methods?	1608
105.27 Why should a search of global names be made while defining the class attributes?	1609
105.28 Why Ring doesn’t avoid the conflict between Global Variables and Class Attributes Names?	1610
105.29 Where can I write a program and execute it?	1611
105.30 How to get the file size using ftell() and fseek() functions?	1611
105.31 How to get the current source file path?	1612
105.32 What about predefined parameters or optional parameters in functions?	1612
105.33 How to print keys or values only in List/Dictionary?	1612
105.34 Why I get a strange result when printing nl with lists?	1613
105.35 Could you explain the output of the StrCmp() function?	1613
105.36 How to use many source code files in the project?	1614
105.37 Why this example use the GetChar() twice?	1615
105.38 How to use NULL and ISNULL() function?	1616
105.39 How to print lists that contains objects?	1617
105.40 How to insert an item to the first position in the list?	1617
105.41 How to print new lines and other characters?	1618
105.42 Why we don’t use () after the QApp class name?	1618
105.43 Why the window title bar is going outside the screen?	1619
105.44 How to create an array of buttons in GUI applications?	1619
105.45 How to Close a window then displaying another one?	1620

105.46 How to create a Modal Window?	1621
105.47 How can I disable maximize button and resize window?	1622
105.48 How to use SQLite using ODBC?	1622
105.49 Can I connect to dbase/harbour database?	1623
105.50 Why setClickEvent() doesn't see the object methods directly?	1624
105.51 Why I get Calling Function without definition Error?	1625
105.52 Can Ring work on Windows XP?	1625
105.53 How to extend RingQt and add more classes?	1626
105.54 How to add Combobox and other elements to the cells of a QTableWidgetItem?	1628
105.55 How to perform some manipulations on selected cells in QTableWidgetItem?	1629
105.56 Which of 3 coding styles are commonly used or recommended by the community?	1630
106 Building From Source Code	1631
106.1 Building using Microsoft Windows	1631
106.2 Building using Ubuntu Linux	1633
106.3 Building using Fedora Linux	1636
106.4 Building using MacOS X	1638
106.5 Building using CMake	1641
107 How to contribute?	1642
107.1 Special thanks to contributors	1642
107.2 Documentation	1642
107.3 Testing	1643
107.4 Samples	1643
107.5 Applications	1643
107.6 Editors Support	1643
107.7 Libraries in Ring	1643
107.8 Extensions in C/C++	1643
107.9 Compiler and Virtual Machine (VM)	1644
108 Language Specification	1645
108.1 Language Keywords	1645
108.2 Language Functions	1647
108.3 Compiler Errors	1651
108.4 Runtime Errors	1652
108.5 Environment Errors	1653
108.6 Language Grammar	1653
108.7 Virtual Machine (VM) Instructions	1655
109 Resources	1664
109.1 Ring Language Website	1664
109.2 Source Code	1664
109.3 Ring Team	1664

APPLICATIONS DEVELOPED IN A FEW HOURS

Ring is a new programming language that focuses on the Natural Language Programming and Declarative Programming paradigms and will let you think different about programming and how to solve your problems in a better way. In little days after the first release we got thousands of downloads and many developers started learning and using the language. Their feedback are the secret behind the language progress and success. They said that Ring is powerful, beautiful and easy to learn, Some of them provided good examples about what can be done using Ring in a few hours. They are very happy with the language productivity.

1.1 Quotes about Ring

“I like Smalltalk very much but now I like Ring better!”

, Gal Zsolt (Hungary)

“I find the language and its syntax very natural and easy to follow.”

, Bhudda (United States)

“Very nice approach for a new language.”

, Matth Moestl (Austria)

“Very interesting! I will keep an eye on it.”

, Eslipak (Argentina)

“I’d like to see some benchmarks. Otherwise, at first glance, it looks really promising.”

, Alex Deva (Sweden)

“Excellent”

, Liju Sankar (United States)

“I wish you the best with this project.”

, David O’Neil (United States)

“Just fantastic.”

, Jose Antonio (Mexico)

“This looks like it was developed by some very competent people.”

, Jim Clack (United States)

“The Ring programming language seems pretty interesting so far.”

, Eric Johnson (United States)

“Thank you for this awesome language and wonderful ready to use Qt binding.”

, Martial FAESSEL

“I think it’s great what he does for the community of developers and novice programming.”

, Marino Esteban

“Ring is just awesome. The language is so cool and fluent. I am sure it’s going to be BIG.”

, Ahmed Zain

“What a proud, really wish you Eng. Mahmoud Samir and Your Team moving forward ^_^ and from now , considered me a big fan of the Ring programming language.”

, Zainab Mahmoud

“Well guys I love this language and it appears that you have created perfect language.”

, Moemen Ghulmi

“Good work Mahmoud, I’ve installed ring pl, and it’s very perfect language.”

, Ahmed Omar (Egypt)

“Thanks for this great startup programming language. I wish you best of luck.”

, Elkhouaja Khalid

“Congratulations! I am very happy and I wish you Success and good luck.”

, Abobasmla Hassan

“Good Features of multi-use language on the Web, Mobile and Desktop.”

, Abdelrhman Haider

“Very interesting effort.”

, Giannakakis Kostas (Greece)

“I am too lazy to open comment window and write message. But in your case I must say (Perfect) Really, create new remarkable language like your Ring is really perfect job. Even create editor for your language in your language with only few rows... Even noticed in rosettacode.org ! I read your previous articles and I tried these examples a few days ago and I will continue. I love Ring. P.S.: Anders Hejlsberg, Niklaus Wirth, Bjarne Stroustrup, Ada Lovelace Hall of fame is waiting....”

, Martin Nedopil (Czech Republic)

“Ring seems very attractive to me through its very easy design and the Qt bindings. I like its declarative approach and the generous documentation.”

, Shalok Shalom (Austria)

“Ring (and plenty of extension library + Qt) is wonderful.”

, Kovacs Attila (Hungary)

“Since two days I’m trying Ring and I’m really impressed, in add to power commands and easy use, it’s really very efficient and very fast. Each day I hope to find the couple of the year PWCT+RING ... Maybe for my Christmas gift!!!! HO HO HO HO Continue your fantastic job and congratulations.”

, Jose Le Roux (France)

“There are 3 different styles, it looks like Python and C”

, 64remy

“I was taking a tour around Rosettacode and have found Ring. I like the syntax a lot. It’s clean and easy to understand. It looks like a very clean BASIC dialect without sigils. I can say that this is the easiest and the most BASIC-like language I’ve ever tried.”

, Tomaaz

“Thanks for your effort. I took a quick look and found it interesting. You are trying to follow more or less like Clipper with simple command and no rigid declaration rules. Good.”

, Anand Gupta

“Thanks for this wonderful language”

, Vinod kc (India)

“Very enlightening. good job!”

, Southmountain (United States)

“The thing I liked was the loop exiting”

, Leon de boer (Australia)

“An outstanding and easy language to program with.”

, Kenneth Burgo (Philippines)

“I chose your language as I feel I can understand it better than other languages”

, Harry Singh

“I like the totality of the language, far more features than expected and the freedom of expressiveness is unique.”

, Evikone

“Thank you very much Mahmoud! I am using ring for many experiments and so far I love it. I really want to continue using ring and contribute what I can.”

, John (SienSystem)

“Sir, Very Good”

, Kamlesh Patel

“That’s more than a “cool” syntax, the example of writing free-form text between curly-brackets such that each word calls a function. Which could be interesting (A syntax like that would be nice for declaring text styles)”

, LaurieCheers

“If you browse around you see they have listed 160 contributors. This year they have entered Top 100 in the TIOBE index. Lot of effort seem to have been made to make this language pop out and catch the attention of masses.”

, Htuholo

“I like the idea of The Ring being in ANSI C it’s an impressive creation, and a lot of skill went into it”

, Garry Taylor

“Very innovative language! Syntactically clean”

, CodeProject Member

“The author must be commended for the readily-obvious hard work and effort that has gone into creating a rich ecosystem for his language. It seems that the language is quite extensive as well. I would find it useful to see a BNF grammar and concise coverage of its semantics.”

, Xx-Leninist-1917-Xx (Reddit)

“I can see the AI of the future using this technology to solve computational problems for.... the humans.”

, Cryptonite (United States)

“I like your programming language, I like you are going to develop mobile app using RingQt and also I appreciate your web library.”

, Domenico D’Oria (Italy)

“Congratulations for the great work with this new programming language.”

, Kenny Silva (Venezuela)

“Ring is an amazingly full-featured language and so well documented (the bane of most newer languages out there!)”

, Alex McCullie

” I found the language yesterday, and liked the Qt bindings, as they give a declarative way to create a QtWidgets GUI.”

, Cochise Cesar

“Ring does look intriguing, and I’ll be reading more of the documentation soon”

, Jamie Cooper

“I was recently considering designing my own dynamically-typed, prototypical language and then developing a means to compile it into C/C++. However, last night I was surfing the web and noticed a little-known language called “Ring” which you’ve recently created. I began reading the Motivation section in Wikibooks to see why the language was designed and implemented, and I was shocked to see that someone else had created a language with the same intention and need as myself. I mean, it’s mind-blowing that someone would have addressed every issue I have with the currently accepted languages. It’s crazy to think it’s only been around for a year and yet, it’s already, practically a batteries-included language.”

, Gedalya (YouTube)

“Thank you Mr. Mahmoud for all the wonderful work, whenever I dive in the Source code I see the great effort, further development more excellence, God will reward you with what you wish”

, Azzedine Ramal

“What a great joy to find this surprisingly genius language !!!.. It was a total joy to go through the documentation and look at the samples in Rosetta code. Marvelous work. I would even leave my fortune to the development of this language. Keep the good work going and wishing this language will go viral. ps: Thanks for keeping array index to start with 1. It means a lot.”

, Nehemiah Jacob (Sydney, Australia)

“I find it very interesting. Especially the fact that it is cross platform makes it something to keep an eye on.”

, Boudewijn Lutgerink

“The language I like the most. Efficient, simple, easy, flexible and wonderful language.”

, Roshan Ali

“I like variety. The richer the toolbox, the more appropriate the tool.”

, Jonathan Day (Quora)

“I greatly appreciated your work and congratulations on what has been achieved.”

, Umberto Meglio (Italy)

“Thanks a lot I just found Ring two days ago and I decided to learn it, it is amazing, the samples are helping a lot.”

, Zaraki Ken

“Extraordinary. well done sir”

, RugbyLeague (CodeProject Member - United Kingdom)

“The Ring language is pleasant. You get ahead very quickly.”

, Nesuk (CodeProject Member - Switzerland)

“I’m happy to use your language.”

, Akhil Reddy

“I am enjoying using the Ring Programming language.”

, Gabriel Wendt

“I’m loving this language!”

, Pablo Prieto

“Ring Notepad is a an example of the power of Ring. It is like NotePad++ with built in form design capability, drag and drop, object attributes etc. It is a marvelous application”

, Bert Mariani (Italy)

“Ring is the language that offers the greatest potential for converting programmers frustrated with the amount of time it takes to develop apps in C/C++, C# and other OOP-based languages. Considering the extent to which Ring has evolved since the first release in 2016, the Ring team has proven itself worthy of a very high achievement award in the world of programming languages. The extent to which Ring has simplified the development database apps, web apps and GUI apps is a great credit to the Ring team. Ring’s implementation of OOP and GUI based apps is far superior to C++ and C#. Another major achievement of the Ring team is the ease at which programmers can get on-line access to Ring documentation, compared to on-line C++ and C# documentation. The Ring Game Engine is truly elegant and it’s designer (s) deserve lots of credit for such an impressive bit of software.”

, L Godioleskky

“Strongly speaking, it is a strong and new game programming language.”

, IsVowel (Japan)

“The language seems to have some interesting features, specially the use of braces to access object fields and methods.”

, Nuaua (Reddit)

“The code that implements the Ring VM actually looks quite nice. There is a bunch of test code – great!”

, Peterfirefly (Reddit)

“Ring seems promising. It first appeared in 2016 although it’s concept is older. It is meant to be portable and can be embedded in C/C++ projects”

, Wim ten Brink (Quora - Top Writer (2018))

“Interesting alternative to Lua.”

, djxtc (Sourceforge)

“Ring is a serious thing in the programming language landscape. One shoud understand its foundation before she can shape an opinion worth considering. There are several innovations outthere with a clear commitment from its designer to simplicity, flexibility and learnability. Natural language as its imagined by Ring opens a window for an unlimited set of applications otherwise impossible to think about. One can built an interactive chatbot based on a rich domain specific language in a matter of hours not months. Combined with a smart yet effective implementation of a declarative programming paradigm, Ring empowers the creation of any kind of programming language on top of it, with any set of syntax. Even the language keywords can be overwritten to serve one’s own keywords in any human language not only english. Ring is a disruption, a big intellectual step forward but also a beautiful reincarnation of several legacy ideas and best practices from other old languages like Basic, Lisp and others. Those ideas ar e a humanity heritage that new visionaries like Mahmoud S. Fayed, the Ring designer, but also Rick Hickey, the Clojure designer, are trying to callback in today’s world of complex programmability. An other dimension of Ring, which formed one of its basic motivations, relates to visual programming. Software is a fluid and evolutionary creature and textual code is not accessible to the most of common humans. The promise of visual programming is to empower people, enhance understandability and invite business users to the arena of software development more intuitively. Ring was made by design with an objective of having a programming language capable of better supporting the visual paradigm. Gamification is a first-class citizen in the language. This is a tremendous advantage compared to other general-purpose programming languages. Ring supports a large number of gaming libraries and open a large window of capabilities to use, not only in gaming but also in business and education applications. The best way to a ssesing the power of Ring is to looking into it and reflecting about the number of problems it is capable to solve.”

, Mansour Ayouni (Tunisia)

“I have only known ring-lang for few weeks, really love features and visions of ring: bracket access, class region, declarative and natural programming. It’s simple and beautiful the way ring deal with these paradigms. I think it’s really great work what you’re done, and doing. I want to develop ethereum client in ring language, not only but it’s style. It’ll have natural and declarative code on it’s main part. Furthermore, It will be fantastic if there is “natural language -> evm bytecode” compiler, maybe ring have the solution”

, Asta

“The language looks great!”

, Eric Hawk

“You put a lot of work in the Ring and you’re a great programmer. I saw your examples in 3D I’ve looked at

part of your project, it's really great"

, Rafal Jopek

"Looks like a big project and an impressive piece of work"

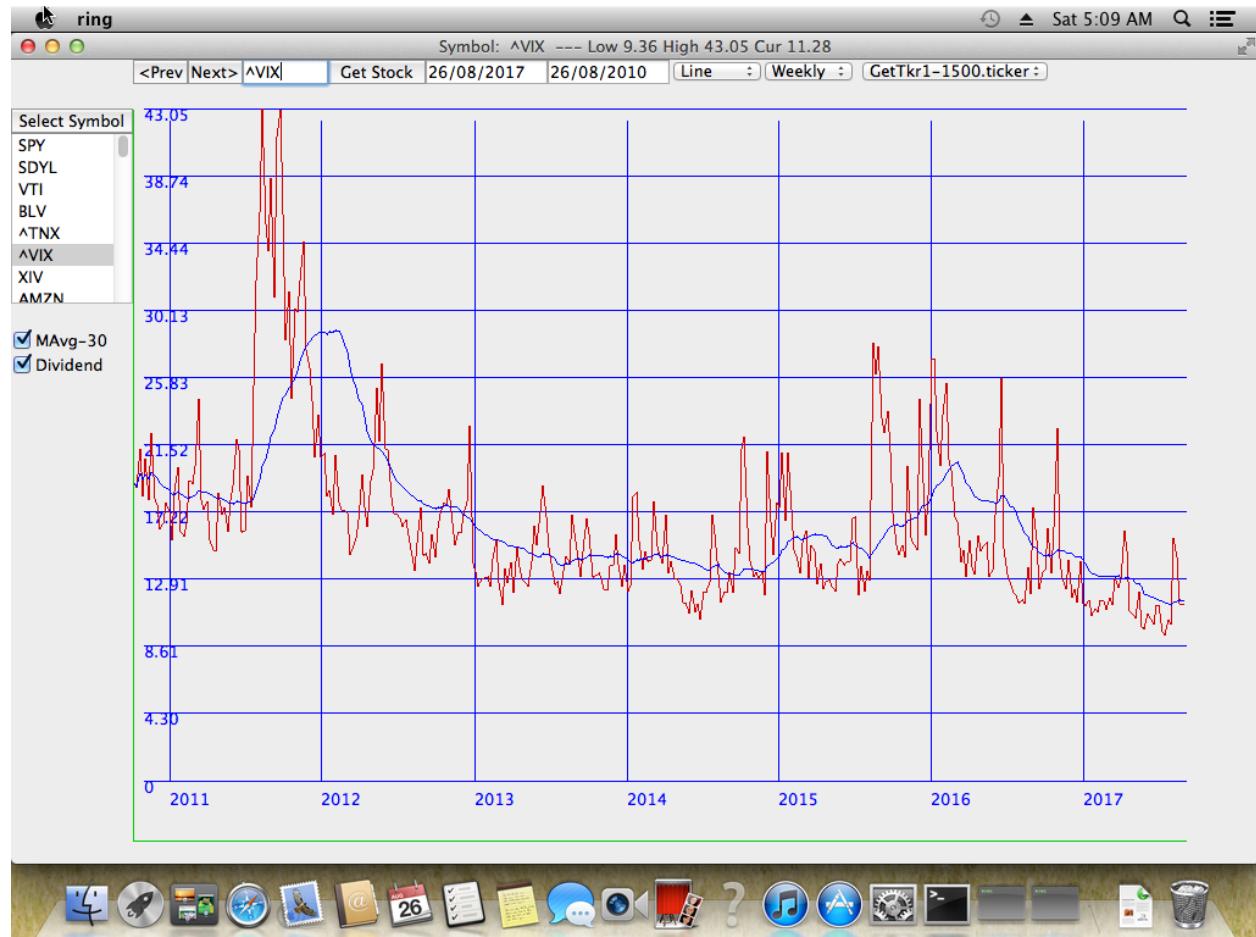
, Rochus Keller (PhD From ETH Zurich, Switzerland)

"I see Ring a very useful and easy in PROGRAMMING IN REGIONAL LANGUAGE. I tried to program in my mother language Hindi (India) using UNICODE It is working. No other language give me such an easy platform."

, Negi Manoj (India)

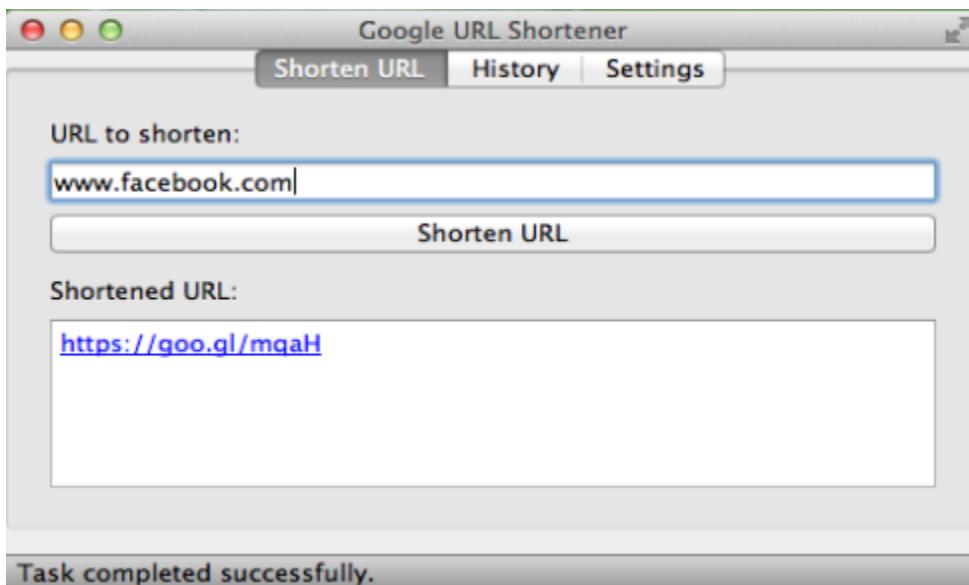
1.2 FetchStockData Application

It will fetch stock data from Yahoo and draw various types of charts.



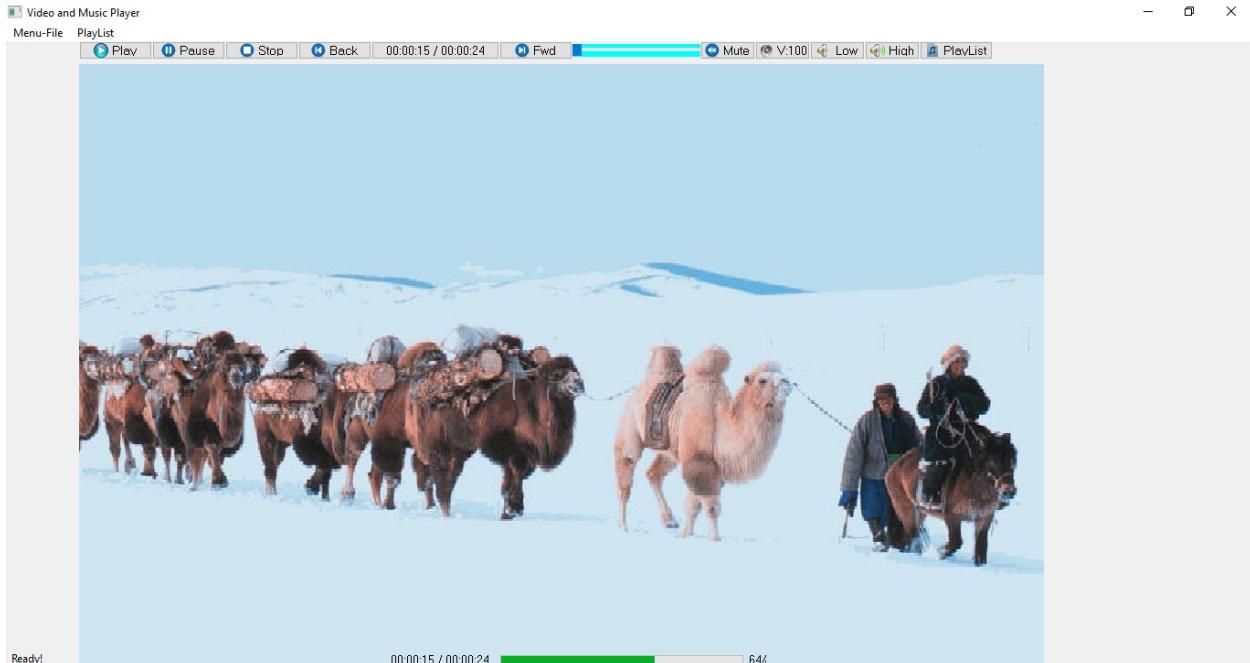
1.3 Google API Shortener Application

A small but very nice tool to shorten urls using the Google shortener API.



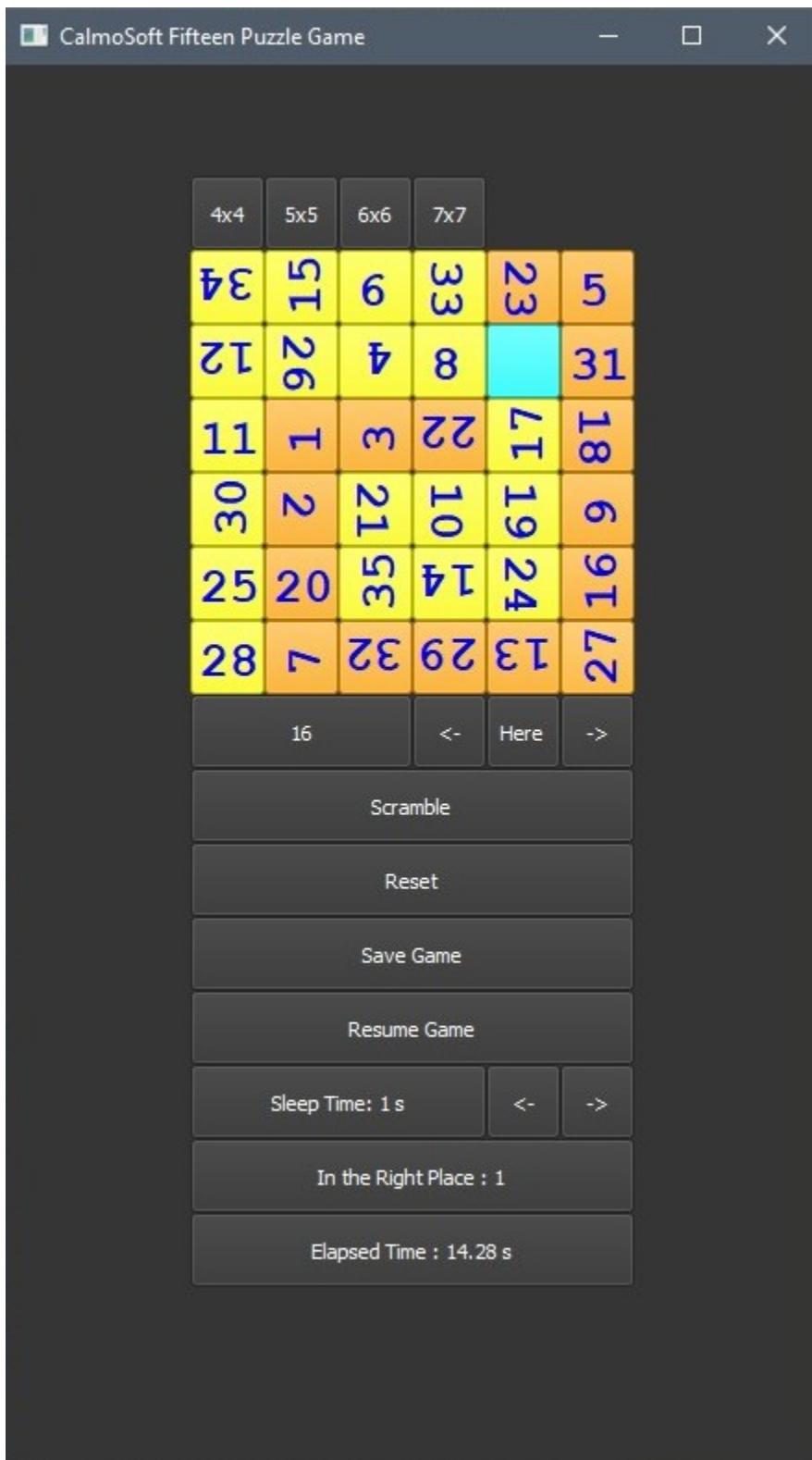
1.4 Video-Music-Player Application

An application to play multi-media files.



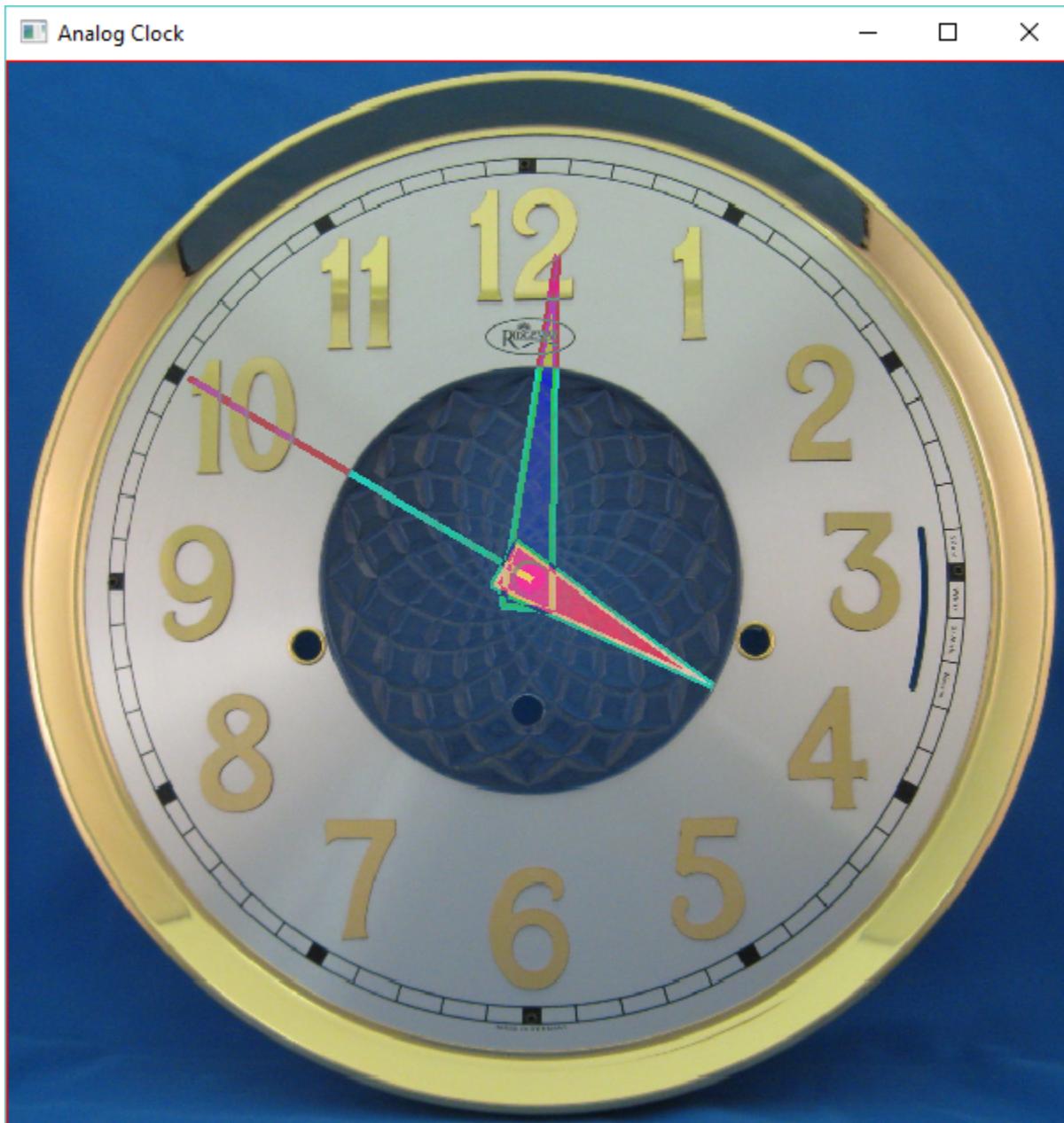
1.5 Fifteen Puzzle Game

An implementation for the Fifteen Puzzle game.



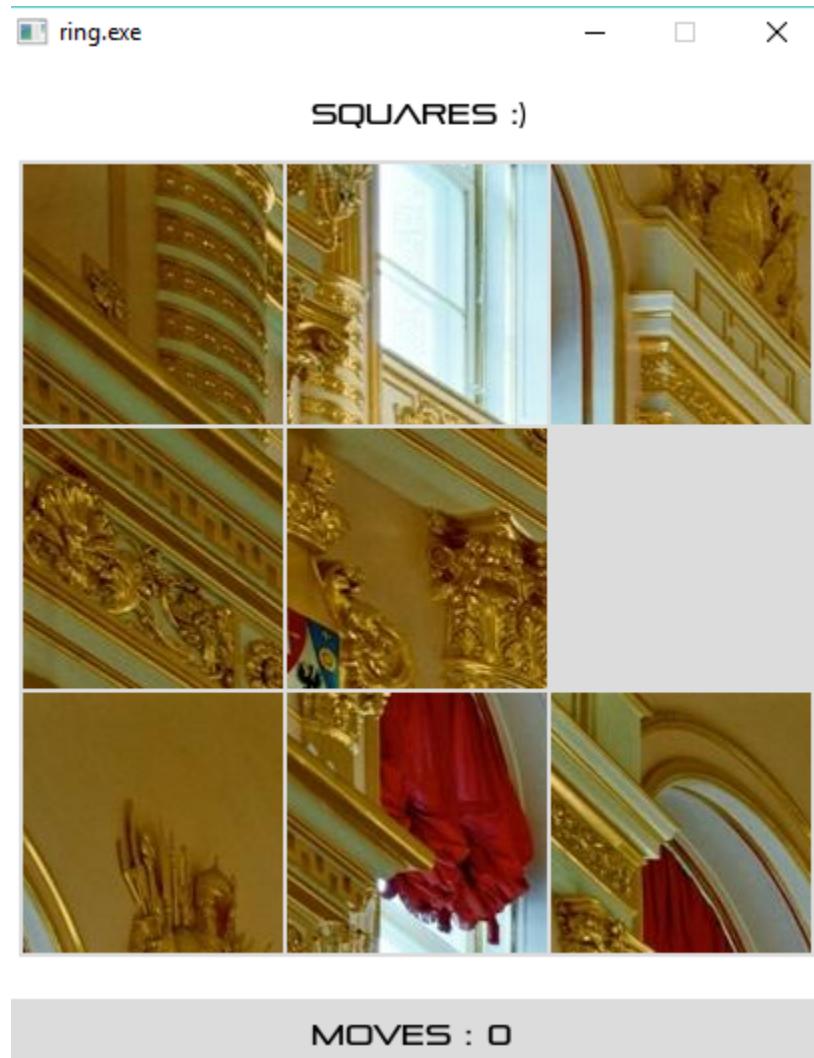
1.6 Analog Clock

Simple implementation for the Analog Clock.



1.7 Squares Puzzle Game

An implementation for the popular Squares Puzzle game.



1.8 Samples in this book

The next samples are developed in a few hours and we will introduce them through this book.

The next screen shot for he Ring Notepad application

The screenshot shows the Ring Notepad interface. On the left, the Project Files tree view shows a folder structure under 'B:' containing various applications like goldmagic800, analogclock, calculator, cards, employee, fifteenpuzzle, fifteenpuzzle3d, findfiles, flappybird3000, formdesigner, game2048, getquoteshistory, memorygame, README.md, ringrep, rnote, sixteenpuzzle, squarespuzzle, starsfighter, stopwatch, superman2016, tesseragame, tictactoe, tictactoe3d, urlshortener, videomusicplayer, weighthistory, and winstartupmanager. The main window displays the source code for 'gui1.ring'.

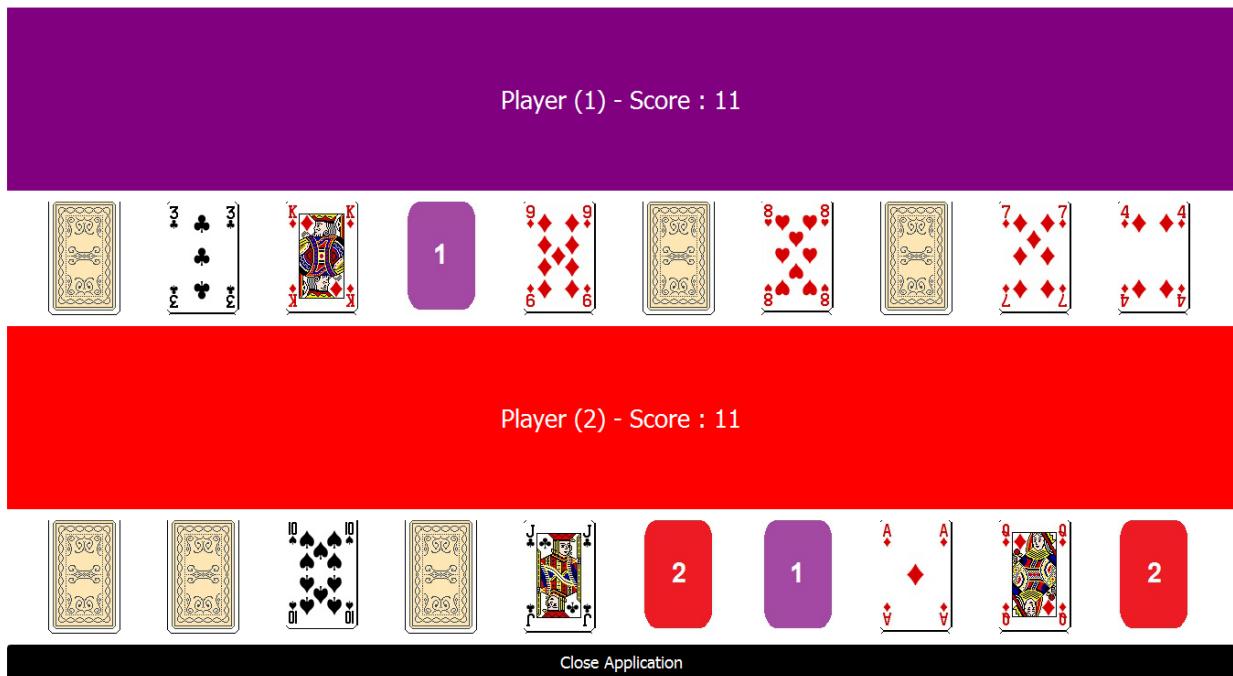
```

1 load "guilib.ring"
2
3 oApp = New qApp {
4
5     win1 = new QWidget()
6
7         setWindowTitle("Hello World")
8         setGeometry(100,100,370,250)
9
10        label1 = new QLabel(win1) {
11            setText("What is your name ?")
12            setGeometry(10,20,350,30)
13            setAlignment(Qt.AlignHCenter)
14        }
15
16        btn1 = new QPushButton(win1) {
17            setGeometry(10,200,100,30)
18            setText("Say Hello")
19            setClickEvent("pHello()")
20        }
21
22        btn1 = new QPushButton(win1) {
23            setGeometry(150,200,100,30)
24            setText("Close")
25            setClickEvent("pClose()")
26    }

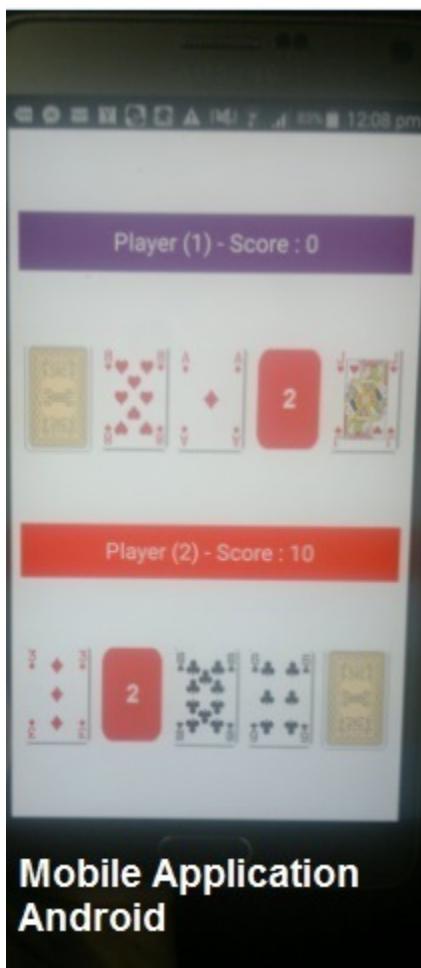
```

The right side of the screen shows a screenshot of the Ring 1.9 documentation website. The title is 'Welcome to Ring's documentation!'. It includes a search bar and a sidebar with a table of contents listing various Ring applications and features.

The next screen shot for the Cards Game



The next screen shot for the Cards Game (Android)



The next screen shot from the Web Development chapter

The screenshot shows a web browser window titled "Test" with the URL "localhost/ringapp/ex24.ring?part=1&searchname=m". The main content is a "Salary Table" with three rows of data:

ID	Name	Salary	Options
1	Mahmoud	15000	Select Option...
12	Mohammed	56786	Select Option... Edit Delete
131	Mageed	23623	

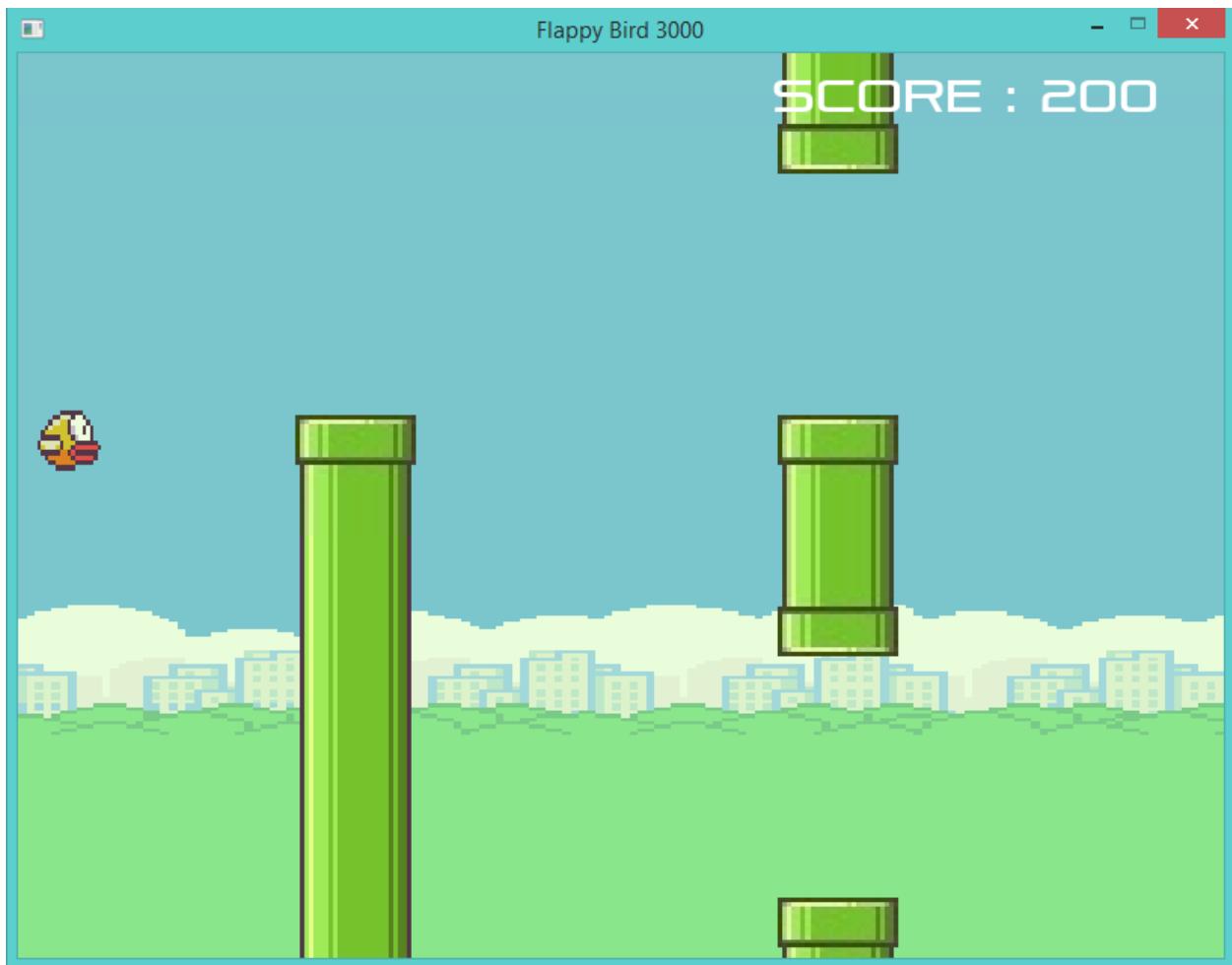
Below the table are navigation links "First", "Prev", "Next", and "Last", and a status message "Records Count (3) : Page 1 of 1". A blue button labeled "Add Record" is visible. An "Edit Record" dialog box is open over the table, showing the details for the first row: Name: Mahmoud and Salary: 15000. A "Save" button is at the bottom of the dialog.

The next screen shots for simple 2D Games that we will present in the Game Engine Chapter.

Stars Fighter Game



Flappy Bird 3000 Game

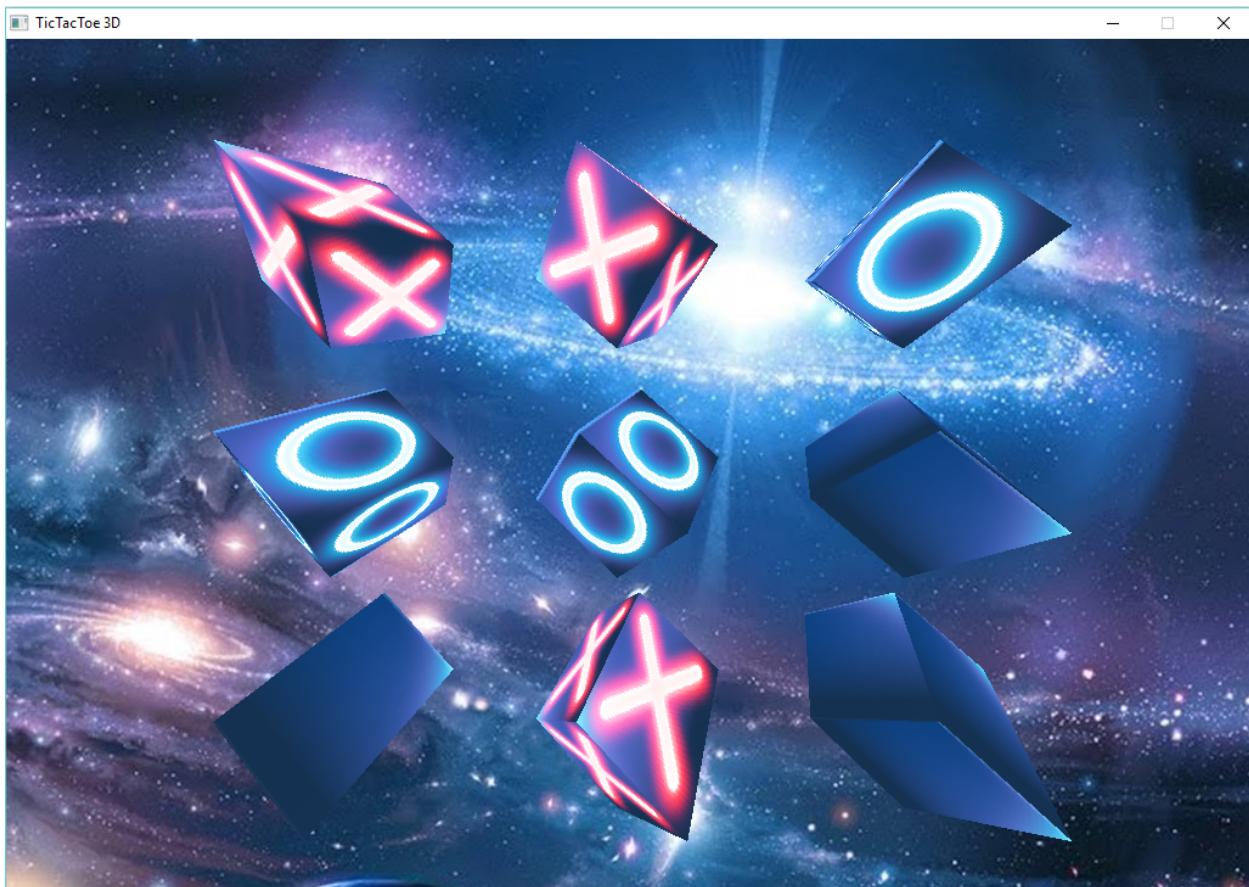


Super Man 2016 Game

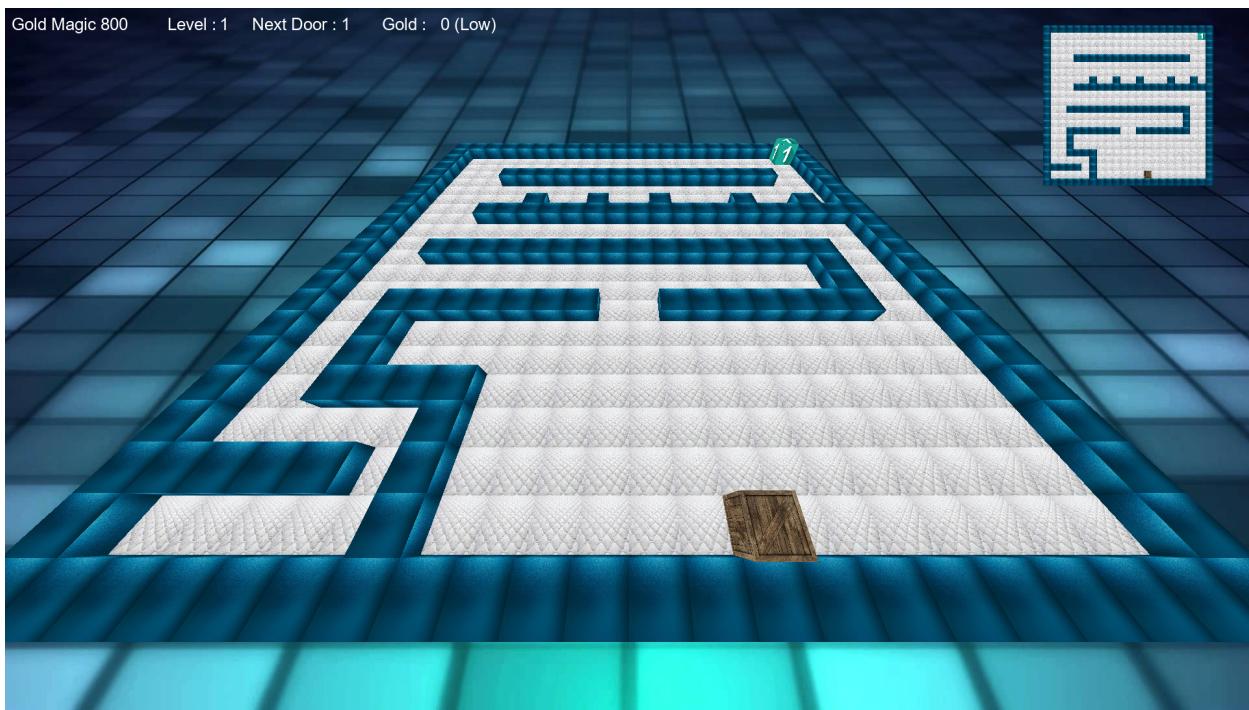


The next screen shot for the TicTacToe 3D Game

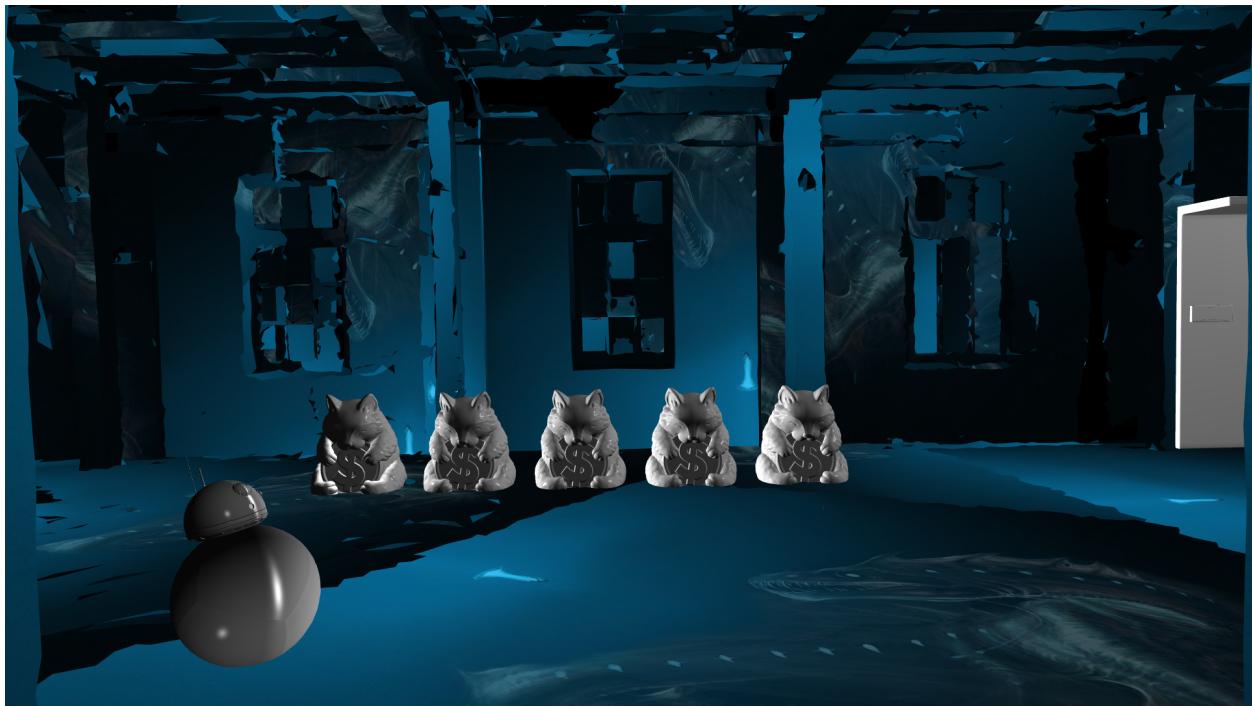
Screen Shot:



The next screen shot for the Gold Magic 800 Game



The next screen shot from the RingQt3D chapter



1.9 Innovative

The language comes with better support for Natural Language Programming and Declarative Programming. The innovation comes in supporting these paradigms with new practical techniques on the top of Object-Oriented Programming and Functional Programming. No need to know anything about (Compilers and Parsing). You get the language constructs ready for use to create domain-specific languages in a fraction of time.

Articles:-

- Natural Language Programming Library :

<https://www.codeproject.com/Articles/1200766/Using-the-Natural-Language-Programming-Library-NLP>

- Natural Language Programming :

<https://www.codeproject.com/Articles/1138605/Natural-Language-Programming-in-the-Ring-Programmi>

- The Declarative Approach :

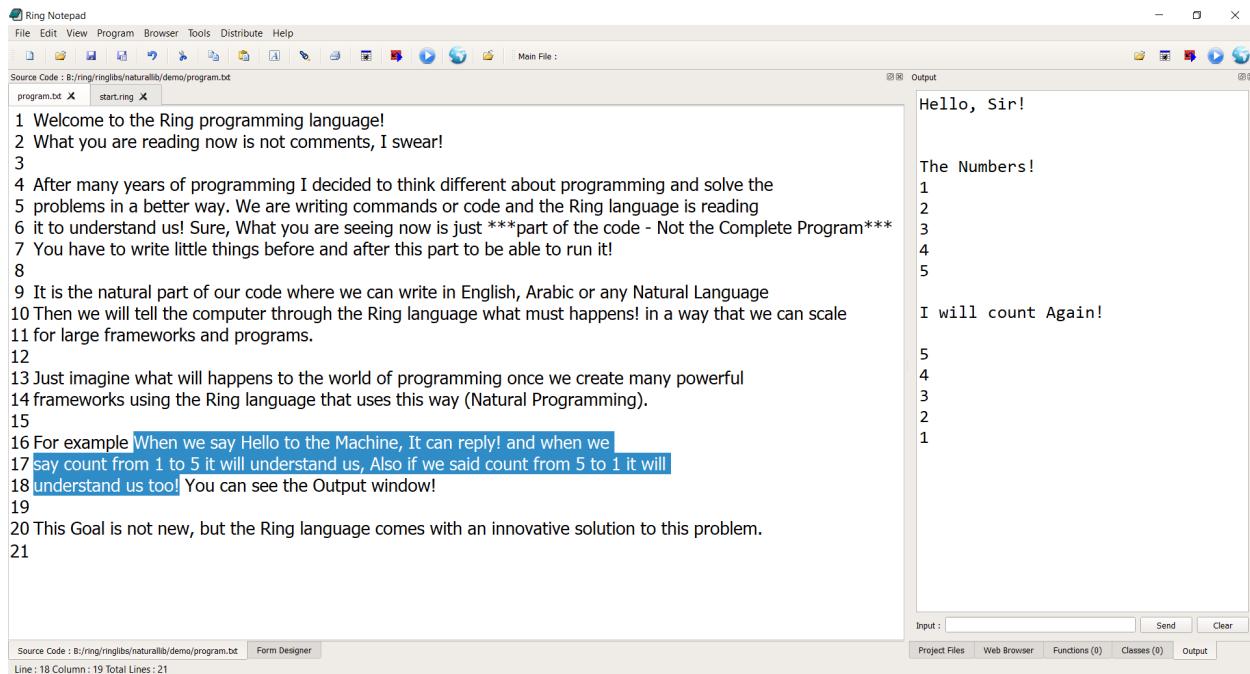
<https://www.codeproject.com/Articles/1222105/The-declarative-approach-of-the-Ring-programming-1>

- Syntax Flexibility :

<https://www.codeproject.com/Articles/1137388/Syntax-Flexibility-in-the-Ring-Programming-Languag>

- The Ring Programming Language :

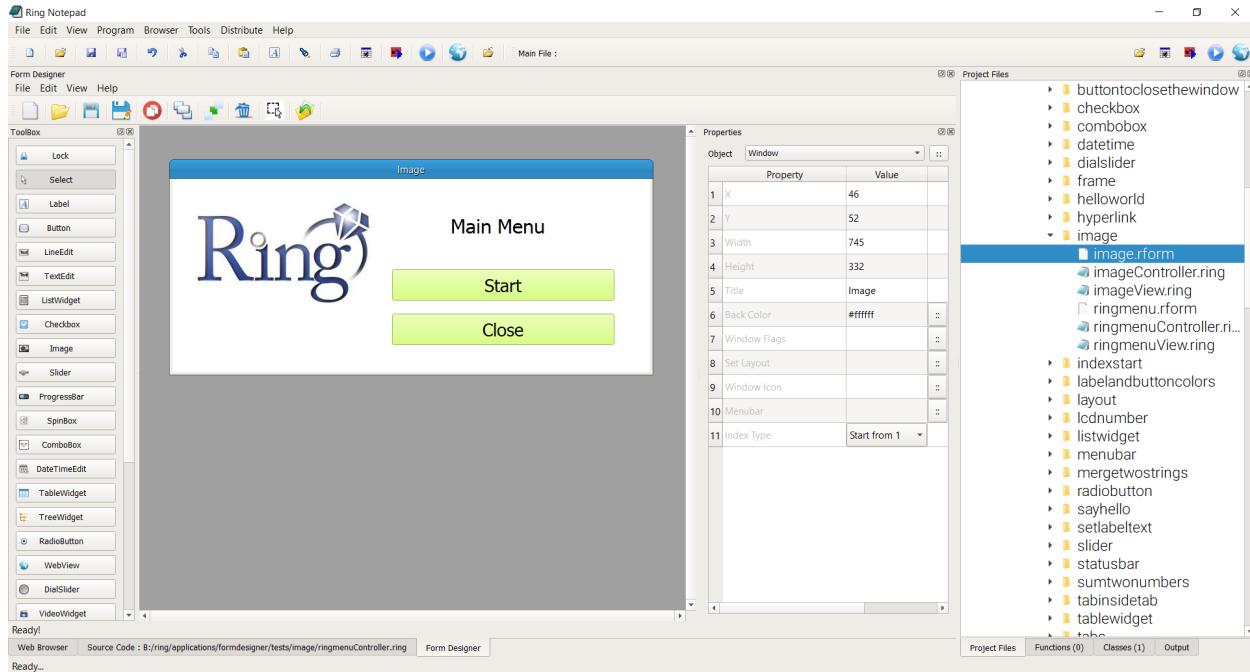
<https://www.codeproject.com/Articles/1089887/The-Ring-Programming-Language>



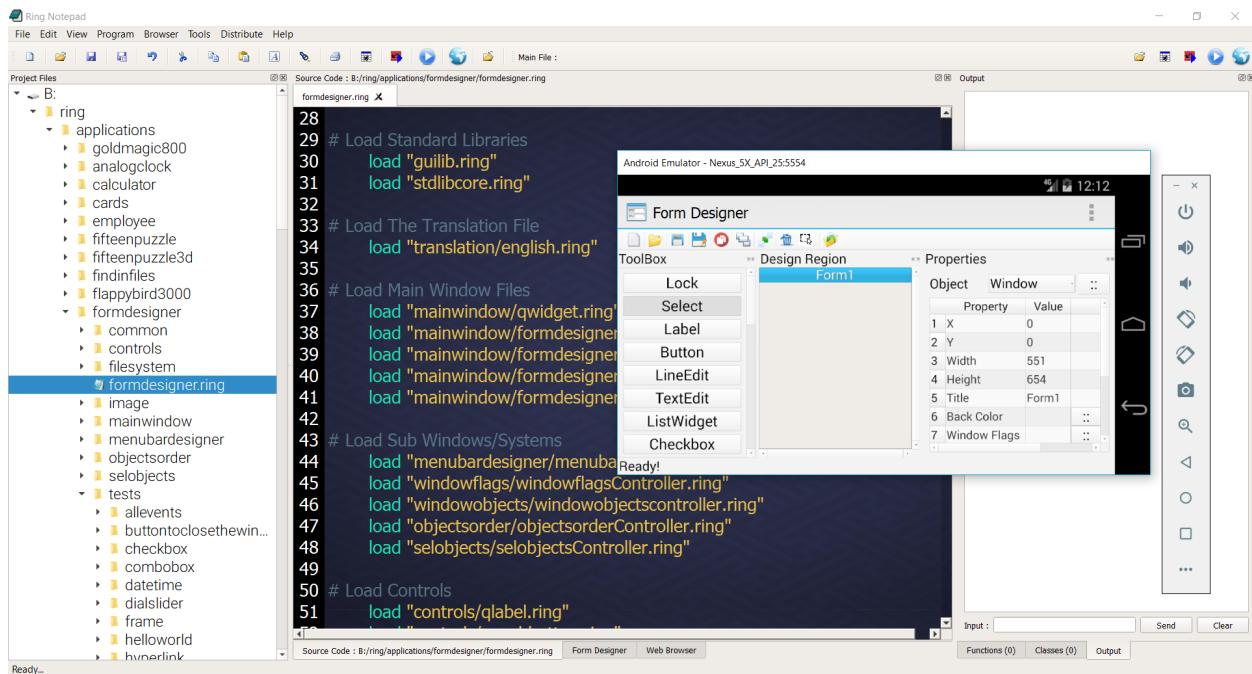
1.10 Practical

Many of the Ring libraries (StdLib, WebLib, Natural Library, Games Engine, etc.) and the Ring IDE (Ring Notepad, Form Designer, etc.) are written in the Ring language itself. Ring is ready for use in production and increase the developers productivity.

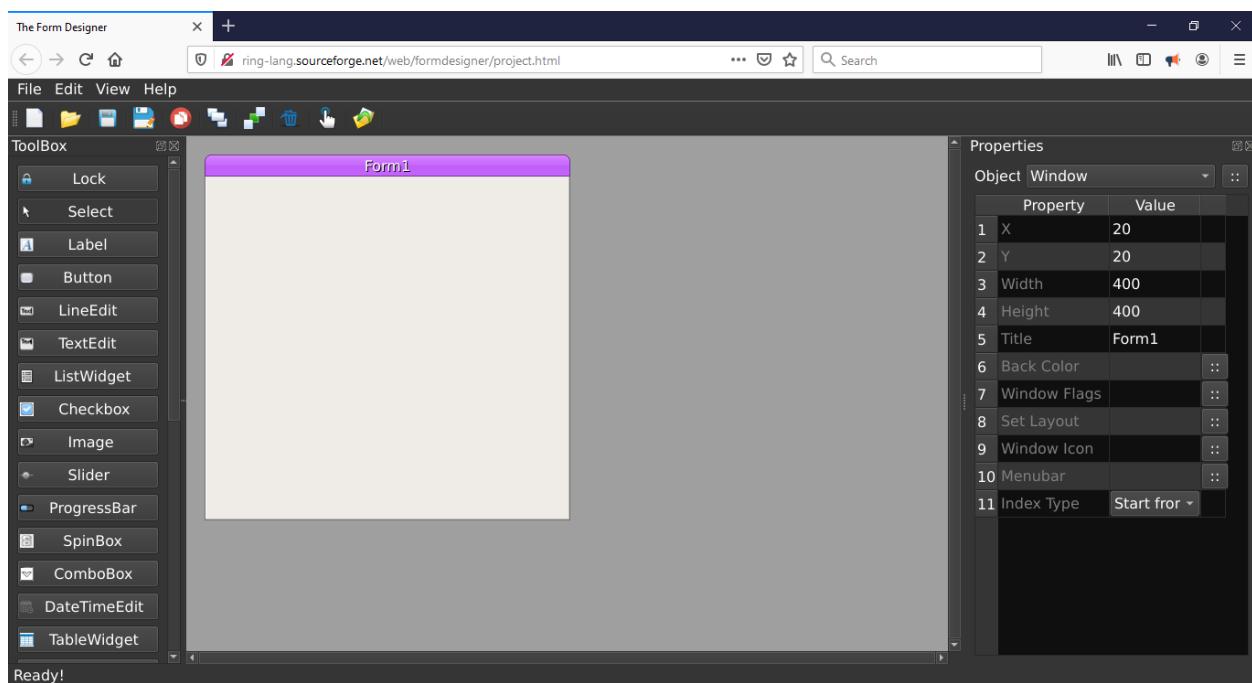
Check the Form Designer source code : <https://github.com/ring-lang/ring/tree/master/tools/formdesigner>



We can run the Form Designer as Android application!



Also we can run it in the Web Browser as a web application using WebAssembly



INTRODUCTION



Welcome to the Ring programming language!

Ring is an Innovative and practical general-purpose multi-paradigm language that can be embedded in C/C++ projects, extended using C/C++ code and/or used as standalone language. The supported programming paradigms are Imperative, Procedural, Object-Oriented, Functional, Meta programming, Declarative programming using nested structures, and Natural programming. The language is portable (Windows, Linux, macOS, Android, etc.) and can be used to create Console, GUI, Web, Games and Mobile applications. The language is designed to be Simple, Small, Flexible and Fast. Its Dynamic Language that compile the source code to byte code then execute it by the Ring Virtual Machine, which is integrated with the Ring Compiler in one program.

In this chapter we are going to discuss the goals behind the language design and implementation.

2.1 Motivation

In Nov. 2011, I started to think about creating a new version of the Programming Without Coding Technology (PWCT) software from scratch.

I was interested in creating multi-platform edition of the software beside adding support for Web & Mobile development.

What I was looking for is a programming language that can be used to build the development environment, provides multi-platform support, more productivity, better performance, can be used for components scripting and developing different kinds of applications.

Instead of using a mix of programming languages, I decided to use one programming language.

I looked at many programming languages, but I discovered that I need a different language that comes with new ideas and intelligent implementation.

2.2 Ring and other languages

Ring is an innovative programming language that comes with better support for Natural Language Programming and Declarative Programming. The innovation comes in supporting these paradigms with new practical techniques on the top of Object-Oriented Programming and Functional Programming.

Also Ring is influenced by the next programming languages

- Lua
- Python
- Ruby
- C
- C#
- BASIC
- QML
- xBase
- Supernova

2.3 History

In Sept. 2013 I started the design and the implementation of the Ring programming language. After 21 months of development, In May 2015 the language Compiler & Virtual Machine were ready for use!

After that I spent three months testing the language again, trying to discover any bug to fix, writing better tests, by the end of August 2015, all known bugs were fixed, Writing many tests and testing automation helped a lot in getting a stable product.

In September 12, 2015, most of the documentation was written. Before releasing the language I started the marketing by writing a post in Arabic language about it to my facebook profile page asking for contributors interested in the language idea after reading a short description, In the same day I got a lot of emails from developers and friends interested to contribute!

Ring 1.0 is released on January 25, 2016

Ring 1.1 is released on October 6, 2016

Ring 1.2 is released on January 25, 2017

Ring 1.3 is released on May 15, 2017

Ring 1.4 is released on June 29, 2017

Ring 1.5 is released on August 21, 2017

Ring 1.6 is released on November 30, 2017

Ring 1.7 is released on January 25, 2018

Ring 1.8 is released on June 25, 2018

Ring 1.9 is released on October 6, 2018

Ring 1.10 is released on January 25, 2019

Ring 1.11 is released on September 15, 2019

Ring 1.12 is released on January 25, 2020

Ring 1.13 is released on September 15, 2020

2.4 Features

The Ring language comes with the next features

Tip: The language is ready for production!

- Free Open Source (MIT License)
- Hybrid Implementation (Compiler + Virtual Machine)
- Declarative programming on the top of Object-Oriented programming
- Natural Language Programming on the top of Object-Oriented programming
- Natural Language Programming Library
- Three different styles for writing the code and you can create your style
- Syntax Flexibility (You can change the language keywords and operators)
- The language keywords can be translated from English to other languages (Arabic, French, etc)
- Compact Syntax, No explicit end for statements (No ; or ENTER is required)
- Using braces { } we can access objects and use attributes/methods as variables/functions
- Transparent Implementation (See the Tokens, Grammar, and Byte Code for each program)
- Visual Implementation - Developed using Visual Programming (PWCT)
- Written in ANSI C (The code is generated + Looks identical to Handwritten Code)
- **A small language**
 - The compiler + The Virtual Machine (20,000 lines of C code)
 - The other 500,000 lines of code are related to libraries!
- Portable (Windows, Linux, macOS, Android, etc)
- Comments (One line & Multi-lines)
- Not Case-Sensitive
- Dynamic Typing
- Weakly typed (Automatic conversion between numbers and strings only)
- Lexical Scoping (Global, Local & Object State)
- Default scope for variables inside functions (Local)
- Default scope for variables outside functions (global)
- We can have separate global scope for each library or sub project
- Garbage Collector - Automatic Memory Management (Escape Analysis and Reference Counting)
- In most cases (90%) using Escape Analysis we don't need to run the Garbage Collector (Faster)
- Structure Programming

- Rich control structures & Operators
- For in get item by reference not value, you can read/edit the item
- Use exit to go outside from more than one loop (Use it for programming in the small only)
- Procedures/Functions
- Main Function (Optional - To avoid using the Global Scope)
- Call Function before the definition (Top-Down Programming)
- Recursion
- Multi-line literals
- Access (read/write) string letter by index
- The list index start by 1
- No keyword to end Functions/Classes/Packages
- Range operator ex: 1:10 and “a”：“z”
- First Class Variables, Lists, Objects and Functions
- Store/Copy Lists/Objects by value (Deep Copy)
- Pass Lists/Objects by reference
- Native Object-Oriented Support
 - Encapsulation
 - Setter/Getter (optional)
 - private state (optional)
 - Instantiation
 - Polymorphism
 - Composition
 - Inheritance (Single Inheritance)
 - Operator Overloading
 - Packages
- Reflection and Meta-programming
- Clear program structure (Statements then functions then packages & classes)
- Exception Handling
- Eval() to execute code during run-time
- 8-bit clean, work on binary data directly
- I/O commands
- Math functions
- String functions
- List functions
- File processing functions
- Database support (ODBC, SQLite, MySQL & PostgreSQL)

- Security Functions (OpenSSL)
- Internet Functions (LibCurl)
- Zip Functions
- CGI Library (Written in Ring)
 - HTTP Get
 - HTTP Post
 - File upload
 - Cookies
 - URL Encode
 - HTML Templates
 - HTML Special Characters
 - HTML Generation using Functions
 - HTML Generation using Classes
 - CRUD Example (using MVC)
 - Users Example (Register, Login and Check)
- Deploying web applications in the Cloud
- Extension using C/C++ (Simple API)
- Embedding the language in C/C++ programs
- Embedding Ring in Ring
- **Comes with code generator (Written in Ring) to quickly wrap C/C++ Libraries**
 - Used to Support Allegro by creating RingAllegro
 - Used to Support LibSDL by creating RingLibSDL
 - Used to Support Qt by creating RingQt
- Create 2D Games for Desktop and Mobile (Using the Allegro Library)
- RingLibSDL Extension
- Comes with simple Game Engine for 2D Games
- RingOpenGL Extension
- RingFreeGLUT Extension
- RingRayLib Extension
- Create GUI Applications for Desktop and Mobile (Using the Qt Framework)
- Comes with IDE contains the Code Editor (Ring Notepad) and the Form Designer
- RingREPL (Read-Eval-Print-Loop)
- Tracing and Debugging
- Type Hints Library
- Comes with Ring2EXE to distribute applications
- RingLibuv Extension

- No Global Interpreter (VM) lock (No GIL) - Better for threads and concurrency (Faster)
- Comes with RingPM (Package Manager)
- Many Samples and Applications
- Complete Documentation.

2.5 License

The Ring Programming Language

<http://ring-lang.net/>

Version 1.13

The MIT License (MIT)

Copyright (c) Mahmoud Fayed

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

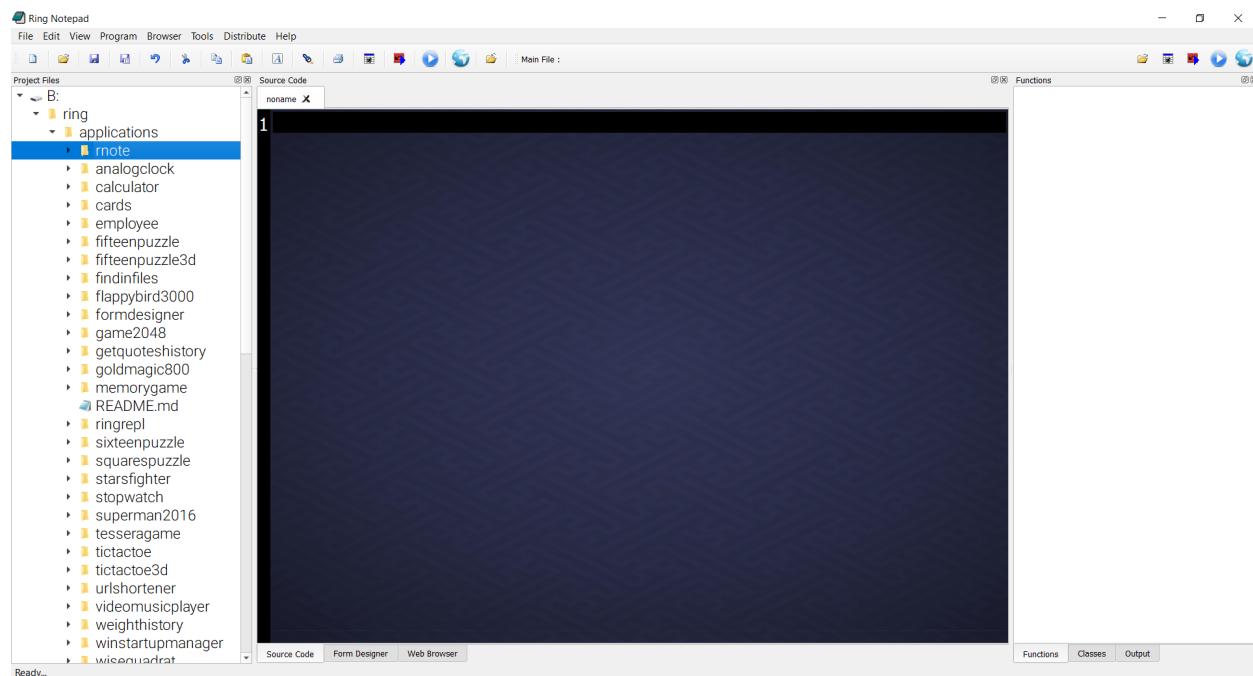
USING RING NOTE PAD

In this chapter we will learn about using Ring Notepad to write and execute Ring programs quickly
Ring Notepad is just a simple application developed using the Ring language.

3.1 Ring Notepad - Main Window

When we run the Ring Notepad we get the next dockable windows

- Project Files Window : where we can select and open any ring file (*.ring) quickly.
- Source Code Window : Where we write the source code.
- Form Designer Window : The Form Designer to create GUI application forms.
- Web Browser Window : Where we read the documentation or quickly open any website.
- Output Window : Output when we run programs that print to the standard output
- Function Window : List of functions in the current source file
- Classes Window : List of classes in the current source file

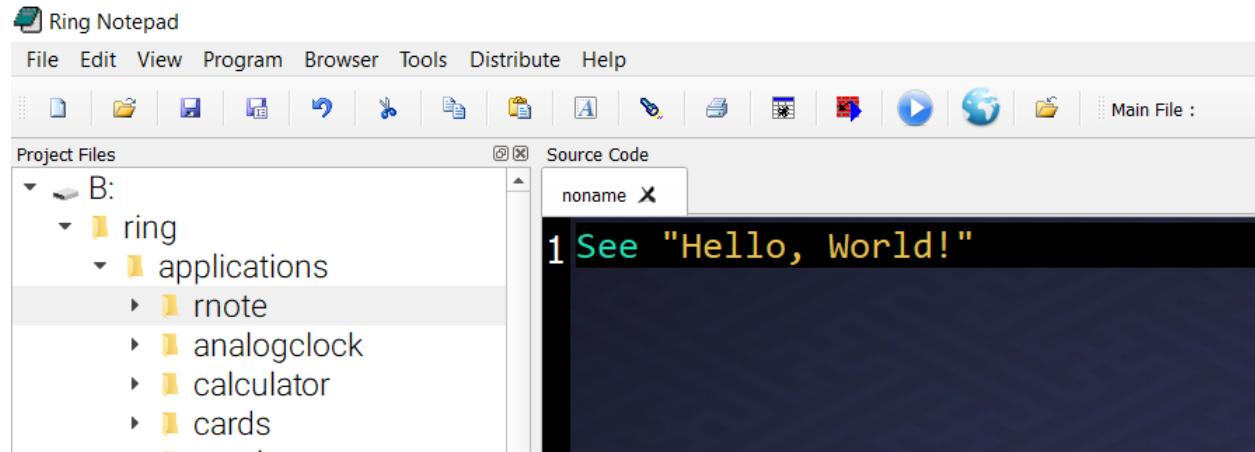


3.2 Creating and running your first Console Application

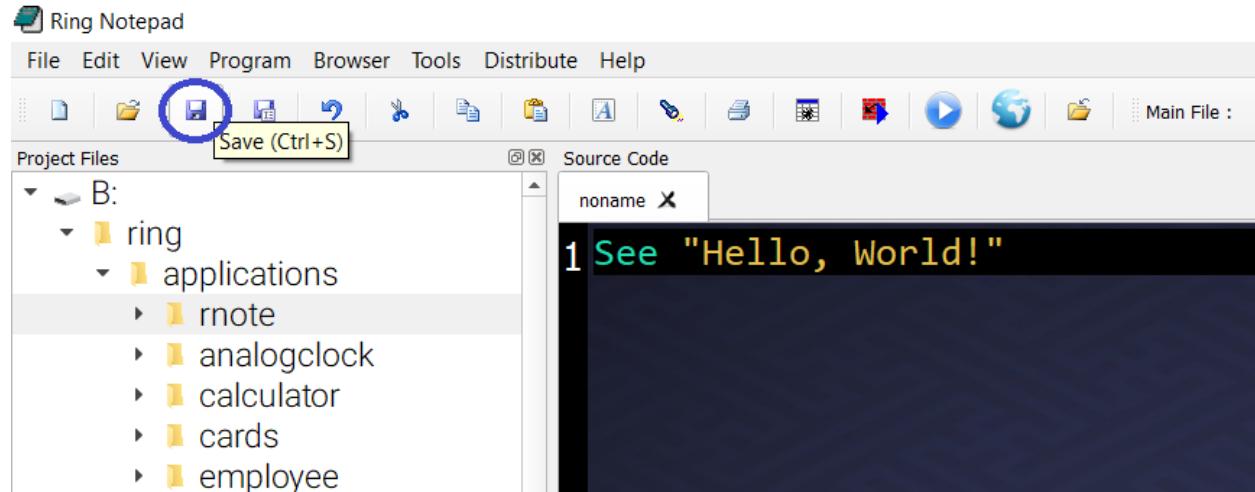
At first we will type the source code

```
see "Hello, World!"
```

As in the next image



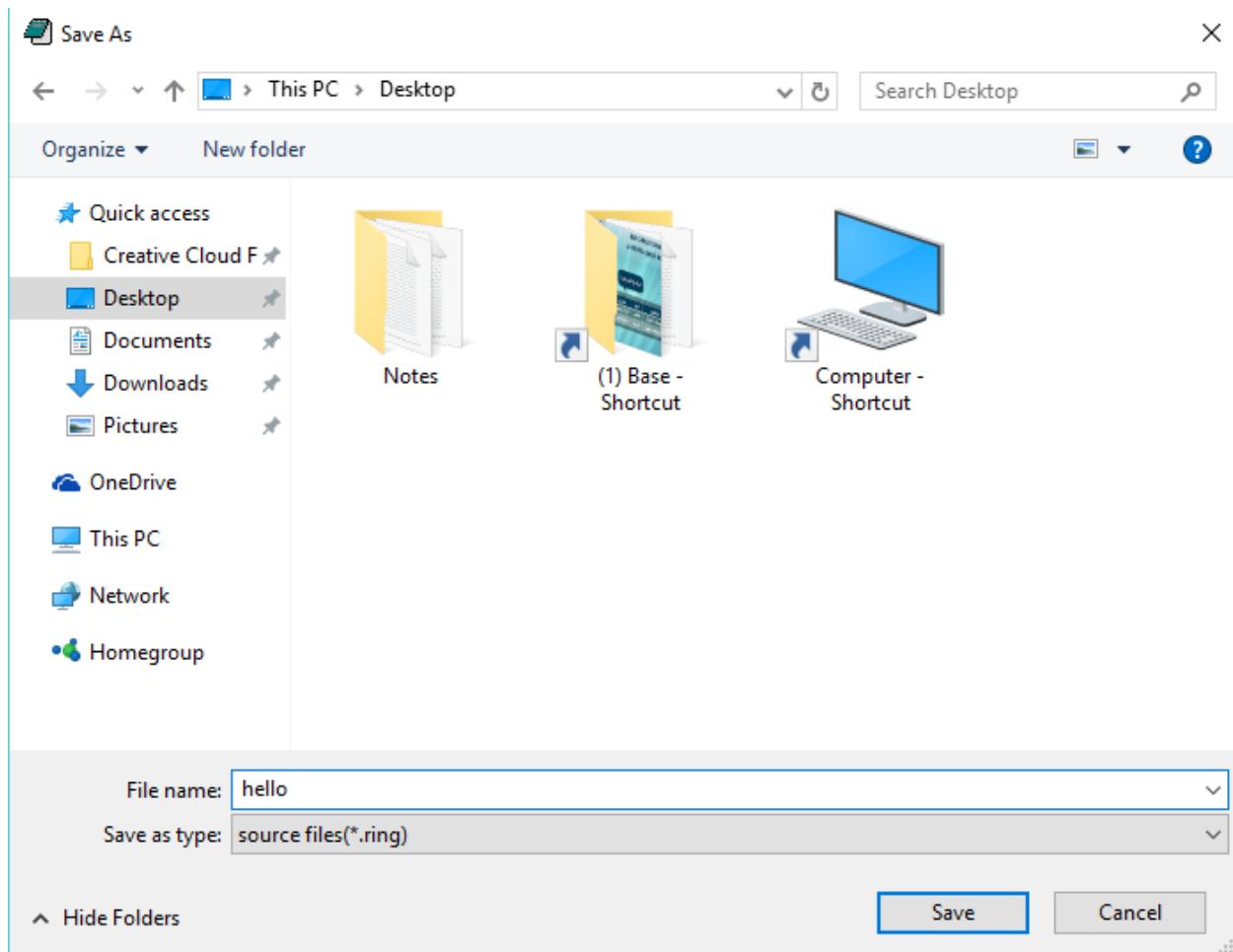
Then we will click on the “Save” button from the toolbar (or press CTRL+S)



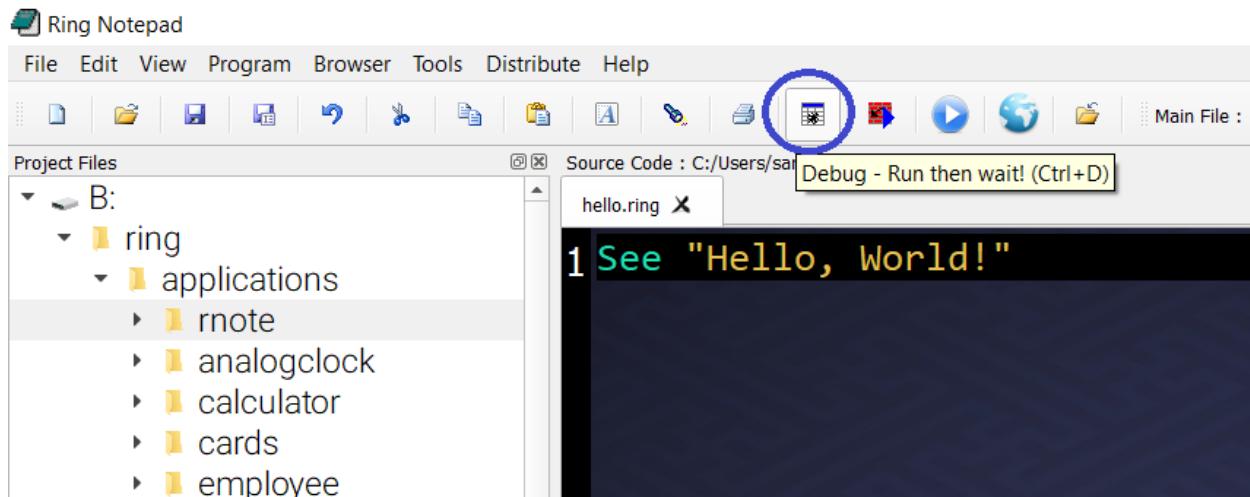
Determine the source code file name and location.

For example type : hello

This will create a new source code file called : hello.ring

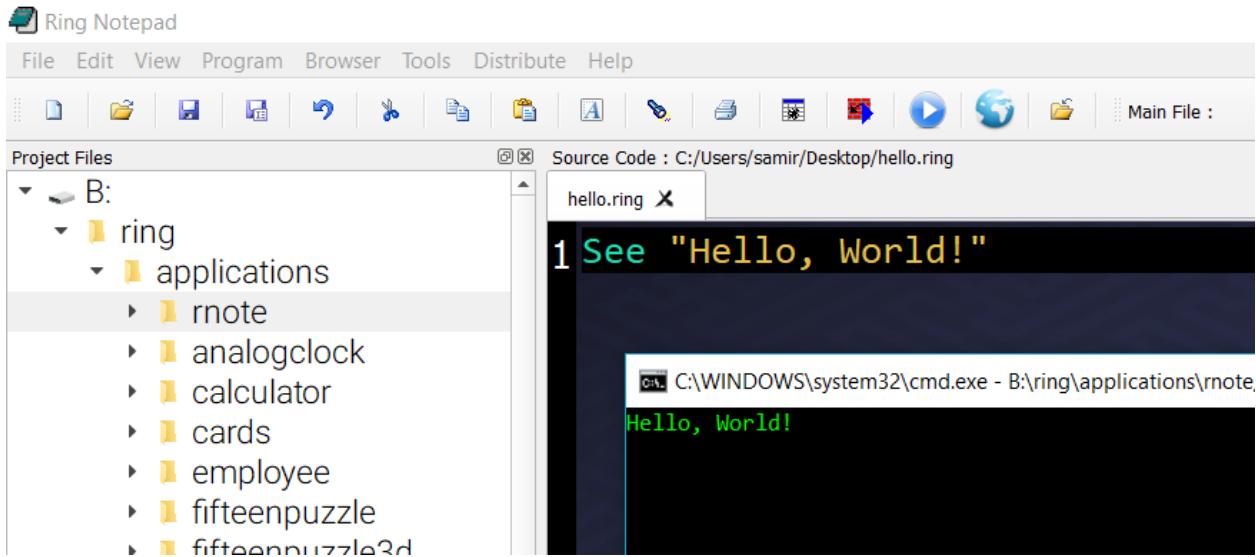


To run the program click on “Debug (Run then wait!)” button from the toolbar



The next screen shot present the application during the runtime

Press Enter to continue and return to the Ring Notepad.



3.3 Creating and running your first GUI/WebAssembly/Mobile Application

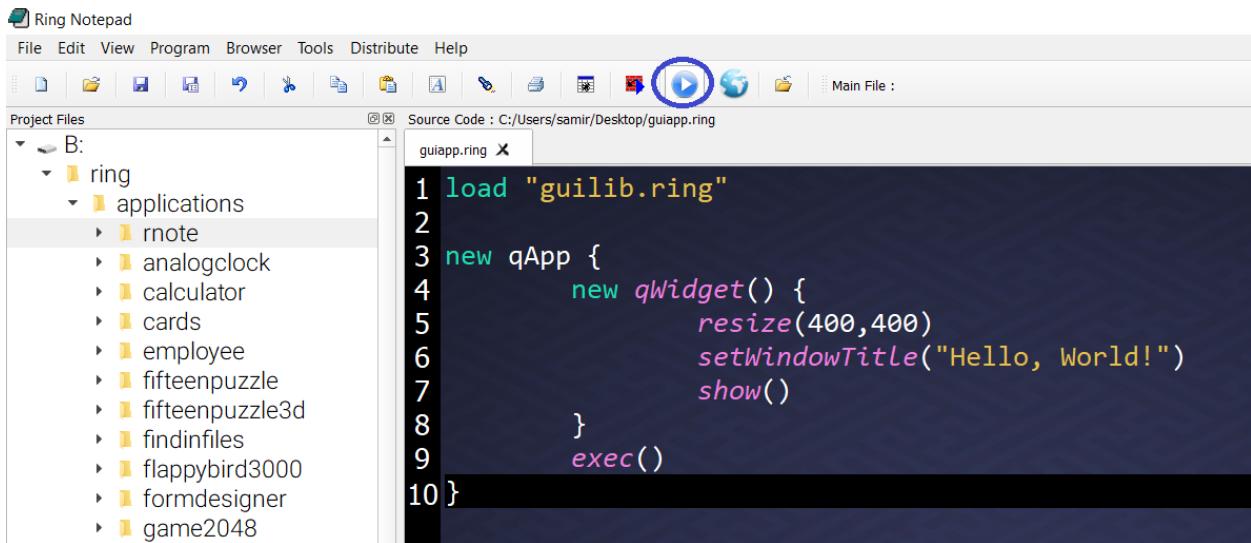
To learn how to create GUI applications using Ring check the “Desktop, WebAssembly and Mobile development using RingQt” chapter.

Source Code:

```
load "guilib.ring"

new qApp {
    new QWidget() {
        resize(400,400)
        setWindowTitle("Hello, World!")
        show()
    }
    exec()
}
```

In Ring notepad we have a special button to run GUI applications without displaying the console window.



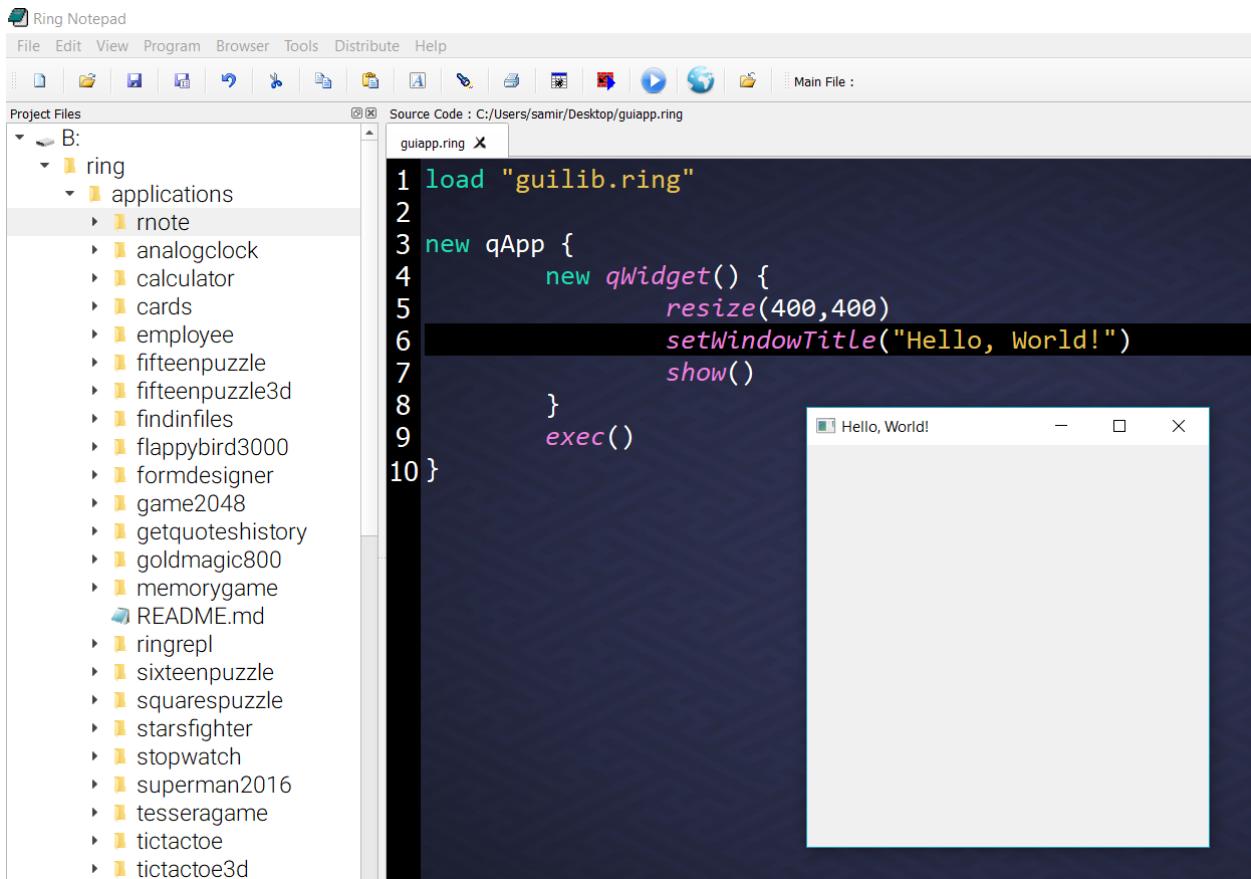
The screenshot shows the Ring Notepad interface. The menu bar includes File, Edit, View, Program, Browser, Tools, Distribute, and Help. The toolbar contains various icons for file operations and tools. The Project Files panel shows a directory structure under 'B:' with 'ring' and 'applications' folders, and several sub-applications like 'rnote', 'analogclock', 'calculator', etc. The main code editor window displays the following Ring script:

```

1 load "guilib.ring"
2
3 new qApp {
4     new QWidget() {
5         resize(400,400)
6         setWindowTitle("Hello, World!")
7         show()
8     }
9     exec()
10}

```

The next screen shot present the application during the runtime



This screenshot shows the Ring Notepad interface again, but now with a running application window in the foreground. The window is titled "Hello, World!" and is a simple white square. The background shows the same project structure and code editor as the previous screenshot.

3.4 Creating and running your first Web Application

To learn how to support Ring in your web server and how to create web applications check the “Web Development (CGI Library)” chapter.

Note: You need to support the Ring language in your web server to be able to run the next example.

Tip: For Windows users, Ring comes with Apache Web server! Using Ring Notepad we can run any web application from any folder directly without doing any configuration.

Source Code:

```
#!ring -cgi

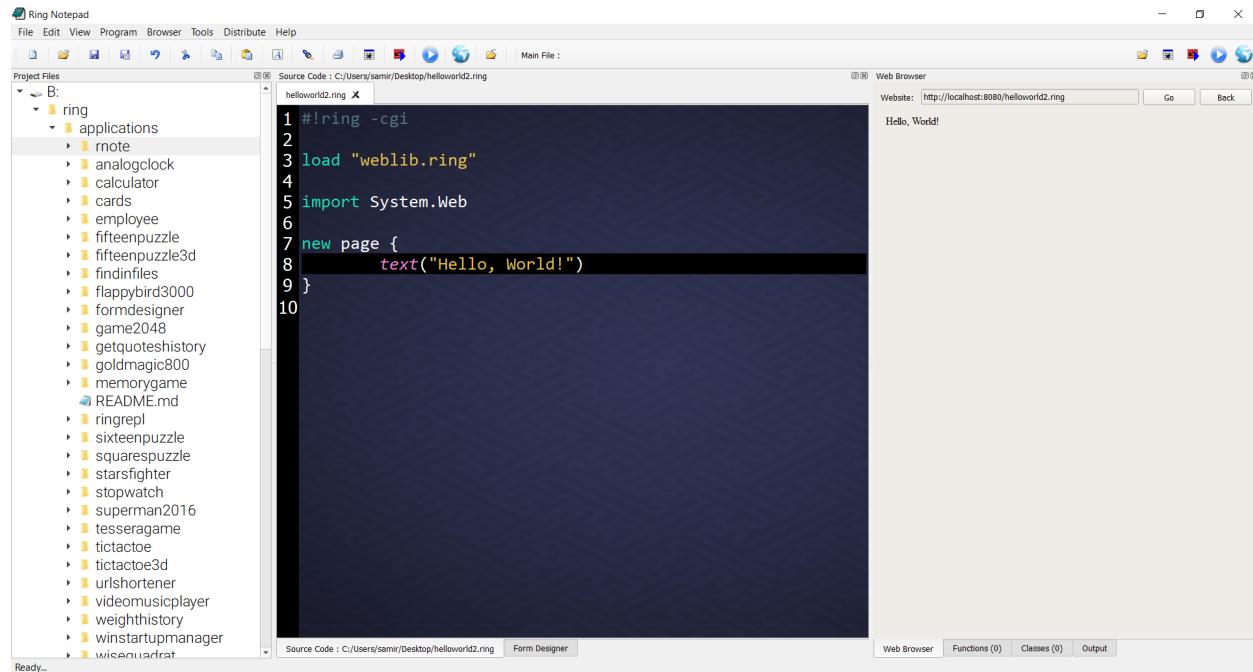
load "weblib.ring"

import System.Web

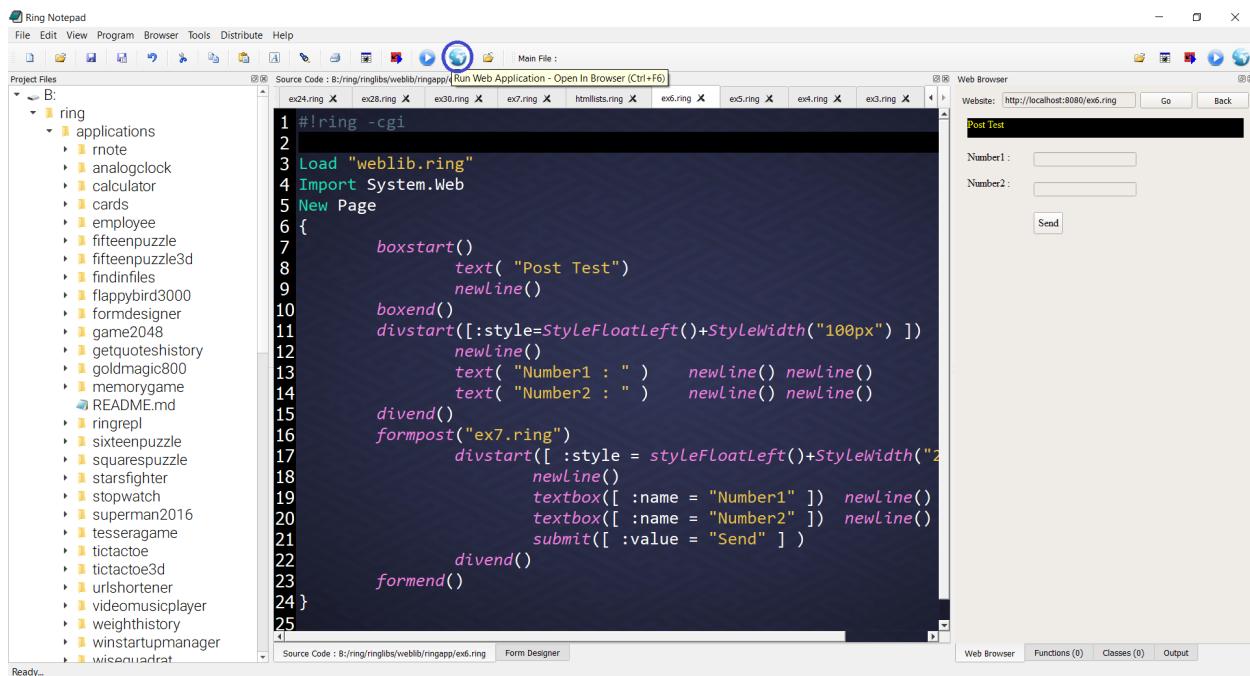
new Page {

    text ("Hello, World!")
}
```

We can run the application in any web browser or in the browser that are embedded in Ring Notepad.



We can run the web application using the Web icon.



3.5 Creating and running your first Desktop/Mobile Game

To learn about creating 2D Games using Ring check the “Demo Project - Game Engine for 2D Games” chapter.

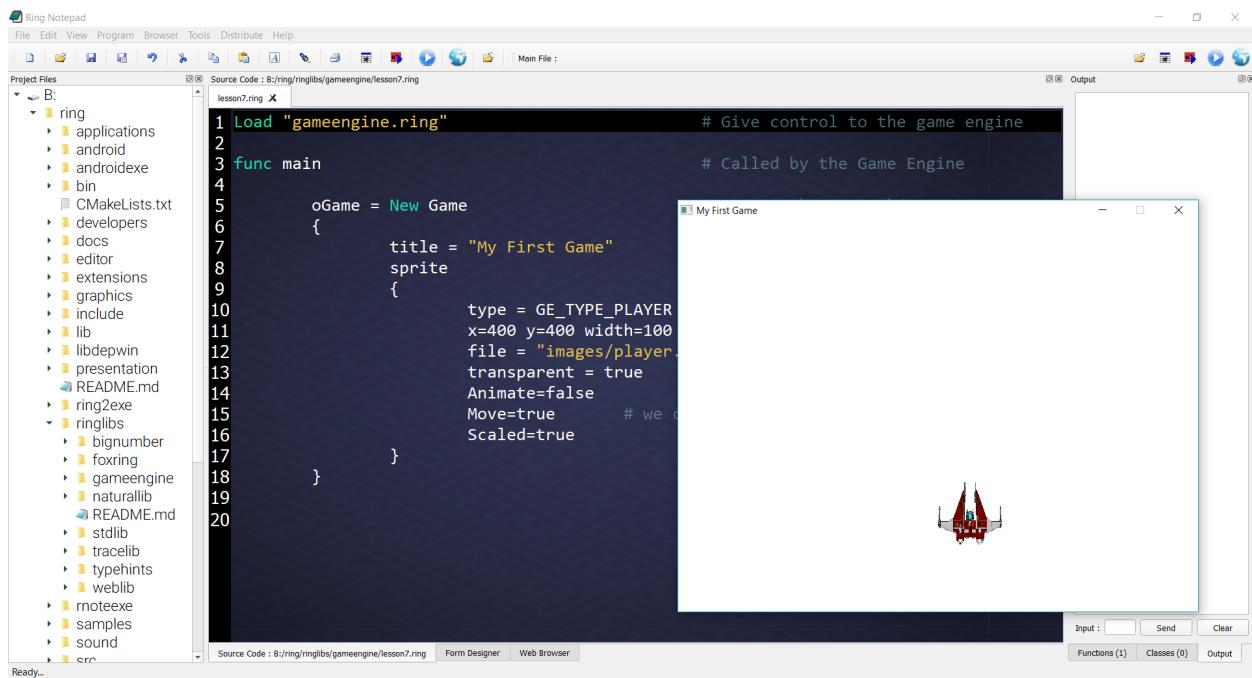
Source Code:

```
load "gameengine.ring"

func main

    oGame = New Game
    {
        title = "My First Game"
        sprite
        {
            type = GE_TYPE_PLAYER
            x=400 y=400 width=100 height=100
            file = "images/player.png"
            transparent = true
            Animate=false
            Move=true
            Scaled=true
        }
    }
```

We can run the application as any GUI application.



3.6 The Main File in the Project

The idea of the Main File ToolBar is to determine the main file in the project When the project contains many source code files

Using this feature we can run the project (Main File) at any time while opening other files in the project without the need to switch to the Main File to run the project.

To quickly use this feature

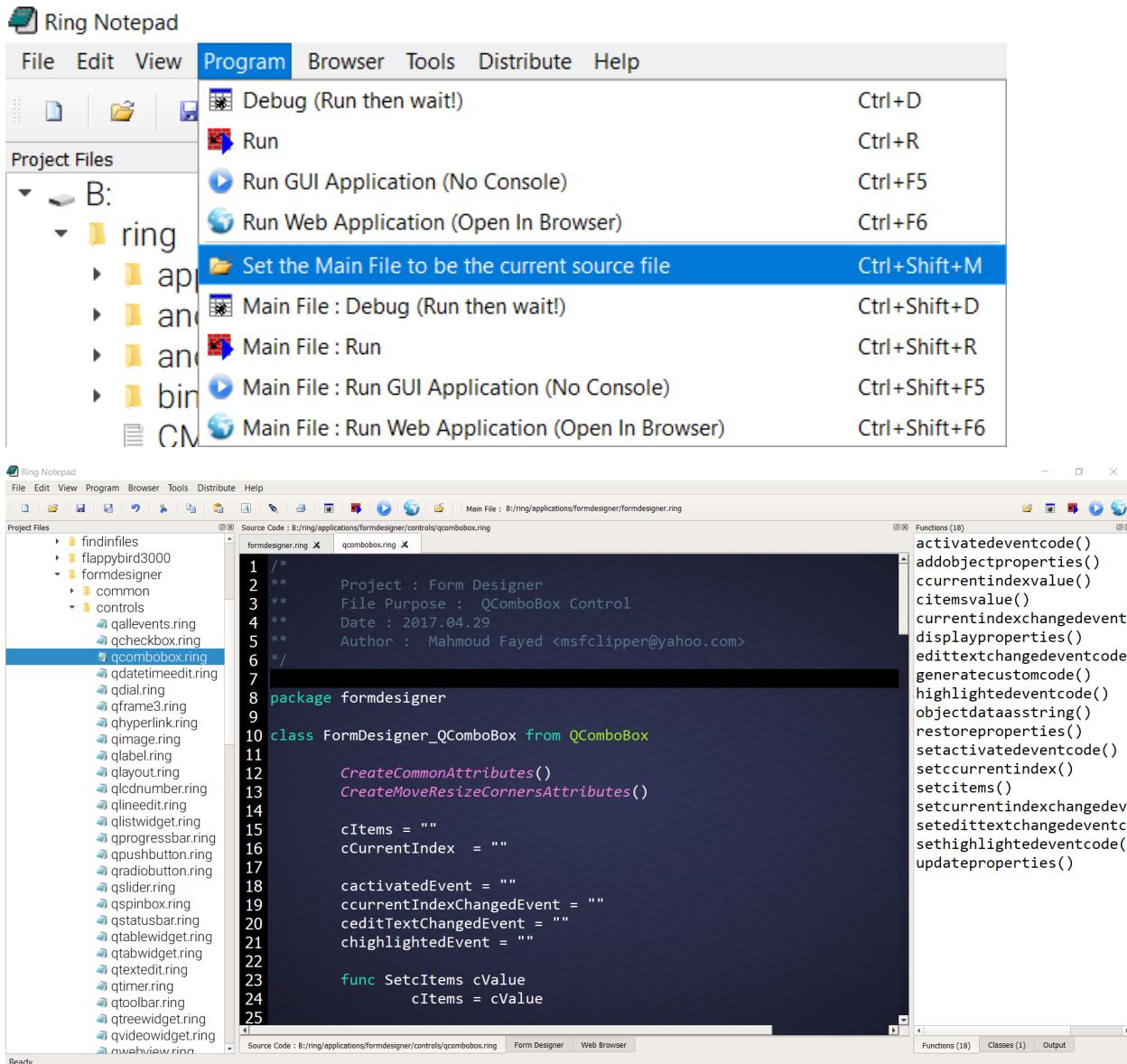
(Open the project main file)

Press Ctrl+Shift+M to set the current source code file as the main file

Open and modify other source code files in the project

To run the project (Main File) at any time press Ctrl+Shift+F5 (GUI) or Ctrl+Shift+D (Console)

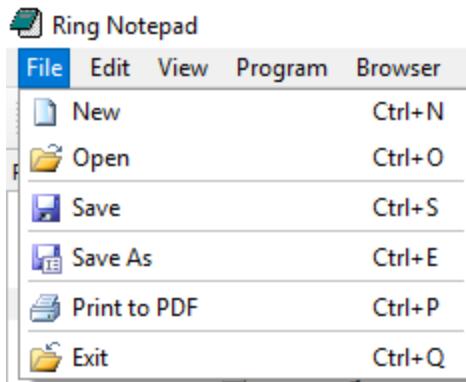
Screen Shots:



3.7 The File Menu

From this menu we can create, open and save the source code files.

Another feature in this menu is “Print to PDF”



3.8 The Edit Menu

From the Edit menu we can Cut, Copy and Paste text.

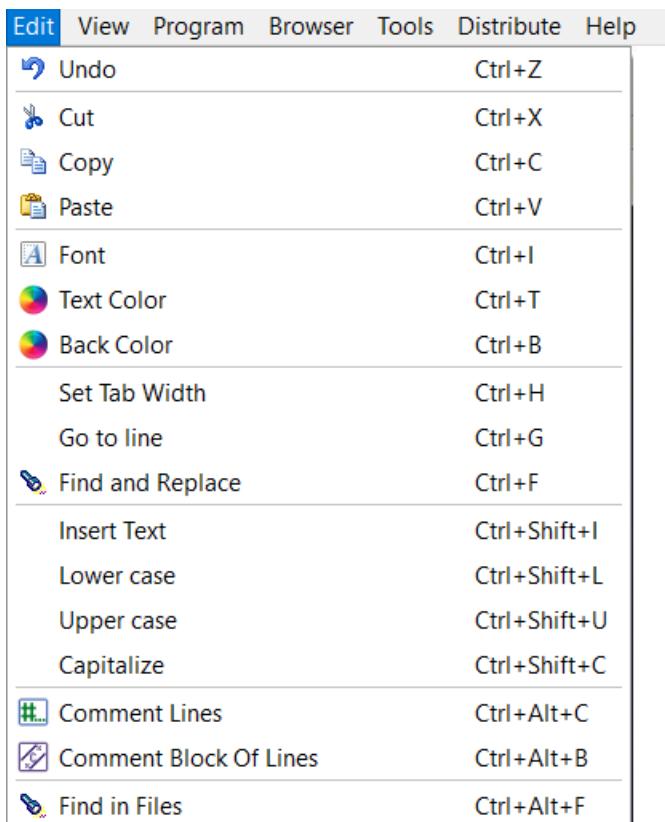
Also we can change the font and the colors.

We can Go to a specific line or use the Find and Replace window to find and replace text.

Also We can set the Tab Width (Number of Spaces)

Starting from Ring 1.8 we have the (Find in Files) option.

Starting from Ring 1.11 we have the (Insert Text, Lower Case, Upper Case & Capitalize) options.

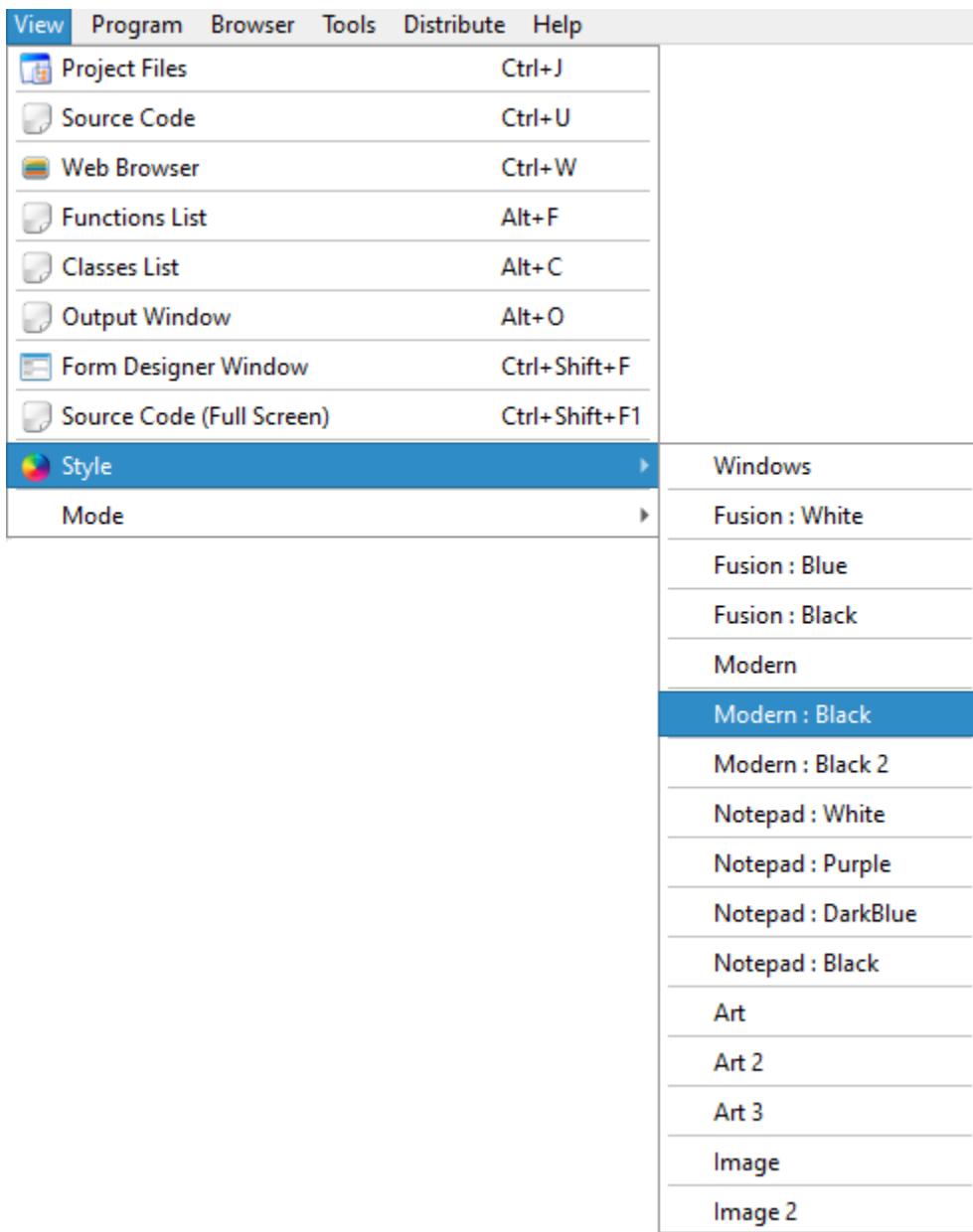


3.9 The View Menu

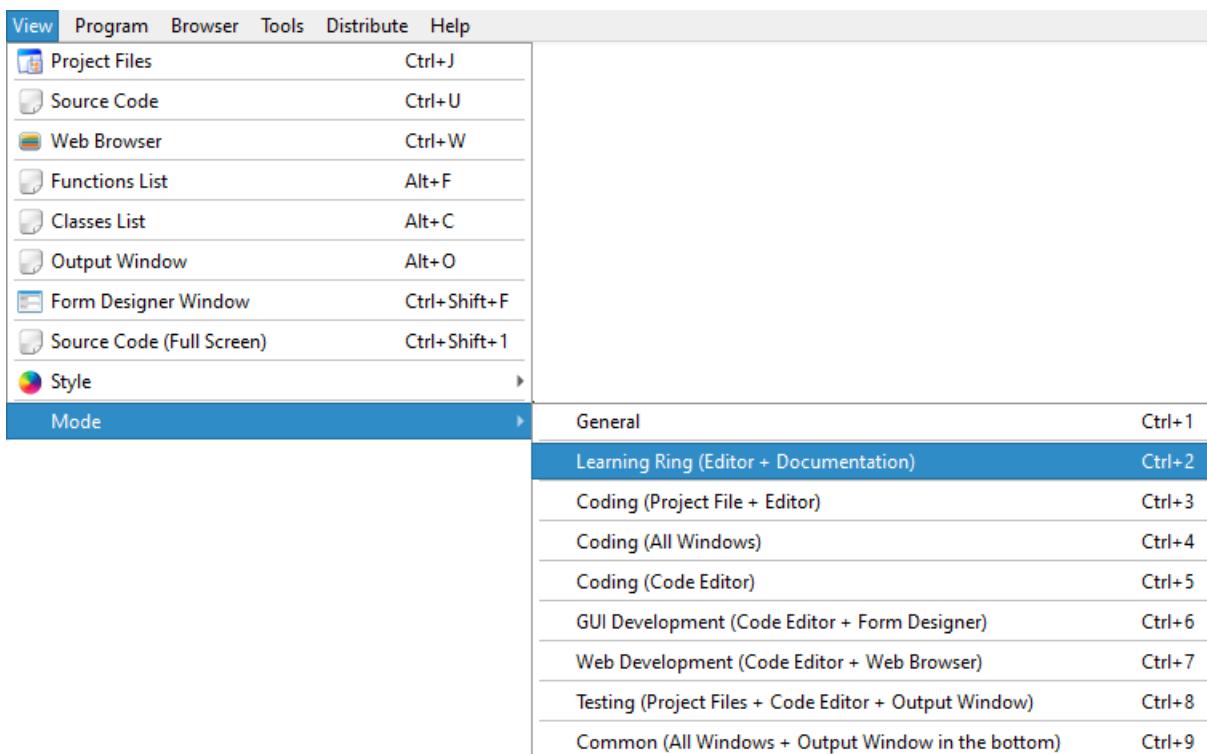
From this menu we can show/hide the dockable windows

Also we can change the Style of the Ring Notepad

Common Styles are (Fusion White and Modern Black)



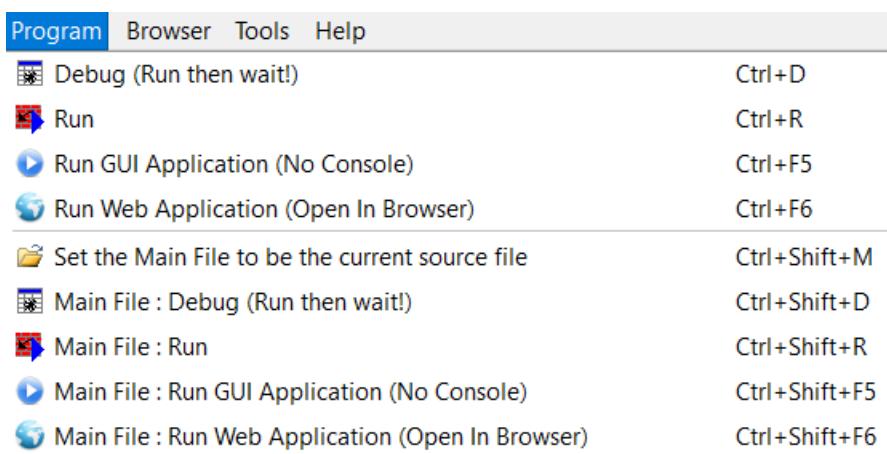
Also we can quickly show/hide group of dockable windows based on the context



3.10 The Program Menu

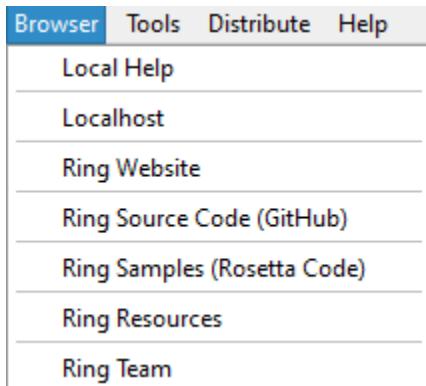
From this menu we can run the programs

Also we can set the Main file in the project



3.11 The Browser Menu

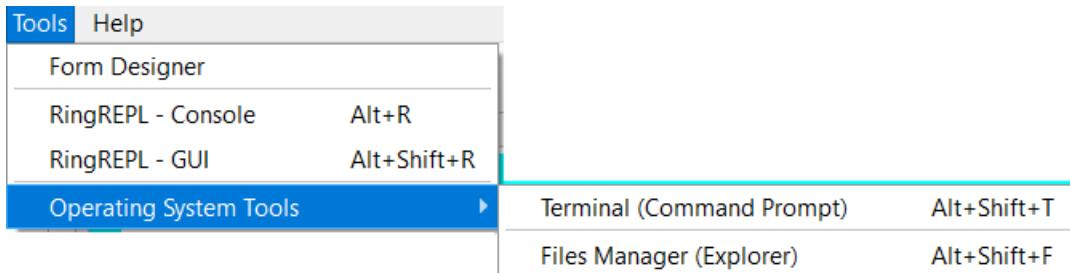
From this menu we can quickly open common links in the browser



3.12 The Tools Menu

From this menu we can run the Form Designer in separate window

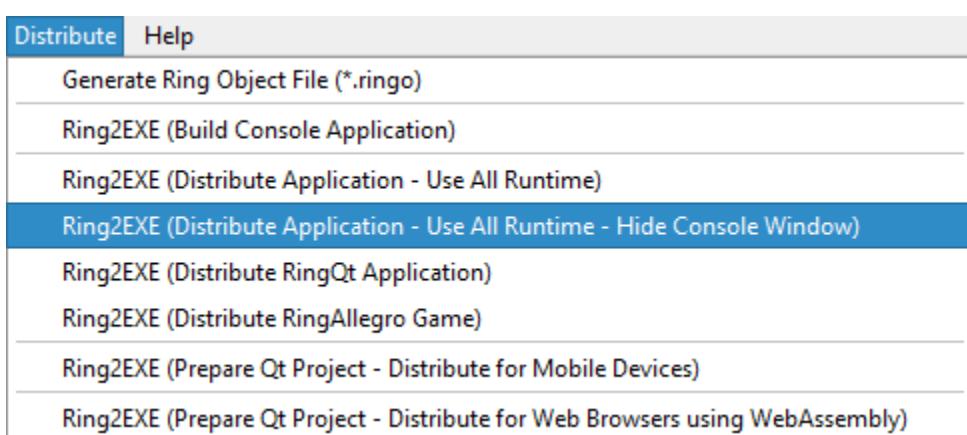
Also we can run the REPL (Read-Eval-Print-Loop) application



3.13 The Distribute Menu

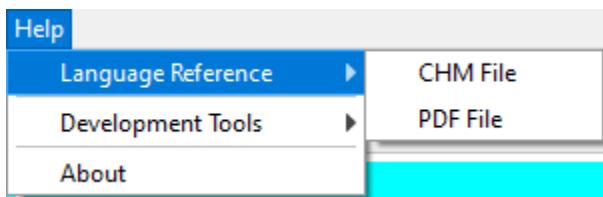
From this menu we can build an executable file for the application

Also we can prepare the application for distribution



3.14 The Help Menu

From this menu we can get the help files (CHM & PDF)



GETTING STARTED - FIRST STYLE

4.1 Hello World

The next program prints the Hello World message on the screen (std-out).

```
see "Hello World"
```

4.2 Run the program

to run the program, save the code in a file, for example : hello.ring then from the command line or terminal, run it using Ring

```
ring hello.ring
```

4.3 Create Executable File

Using Ring2EXE we can create executable file for our application

```
ring2exe hello.ring -static
```

4.4 Not Case-Sensitive

Since the Ring language is not case-sensitive, the same program can be written in different styles

Tip: It's better to select one style and use it in all of the program source code

```
SEE "Hello World"
```

```
See "Hello World"
```

4.5 Multi-Line literals

Using Ring we can write multi-line literal, see the next example

```
See "
    Hello
    Welcome to the Ring programming language
    How are you?
"
"
```

Also you can use the nl variable to insert new line and you can use the + operator to concatenate strings

As we have NL for new lines, we have Tab and CR (Carriage return) too!

Note: nl value means a new line and the actual codes that represent a newline is different between operating systems

```
See "Hello" + nl + "Welcome to the Ring programming language" +
nl + "How are you?"
```

4.6 Getting Input

You can get the input from the user using the give command

```
See "What is your name? "
Give cName
See "Hello " + cName
```

4.7 No Explicit End For Statements

You don't need to use ';' or press ENTER to separate statements. The previous program can be written in one line.

```
See "What is your name? " give cName see "Hello " + cName
```

4.8 Using ? to print expression then new line

It's common to print new line after printing an expression, We can use the ? operator to do that!

Example:

```
? "Hello, World!"
for x = 1 to 10
    ? x
next
```

Output:

```
Hello, World!
1
2
3
4
5
6
7
8
9
10
```

4.9 Writing Comments

We can write one line comments and multi-line comments

The comment starts with # or //

Multi-lines comments are written between /* and */

```
/*
    Program Name : My first program using Ring
    Date        : 2016.09.09
    Author       : Mahmoud Fayed
*/
 
See "What is your name? "          # print message on screen
give cName                         # get input from the user
see "Hello " + cName               # say hello!

// See "Bye!"
```

Note: Using // to comment a lines of code is just a code style.

GETTING STARTED - SECOND STYLE

5.1 Hello World

The next program prints the Hello World message on the screen (std-out).

```
put "Hello World"
```

5.2 Run the program

to run the program, save the code in a file, for example : hello.ring then from the command line or terminal, run it using Ring

```
ring hello.ring
```

5.3 Create Executable File

Using Ring2EXE we can create executable file for our application

```
ring2exe hello.ring -static
```

5.4 Not Case-Sensitive

Since the Ring language is not case-sensitive, the same program can be written in different styles

Tip: It's better to select one style and use it in all of the program source code

```
PUT "Hello World"
```

```
Put "Hello World"
```

5.5 Multi-Line literals

Using Ring we can write multi-line literal, see the next example

```
Put "
    Hello
    Welcome to the Ring programming language
    How are you?

"
```

Also you can use the nl variable to insert new line and you can use the + operator to concatenate strings

As we have NL for new lines, we have Tab and CR (Carriage return) too!

Note: nl value means a new line and the actual codes that represent a newline is different between operating systems

```
Put "Hello" + nl + "Welcome to the Ring programming language" +
nl + "How are you?"
```

5.6 Getting Input

You can get the input from the user using the get command

```
Put "What is your name? "
Get cName
Put "Hello " + cName
```

5.7 No Explicit End For Statements

You don't need to use ';' or press ENTER to separate statements. The previous program can be written in one line.

```
Put "What is your name? " get cName put "Hello " + cName
```

5.8 Writing Comments

We can write one line comments and multi-line comments

The comment starts with # or //

Multi-lines comments are written between /* and */

```
/*
    Program Name : My first program using Ring
    Date        : 2016.09.09
    Author      : Mahmoud Fayed
*/
```

(continues on next page)

(continued from previous page)

```
Put "What is your name? "      # print message on screen
get cName                      # get input from the user
put "Hello " + cName           # say hello!
// Put "Bye!"
```

Note: Using // to comment a lines of code is just a code style.

GETTING STARTED - THIRD STYLE

6.1 Hello World

The next program prints the Hello World message on the screen (std-out).

```
load "stdlib.ring"  
print ("Hello World")
```

6.2 Run the program

to run the program, save the code in a file, for example : hello.ring then from the command line or terminal, run it using Ring

```
ring hello.ring
```

6.3 Create Executable File

Using Ring2EXE we can create executable file for our application

```
ring2exe hello.ring -static
```

The -static option will avoid the need to ring.dllring.so|ring.dylib

But since the stdlib.ring load libraries like (LibCurl, OpenSSL, MySQL, etc)

You will need these libraries!

To avoid the need to these libraries (If you don't need stdlib classes)

Use stdlibcore.ring instead of stdlib.ring as in the next example

```
load "stdlibcore.ring"  
print ("Hello World")
```

Using stdlibcore.ring You can access the stdlib functions but not the stdlib classes.

if you want to use stdlib.ring and distribute your application

```
ring2exe hello.ring -dist -allruntime -noqt -noallegro
```

6.4 Not Case-Sensitive

Since the Ring language is not case-sensitive, the same program can be written in different styles

Tip: It's better to select one style and use it in all of the program source code

```
LOAD "stdlib.ring"
PRINT("Hello World")
```

```
Load "stdlib.ring"
Print("Hello World")
```

6.5 Multi-Line literals

Using Ring we can write multi-line literal, see the next example

```
Load "stdlib.ring"
Print("
    Hello
    Welcome to the Ring programming language
    How are you?

")
```

Also you can use the \n to insert new line and you can use #{variable_name} to insert variables values.

```
Load "stdlib.ring"
Print( "Hello\nWelcome to the Ring programming language\nHow are you?")
```

6.6 Getting Input

You can get the input from the user using the getString() function

```
Load "stdlib.ring"
Print("What is your name? ")
cName = GetString()
Print("Hello #{cName}")
```

6.7 No Explicit End For Statements

You don't need to use ';' or press ENTER to separate statements. The previous program can be written in one line.

```
Load "stdlib.ring"
Print("What is your name? ") cName=getstring() print("Hello #{cName}")
```

6.8 Writing Comments

We can write one line comments and multi-line comments

The comment starts with # or //

Multi-lines comments are written between /* and */

```
/*
    Program Name : My first program using Ring
    Date        : 2016.09.09
    Author      : Mahmoud Fayed
*/

Load "stdlib.ring"

Print("What is your name? ")      # print message on screen
cName=GetString()                # get input from the user
print("Hello #{cName}")          # say hello!

// print("Bye!")
```

Note: Using // to comment a lines of code is just a code style.

CHAPTER SEVEN

VARIABLES

To create a new variable, you just need to determine the variable name & value. The value will determine the variable type and you can change the value to switch between the types using the same variable name.

Syntax:

```
<Variable Name> = <Value>
```

Tip: The operator ‘=’ is used here as an Assignment operator and the same operator can be used in conditions, but for testing equality of expressions.

Note: The Variable will contains the real value (not a reference). This means that once you change the variable value, the old value will be removed from memory (even if the variable contains a list or object).

7.1 Dynamic Typing

Ring is a dynamic programming language that uses Dynamic Typing.

```
x = "Hello"           # x is a string
see x + nl
x = 5                # x is a number (int)
see x + nl
x = 1.2              # x is a number (double)
see x + nl
x = [1,2,3,4]         # x is a list
see x                 # print list items
x = date()            # x is a string contains date
see x + nl
x = time()             # x is a string contains time
see x + nl
x = true               # x is a number (logical value = 1)
see x + nl
x = false              # x is a number (logical value = 0)
see x + nl
```

7.2 Deep Copy

We can use the assignment operator ‘=’ to copy variables. We can do that to copy values like strings & numbers. Also, we can copy complete lists & objects. The assignment operator will do a complete duplication for us. This operation called **Deep Copy**

```
list = [1,2,3,"four","five"]
list2 = list
list = []
See list      # print the first list - no items to print
See "*****" + nl
See list2     # print the second list - contains 5 items
```

7.3 Implicit Conversion

The language can automatically convert between numbers and strings.

Rules:

```
<NUMBER> + <STRING> --> <NUMBER>
<STRING> + <NUMBER> --> <STRING>
```

Note: The same operator ‘+’ can be used as an arithmetic operator or for string concatenation.

Example:

```
x = 10          # x is a number
y = "20"        # y is a string
sum = x + y    # sum is a number (y will be converted to a number)
Msg = "Sum = " + sum  # Msg is a string (sum will be converted to a string)
see Msg + nl
```

**CHAPTER
EIGHT**

OPERATORS

In this chapter we will introduce the operators provided by the Ring programming language.

8.1 Arithmetic Operators

The next table presents all of the arithmetic operators provided by the Ring language. Assume variable X=50 and variable Y=10 then:

Operator	Description	Example	Result
+	Add	x+y	60
-	Subtract	x-y	40
*	Multiplies	x*y	500
/	Divide	x/y	5
%	Modulus	x%y	0
++	Increment	x++	51
--	Decrement	x--	49

8.2 Relational Operators

The next table presents all of the relational operators provided by the Ring language. Assume variable X=50 and variable Y=10 then:

Operator	Description	Example	Result
=	Equal	x = y	False
!=	Not Equal	x != y	True
>	Greater than	x > y	True
<	Less than	x < y	False
>=	Greater or Equal	x >= y	True
<=	Less than or Equal	x <= y	False

8.3 Logical Operators

The next table presents all of the logical operators provided by the Ring language. Assume variable X=True and variable Y=False then:

Operator	Description	Example	Result
and	Logical AND	x and y	False
or	Logical OR	x or y	True
not	Logical Not	not x	False

Another style

Operator	Description	Example	Result
&&	Logical AND	x && y	False
	Logical OR	x y	True
!	Logical Not	! x	False

8.4 Bitwise Operators

The next table presents all of the bitwise operators provided by the Ring language. Assume variable X=8 and variable Y=2 then:

Operator	Description	Example	Result
&	Binary AND	x & y	0
	Binary OR	x y	10
^	Binary XOR	x ^ y	10
~	Binary Ones Complement	~x	-9
<<	Binary Left Shift	x << y	32
>>	Binary Right Shift	x >> y	2

8.5 Assignment Operators

The next table presents all of the assignment operators provided by the Ring language.

Assume variable X=8 then:

Operator	Description	Example	Result
=	Assignment	x = 10	x=10
+=	Add AND assignment	x += 5	x=13
-=	Subtract AND assignment	x -= 3	x=5
*=	Multiply AND assignment	x *= 2	x=16
/=	Divide AND assignment	x /= 3	x=2.67
%=	Modulus AND assignment	x %= 2	x=0
<=>	Left shift AND assignment	x <=> 2	x=32
>=>	Right shift AND assignment	x >=> 2	x=2
&=	Bitwise AND assignment	x &= 4	x=0
=	Bitwise OR and assignment	x = 3	x=11
^=	Bitwise XOR and assignment	x ^= 4	x=12

8.6 Misc Operators

Operator	Description
:literal	using : before identifier mean literal
Start:End	create list contains items from start to end
[list items]	define list items
list[index]	access list item
obj.name	using the dot operator to access object members (attributes/methods).
obj {stmts}	execute statements with direct access to object attributes & methods
func(para,...)	call function using parameters separated by comma
? <expr>	Print expression then new line

8.7 Operators Precedence

The next table present operators from higher precedence (Evaluated first) to lower precedence.

Operator
. [] () {}
- ~ :Literal [list items]
++ --
Start:End
* / %
+ -
<< >>
&
^
< > <= >=
= !=
not !
and or &&
Assignment = += -= *= /= %=>>= <<= &= ^= =
?

Example:

See 3+5*4	# prints 23
------------------	-------------

CONTROL STRUCTURES - FIRST STYLE

In this chapter we are going to learn about the control structures provided by the Ring programming language.

9.1 Branching

- If Statement

Syntax:

```
if Expression
    Block of statements
but Expression
    Block of statements
else
    Block of statements
ok
```

Example:

```
see "
Main Menu
-----
(1) Say Hello
(2) About
(3) Exit

" give nOption

if nOption = 1  see "Enter your name : " give name see "Hello " + name + nl
but nOption = 2 see "Sample : using if statement" + nl
but nOption = 3 bye
else see "bad option..." + nl
ok
```

- Switch Statement

Syntax:

```
switch Expression
on Expression
    Block of statements
other
    Block of statements
off
```

Example:

```
See "
    Main Menu
    -----
    (1) Say Hello
    (2) About
    (3) Exit

    " Give nOption

Switch nOption
On 1 See "Enter your name : " Give name See "Hello " + name + nl
On 2 See "Sample : using switch statement" + nl
On 3 Bye
Other See "bad option..." + nl
Off
```

9.2 Looping

- While Loop

Syntax:

```
while Expression
    Block of statements
end
```

Example:

```
While True

    See "
        Main Menu
        -----
        (1) Say Hello
        (2) About
        (3) Exit

        " Give nOption

    Switch nOption
    On 1
        See "Enter your name : "
        Give name
        See "Hello " + name + nl
    On 2
        See "Sample : using while loop" + nl
    On 3
        Bye
    Other
        See "bad option..." + nl
    Off
End
```

- For Loop

Syntax:

```
for identifier=expression to expression [step expression]
    Block of statements
next
```

Example:

```
# print numbers from 1 to 10
for x = 1 to 10 see x + nl next
```

Example:

```
# Dynamic loop
See "Start : " give nStart
See "End : " give nEnd
See "Step : " give nStep
For x = nStart to nEnd Step nStep
    see x + nl
Next
```

Example:

```
# print even numbers from 0 to 10
for x = 0 to 10 step 2
    see x + nl
next
```

Example:

```
# print even numbers from 10 to 0
for x = 10 to 0 step -2
    see x + nl
next
```

- For in Loop

Syntax:

```
for identifier in List/String [step expression]
    Block of statements
next
```

Example:

```
aList = 1:10    # create list contains numbers from 1 to 10
for x in aList see x + nl next # print numbers from 1 to 10
```

9.3 Using The Step option with For in

We can use the Step option with For in to skip number of items in each iteration

Example:

```
aList = 1:10      # create list contains numbers from 1 to 10
# print odd items inside the list
for x in aList step 2
    see x + nl
next
```

9.4 Using For in to modify lists

When we use (For in) we get items by reference.

This means that we can read/edit items inside the loop.

Example:

```
aList = 1:5      # create list contains numbers from 1 to 5
# replace list numbers with strings
for x in aList
    switch x
        on 1  x = "one"
        on 2  x = "two"
        on 3  x = "three"
        on 4  x = "four"
        on 5  x = "five"
    off
next
see aList       # print the list items
```

9.5 Do Again Loop

Syntax:

```
do
    Block of statements
again expression
```

Example:

```
x = 1
do
    see x + nl
    x++
again x <= 10
```

9.6 Exit Command

Used to go outside one or more loops.

Syntax:

```
exit [expression]      # inside loop
```

Example:

```
for x = 1 to 10
    see x + nl
    if x = 5 exit ok
next
```

9.7 Exit from two loops

The next example presents how to use the exit command to exit from two loops in one jump.

Example:

```
for x = 1 to 10
    for y = 1 to 10
        see "x=" + x + " y=" + y + nl
        if x = 3 and y = 5
            exit 2      # exit from 2 loops
        ok
    next
next
```

9.8 Loop Command

Used to jump to the next iteration in the loop.

Syntax:

```
loop [expression]      # inside loop
```

Example:

```
for x = 1 to 10
    if x = 3
        see "Number Three" + nl
        loop
    ok
    see x + nl
next
```

9.9 Short-circuit evaluation

The logical operators and/or follow the short-circuit evaluation.

If the first argument of the AND operator is zero, then there is no need to evaluate the second argument and the result will be zero.

If the first argument of the OR operator is one, then there is no need to evaluate the second argument and the result will be one.

Example:

```
/* output
** nice
** nice
** great
*/
x = 0 y = 10

if (x = 0 and nice()) and (y = 10 and nice())
    see "great" + nl
ok

func nice see "nice" + nl    return 1
```

Example:

```
# No output

x = 0 y = 10

if (x = 1 and nice()) and (y = 10 and nice())
    see "great" + nl
ok

func nice see "nice" + nl    return 1
```

Example:

```
/* output
** nice
** great
*/
x = 0 y = 10

if (x = 0 and nice()) or (y = 10 and nice())
    see "great" + nl
ok

func nice see "nice" + nl    return 1
```

9.10 Comments about evaluation

- True, False, nl & NULL are variables defined by the language
- True = 1
- False = 0
- nl = new line
- NULL = empty string = “”
- Everything evaluates to true except 0 (False).

Example:

```
# output = message from the if statement

if 5      # 5 evaluates to true because it's not zero (0).
            see "message from the if statement" + nl
ok
```

CONTROL STRUCTURES - SECOND STYLE

In this chapter we are going to learn about the second style of control structures provided by the Ring programming language.

10.1 Branching

- If Statement

Syntax:

```
if Expression
    Block of statements
elseif Expression
    Block of statements
else
    Block of statements
end
```

Example:

```
put "
Main Menu
-----
(1) Say Hello
(2) About
(3) Exit

" get nOption

if nOption = 1 put "Enter your name : " get name put "Hello " + name + nl
elseif nOption = 2 put "Sample : using if statement" + nl
elseif nOption = 3 bye
else put "bad option..." + nl
end
```

- Switch Statement

Syntax:

```
switch Expression
case Expression
    Block of statements
else
```

(continues on next page)

(continued from previous page)

```
    Block of statements
end
```

Example:

```
Put "
    Main Menu
    -----
    (1) Say Hello
    (2) About
    (3) Exit

    " Get nOption

Switch nOption
Case 1 Put "Enter your name : " Get name Put "Hello " + name + nl
Case 2 Put "Sample : using switch statement" + nl
Case 3 Bye
Else Put "bad option..." + nl
End
```

10.2 Looping

- While Loop

Syntax:

```
while Expression
    Block of statements
end
```

Example:

```
While True

    Put "
        Main Menu
        -----
        (1) Say Hello
        (2) About
        (3) Exit

        " Get nOption

    Switch nOption
    Case 1
        Put "Enter your name : "
        Get name
        Put "Hello " + name + nl
    Case 2
        Put "Sample : using while loop" + nl
    Case 3
        Bye
    Else
```

(continues on next page)

(continued from previous page)

```

    Put "bad option..." + nl
End
End

```

- For Loop

Syntax:

```

for identifier=expression to expression [step expression]
    Block of statements
end

```

Example:

```

# print numbers from 1 to 10
for x = 1 to 10 put x + nl end

```

Example:

```

# Dynamic loop
Put "Start : " get nStart
Put "End   : " get nEnd
Put "Step  : " get nStep
For x = nStart to nEnd Step nStep
    Put x + nl
End

```

Example:

```

# print even numbers from 0 to 10
for x = 0 to 10 step 2
    Put x + nl
end

```

Example:

```

# print even numbers from 10 to 0
for x = 10 to 0 step -2
    Put x + nl
end

```

- For in Loop

Syntax:

```

for identifier in List/String [step expression]
    Block of statements
end

```

Example:

```

aList = 1:10    # create list contains numbers from 1 to 10
for x in aList put x + nl end  # print numbers from 1 to 10

```

10.3 Exceptions

```
try
    Block of statements
catch
    Block of statements
end
```

CHAPTER
ELEVEN

CONTROL STRUCTURES - THIRD STYLE

In this chapter we are going to learn about the third style of control structures provided by the Ring programming language.

11.1 Branching

- If Statement

Syntax:

```
if Expression {
    Block of statements
elseif Expression
    Block of statements
else
    Block of statements
}
```

Example:

```
Load "stdlib.ring"

print("Main Menu
-----
(1) Say Hello
(2) About
(3) Exit
")

nOption = getnumber()

if nOption = 1 {
    print("Enter your name : ")
    name = getstring()
    print("Hello #{name}\n")
elseif nOption = 2
    print("Sample : using if statement\n")
elseif nOption = 3
    bye
else
    print("bad option...\n")
}
```

- Switch Statement

Syntax:

```
switch Expression {
    case Expression
        Block of statements
    else
        Block of statements
}
```

Example:

```
Load "stdlib.ring"

print("Main Menu
-----
(1) Say Hello
(2) About
(3) Exit

")

nOption = GetString()

switch nOption {
case 1
    print("Enter your name : ")
    name = getstring()
    print("Hello #{name}\n")
case 2
    print("Sample : using switch statement\n")
case 3
    Bye
else
    print("bad option...\n")
}
```

11.2 Looping

- While Loop

Syntax:

```
while Expression {
    Block of statements
}
```

Example:

```
Load "stdlib.ring"

While True {
    print("
```

(continues on next page)

(continued from previous page)

```

Main Menu
-----
(1) Say Hello
(2) About
(3) Exit

")

nOption = GetString()

switch nOption {
case 1
    print("Enter your name : ")
    name = getstring()
    print("Hello #{name}\n")
case 2
    print("Sample : using switch statement\n")
case 3
    Bye
else
    print("bad option...\n")
}

}

```

- For Loop

Syntax:

```

for identifier=expression to expression [step expression] {
    Block of statements
}

```

Example:

```

# print numbers from 1 to 10
load "stdlib.ring"
for x = 1 to 10 {
    print("#{x}\n")
}

```

Example:

```

load "stdlib.ring"

# Dynamic loop
print("Start : ") nStart = getnumber()
print("End   : ") nEnd = getnumber()
print("Step  : ") nStep = getnumber()
for x = nStart to nEnd step nStep {
    print("#{x}\n")
}

```

Example:

```

load "stdlib.ring"

```

(continues on next page)

(continued from previous page)

```
# print even numbers from 0 to 10
for x = 0 to 10 step 2 {
    print("#{x}\n")
}
```

Example:

```
load "stdlib.ring"

# print even numbers from 10 to 0
for x = 10 to 0 step -2 {
    print("#{x}\n")
}
```

- For in Loop

Syntax:

```
for identifier in List/String [step expression] {
    Block of statements
}
```

Example:

```
load "stdlib.ring"

aList = 1:10      # create list contains numbers from 1 to 10
for x in aList { print("#{x}\n") }  # print numbers from 1 to 10
```

Example:

```
load "stdlib.ring"

aList = 1:10      # create list contains numbers from 1 to 10
# print odd items inside the list
for x in aList step 2 {
    print("#{x}\n")
}
```

When we use (For in) we get items by reference.

This means that we can read/edit items inside the loop.

Example:

```
load "stdlib.ring"

aList = 1:5      # create list contains numbers from 1 to 5
# replace list numbers with strings
for x in aList {
    switch x {
        case 1 x = "one"
        case 2 x = "two"
        case 3 x = "three"
        case 4 x = "four"
        case 5 x = "five"
    }
}
```

(continues on next page)

(continued from previous page)

```
}
```

```
print(aList)      # print the list items
```

11.3 Exceptions

```
try {
```

```
    Block of statements
```

```
catch
```

```
    Block of statements
```

```
}
```

CHAPTER
TWELVE

GETTING INPUT

We can get input from the keyboard using

- The Give Command
- The GetChar() Function
- The Input() Function

12.1 Give Command

Syntax:

```
Give VariableName
```

Example:

```
See "Enter the first number : " Give nNum1
See "Enter the second number : " Give nNum2
See "Sum : " + ( 0 + nNum1 + nNum2 )
```

Output:

```
Enter the first number : 3
Enter the second number : 4
Sum : 7
```

12.2 GetChar() Function

We can get one character from the standard input using the GetChar() function

Syntax:

```
GetChar() ---> Character
```

Example:

```
While True
    See "
        Main Menu
        (1) Say Hello
```

(continues on next page)

(continued from previous page)

```

(2) Exit
"
Option = GetChar()
GetChar() GetChar() # End of line

# the previous two lines can be replaced with the next line
# Give Option

if Option = 1
    see "Enter your name : " give cName
    see "Hello " + cName
else
    bye
ok
End

```

12.3 Input() Function

We can get input from the keyboard using the Input() function

Syntax:

```
Input (nCount) ---> string
```

The function will wait until nCount characters (at least) are read

Example:

```

See "Enter message (30 characters) : " cMsg = input (30)
See "Message : " + cMsg

```

CHAPTER
THIRTEEN

FUNCTIONS - FIRST STYLE

In this chapter we are going to learn about the next topics :-

- Define functions
- Call functions
- Declare parameters
- Send parameters
- Main Function
- Variables Scope
- Return Value
- Recursion

13.1 Define Functions

To define new function

Syntax:

```
func <function_name> [parameters]
      Block of statements
```

Note: No keyword is required to end the function definition.

Example:

```
func hello
    see "Hello from function" + nl
```

13.2 Call Functions

To call function without parameters, we type the function name then ()

Tip: We can call the function before the function definition and the function code.

Example:

```
hello()

func hello
    see "Hello from function" + nl
```

Example:

```
first() second()

func first    see "message from the first function" + nl

func second   see "message from the second function" + nl
```

13.3 Declare parameters

To declare the function parameters, after the function name type the list of parameters as a group of identifiers separated by comma.

Example:

```
func sum x,y
    see x+y+nl
```

13.4 Send Parameters

To send parameters to function, type the parameters inside () after the function name

Syntax:

```
funcname(parameters)
```

Example:

```
/* output
** 8
** 3000
*/
sum(3,5) sum(1000,2000)

func sum x,y see x+y+nl
```

13.5 Main Function

Using the Ring programming language, the Main Function is optional, when it's defined, it will be executed after the end of other statements.

if no other statements comes alone, the main function will be the first entry point

Example:

```
# this program will print the hello world message first then execute the main function

See "Hello World!" + nl

func main
    see "Message from the main function" + nl
```

13.6 Variables Scope

The Ring programming language uses [lexical scoping](#) to determine the scope of a variable.

Variables defined inside functions (including function parameters) are local variables. Variables defined outside functions (before any function) are global variables.

Inside any function we can access the variables defined inside this function beside the global variables.

Example:

```
# the program will print numbers from 10 to 1

x = 10                      # x is a global variable.

func main

    for t = 1 to 10           # t is a local variable
        mycounter()            # call function
    next

func mycounter

    see x + nl                # print the global variable value
    x--                         # decrement
```

Note: Using the main function before the for loop declare the t variable as a local variable, It's recommended to use the main functions instead of typing the instructions directly to set the scope of the new variables to local.

13.7 Return Value

The function can return a value using the Return command.

Syntax:

```
Return [Expression]
```

Tip: the Expression after the return command is optional and we can use the return command to end the function execution without returning any value.

Note: if the function doesn't return explicit value, it will return NULL (empty string = “”).

Example:

```
if novalue() = NULL
    See "the function doesn't return a value" + nl
ok

func novalue
```

13.8 Recursion

The Ring programming language support **Recursion** and the function can call itself using different parameters.

Example:

```
see fact(5)      # output = 120

func fact x if x = 0 return 1 else return x * fact(x-1) ok
```

CHAPTER
FOURTEEN

FUNCTIONS - SECOND STYLE

In this chapter we are going to learn about the next topics :-

- Define functions
- Call functions
- Declare parameters
- Send parameters
- Main Function
- Variables Scope
- Return Value
- Recursion

14.1 Define Functions

To define new function

Syntax:

```
def <function_name> [parameters]
    Block of statements
[end]
```

Note: the keyword ‘end’ is optional.

Example:

```
def hello
    put "Hello from function" + nl
end
```

14.2 Call Functions

To call function without parameters, we type the function name then ()

Tip: We can call the function before the function definition and the function code.

Example:

```
hello()

def hello
    put "Hello from function" + nl
end
```

Example:

```
first() second()

def first put "message from the first function" + nl

def second put "message from the second function" + nl
```

14.3 Declare parameters

To declare the function parameters, after the function name type the list of parameters as a group of identifiers separated by comma.

Example:

```
def sum x,y
    put x+y+nl
end
```

14.4 Send Parameters

To send parameters to function, type the parameters inside () after the function name

Syntax:

```
funcname(parameters)
```

Example:

```
/* output
** 8
** 3000
*/
sum(3,5) sum(1000,2000)

def sum x,y put x+y+nl
```

14.5 Main Function

Using the Ring programming language, the Main Function is optional, when it's defined, it will be executed after the end of other statements.

if no other statements comes alone, the main function will be the first entry point

Example:

```
# this program will print the hello world message first then execute the main function

put "Hello World!" + nl

def main
    put "Message from the main function" + nl
end
```

14.6 Variables Scope

The Ring programming language uses [lexical scoping](#) to determine the scope of a variable.

Variables defined inside functions (including function parameters) are local variables. Variables defined outside functions (before any function) are global variables.

Inside any function we can access the variables defined inside this function beside the global variables.

Example:

```
# the program will print numbers from 10 to 1

x = 10                                # x is a global variable.

def main
    for t = 1 to 10                      # t is a local variable
        mycounter()                      # call function
    end
end

def mycounter
    put x + nl                         # print the global variable value
    x--                                 # decrement
end
```

Note: Using the main function before the for loop declare the t variable as a local variable, It's recommended to use the main functions instead of typing the instructions directly to set the scope of the new variables to local.

14.7 Return Value

The function can return a value using the Return command.

Syntax:

```
Return [Expression]
```

Tip: the Expression after the return command is optional and we can use the return command to end the function execution without returning any value.

Note: if the function doesn't return explicit value, it will return NULL (empty string = “”).

Example:

```
if novalue() = NULL
    put "the function doesn't return a value" + nl
end

def novalue
```

14.8 Recursion

The Ring programming language support **Recursion** and the function can call itself using different parameters.

Example:

```
put fact(5)      # output = 120

def fact x if x = 0 return 1 else return x * fact(x-1) end
```

CHAPTER
FIFTEEN

FUNCTIONS - THIRD STYLE

In this chapter we are going to learn about the next topics :-

- Define functions
- Call functions
- Declare parameters
- Send parameters
- Main Function
- Variables Scope
- Return Value
- Recursion

15.1 Define Functions

To define new function

Syntax:

```
func <function_name> [parameters] [ '{ ' ]
    Block of statements
[ ' } ' ]
```

Example:

```
load "stdlib.ring"
func hello {
    print("Hello from function \n")
}
```

15.2 Call Functions

To call function without parameters, we type the function name then ()

Tip: We can call the function before the function definition and the function code.

Example:

```
load "stdlib.ring"

hello()

func hello {
    print("Hello from function \n")
}
```

Example:

```
load "stdlib.ring"

first() second()

func first { print("message from the first function \n") }

func second { print("message from the second function \n") }
```

15.3 Declare parameters

To declare the function parameters, after the function name type the list of parameters as a group of identifiers separated by comma.

Example:

```
load "stdlib.ring"

func sum(x,y) {
    print(x+y)
}
```

15.4 Send Parameters

To send parameters to function, type the parameters inside () after the function name

Syntax:

```
funcname(parameters)
```

Example:

```
/* output
** 8
** 3000
*/
load "stdlib.ring"
sum(3,5) sum(1000,2000)
func sum(x,y) { print(x+y) }
```

15.5 Main Function

Using the Ring programming language, the Main Function is optional, when it's defined, it will be executed after the end of other statements.

if no other statements comes alone, the main function will be the first entry point

Example:

```
# this program will print the hello world message first then execute the main function
load "stdlib.ring"
print("Hello, World! \n")
func main {
    print("Message from the main function \n")
}
```

15.6 Variables Scope

The Ring programming language uses **lexical scoping** to determine the scope of a variable.

Variables defined inside functions (including function parameters) are local variables. Variables defined outside functions (before any function) are global variables.

Inside any function we can access the variables defined inside this function beside the global variables.

Example:

```
# the program will print numbers from 10 to 1
load "stdlib.ring"

x = 10                      # x is a global variable.

func main {
    for t = 1 to 10 {        # t is a local variable
        mycounter()          # call function
    }
}

func mycounter {
```

(continues on next page)

(continued from previous page)

```

print("#{x}\n")          # print the global variable value
x--                      # decrement
}

```

Note: Using the main function before the for loop declare the t variable as a local variable, It's recommended to use the main functions instead of typing the instructions directly to set the scope of the new variables to local.

15.7 Return Value

The function can return a value using the Return command.

Syntax:

```
Return [Expression]
```

Tip: the Expression after the return command is optional and we can use the return command to end the function execution without returning any value.

Note: if the function doesn't return explicit value, it will return NULL (empty string = "").

Example:

```

load "stdlib.ring"

if novalue() = NULL {
    print("the function doesn't return a value\n")
}

func novalue { }

```

15.8 Recursion

The Ring programming language support **Recursion** and the function can call itself using different parameters.

Example:

```

load "stdlib.ring"

print( fact(5) )          # output = 120

func fact(x) { if x = 0 { return 1 } else return x * fact(x-1) } }

```

CHAPTER
SIXTEEN

PROGRAM STRUCTURE

In this chapter we will learn about using many source code files in the same project.

16.1 Source Code File Sections

Each source code file may contains the next sections (in the same order).

Source Code File Sections
Load Files
Statements and Global Variables
Functions
Packages and Classes

The application maybe one or more of files.

16.2 Using Many Source Code Files

To include another source file in the project, just use the load command.

Syntax:

```
Load "filename.ring"
```

Note: The Load command is executed directly by the compiler in the parsing stage

Tip: if you don't know the file name until the runtime, or you need to use functions to get the file path, just use eval().

Example:

```
# File : Start.ring

Load "sub.ring"

sayhello("Mahmoud")
```

```
# File : sub.ring

func sayhello cName
    see "Hello " + cName + nl
```

16.3 Load Package

Using the ‘load’ command we can use many ring source files in the same project

But all of these files will share the same global scope

We have also the “Load Package” command

Using “Load Package” we can load a library (*.ring file) in new global scope

This is very useful to create libraries that avoid conflicts in global variables

Example:

File: loadpackage.ring

```
x = 100
? "Hello, World!"
load package "testloadpackage.ring"

? x
test()
```

File: testloadpackage.ring

```
? "Hello from testloadpackage.ring"
x = 1000
test()

func test
    ? x
```

Output:

```
Hello, World!
Hello from testloadpackage.ring
1000
100
1000
```

16.4 Load Again

Ring 1.12 comes with the Load Again command

Using this command we can load the Ring source file which contains constants more than one time.

This is useful when using Ring source files for translations through global constants.

Example:

The next function is part from a project which support Arabic and English languages

The files english.ring and arabic.ring contains constants for translation

One of these files is loaded in the start of the program

Loading the same file again using the (Load) command is not possible

Because the (Load) command load the same source file only for the first time and ignore next times.

So we have to use the (Load Again) command.

Where we can use these files again during the runtime as in the next code

```
func setLang nLanguage
    if C_ENV_DEFAULT_LANG = nLanguage
        return
    ok
    C_ENV_DEFAULT_LANG = nLanguage
    # Change the language
    switch nLanguage
        on C_TRANSLATION_ENGLISH
            load again "translation/english.ring"
        on C_TRANSLATION_ARABIC
            load again "translation/arabic.ring"
    off
```

CHAPTER SEVENTEEN

LISTS

In this chapter we are going to learn how to deal with lists.

17.1 Create Lists

We can create new lists by defining the list items inside square bracts.

Example:

```
aList = [1, 2, 3, 4, 5]
```

Also we can create new lists using the : operator

Example:

```
aList = 1:5
aList2 = "a":"z"
```

Example:

```
aList = 5:1
aList2 = "z":"a"
```

Also we can create lists using the list() function

Syntax:

```
list = list(size)
```

To create 2D list

```
list = list(nRows,nCols)
```

Example (1)

```
aList = list(10)           # aList contains 10 items
```

Example (2)

```
aList = list(5,4)          # Create 2D List contains 5 rows and 4 columns
```

Note: the list index start from 1

17.2 Add Items

To add new items to the list, we can use the Add() function.

Syntax:

```
Add(List, Item)
```

Example:

```
aList = ["one", "two"]
add(aList, "three")
see aList
```

Also we can do that using the + operator.

Syntax:

```
List + item
```

Example:

```
aList = 1:10      # create list contains numbers from 1 to 10
aList + 11       # add number 11 to the list
see aList       # print the list
```

17.3 Get List Size

We can get the list size using the len() function

Syntax:

```
Len(List)
```

Example:

```
aList = 1:20  see len(aList)  # print 20
```

17.4 Delete Item From List

To delete an item from the list, we can use the del() function

Syntax:

```
del(list, index)
```

Example:

```
aList = ["one", "two", "other", "three"]
Del(aList, 3)      # delete item number three
see aList        # print one two three
```

17.5 Get List Item

To get an item from the list, we uses the next syntax

```
List [Index]
```

Example:

```
aList = ["Cairo", "Riyadh"]
see "Egypt : " + aList[1] + nl +
    "KSA   : " + aList[2] + nl
```

17.6 Set List Item

To set the value of an item inside the list, we can use the next syntax

```
List [Index] = Expression
```

Example:

```
aList = list(3) # create list contains three items
aList[1] = "one" aList[2] = "two" aList[3] = "three"
see aList
```

17.7 Search

To find an item inside the list we can use the find() function

Syntax:

```
Find(List, ItemValue) ---> Item Index
Find(List, ItemValue, nColumn) ---> Search in nColumn, returns the Item Index
Find(List, ItemValue, nColumn, cAttribute) ---> Item Index
```

Example:

```
aList = ["one", "two", "three", "four", "five"]
see find(aList, "three")      # print 3
```

Example:

```
mylist = [[ "one", 1],
          [ "two", 2],
          [ "three", 3]]

see find(mylist, "two", 1) + nl      # print 2
see find(mylist, 2, 2) + nl          # print 2
```

Also we can use the binarysearch() function to search in sorted list.

Syntax:

```
BinarySearch(List,ItemValue) ---> Item Index
BinarySearch(List,ItemValue,nColumn) ---> Search in nColumn, returns the Item Index
```

Example:

```
aList = ["one","two","three","four","five"]
aList = sort(aList)
see binarysearch(aList,"three")
```

Output:

```
five
four
one
three
two
4
```

17.8 Sort

We can sort the list using the sort() function.

Syntax:

```
Sort(List) ---> Sorted List
Sort(List,nColumn) ---> Sorted List based on nColumn
Sort(List,nColumn,cAttribute) ---> Sorted List based on Object Attribute
```

Example:

```
aList = [10,12,3,5,31,15]
aList = sort(aList) see aList # print 3 5 10 12 15 31
```

We can sort list of strings

Example:

```
mylist = ["mahmoud","samir","ahmed","ibrahim","mohammed"]
see mylist          # print list before sorting
mylist = sort(mylist)      # sort list
see "list after sort"+nl
see mylist          # print ahmed ibrahim mahmoud mohammed samir
```

We can sort a list based on a specific column.

Example:

```
aList = [ ["mahmoud",15000] ,
          ["ahmed", 14000] ,
          ["samir", 16000] ,
          ["mohammed", 12000] ,
          ["ibrahim",11000] ]

aList2 = sort(aList,1)
see aList2
```

Output:

```
ahmed
14000
ibrahim
11000
mahmoud
15000
mohammed
12000
samir
16000
```

17.9 Reverse

We can reverse a list using the reverse() function.

Syntax:

```
Reverse(List) ---> Reversed List
```

Example:

```
aList = [10,20,30,40,50]
aList = reverse(aList)
see aList      # print 50 40 30 20 10
```

17.10 Insert Items

To insert an item in the list we can use the insert() function.

Syntax:

```
Insert(List, Index, Item)
```

The inserted item will be AFTER the Index

Example:

```
aList = ["A", "B", "D", "E"]
insert(aList, 2, "C")    # Inserts AFTER Index 2, "C" into Position 3
see aList              # print A B C D E
```

17.11 Nested Lists

The list may contain other lists

Example:

```
aList = [ 1 , [10,20,30] , 5 , [100,1000,5000] ]
aList2 = [
"one", "two",
[3,4],
[20,30], ["three",
    "four",
    "five", [100,200,300]
]
]



```

17.12 Copy Lists

We can copy lists (including nested lists) using the Assignment operator.

Example:

```
aList = [
"one", "two",
[3,4],
[20,30], ["three",
    "four",
    "five", [100,200,300]
]
]

aList2 = aList          # Copy aList to aList2
aList2[5] = "other"     # modify item number five


```

17.13 First-class lists

Lists are **first-class citizens** where we can store lists in variables, pass lists to functions, and return lists from functions.

Example:

```
aList = duplicate( [1,2,3,4,5] )


```

(continues on next page)

(continued from previous page)

```

nMax = len(list)
for x = 1 to nMax
    list + list[x]
next
return list

func mylist return [10,20,30,40,50]

```

17.14 Using Lists during definition

We can use the list and the list items while we are defining the list for the first time.

Example:

```

aList = [ 1,2,3,4,5 ] , aList[1] , aList[1]
see aList      # print 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5

```

Example:

```

x = [ 1, 2, x ]
? x                  # print 1 2 1 2
? len(x)            # print 3
? x[1]              # print 1
? x[2]              # print 2
? x[3]              # print 1 2

```

Output:

```

1
2
1
2

3
1
2
1
2

```

17.15 Passing Lists to Functions

Lists are passed to functions by reference, This means that the called function will work on the same list and can modify it.

Example:

```

func main
    aList = [1,2,3,4,5]      # create list, local in function main
    myfunc(aList)           # call function, pass list by reference
    see aList               # print 1 2 3 4 5 6 7 8 9 10

func myfunc list
    list + [6,7,8,9,10]

```

17.16 Access List Items by String Index

Instead of using numbers to determine the item index when we get item value or set item value, We can access items using string index if the item is a list contains two items and the first item is a string.

Example:

```
aList = [ ["one",1] , ["two",2] , ["three",3] ]
see aList["one"] + nl +
      aList["two"] + nl +
      aList["three"]      # print 1 2 3
```

This type of lists can be defined in a better syntax using the : and = operators.

Example:

```
aList = [ :one = 1 , :two = 2 , :three = 3 ]
see aList["one"] + nl +
      aList["two"] + nl +
      aList["three"] + nl # print 1 2 3
see aList[1]           # print one 1
```

Tip: using : before identifier (one word) means literal

Note: using = inside list definition create a list of two items where the first item is the left side and the second item is the right side.

We can add new items to the list using the string index

Example:

```
aList = []
aList["Egypt"] = "Cairo"
aList["KSA"] = "Riyadh"
see aList["Egypt"] + nl +      # print Cairo
      aList["KSA"] + nl       # print Riyadh
```

17.17 Passing Parameters or Arguments Using List

This type of lists is very good for passing parameters to functions Where the order of parameters will not be important (we can change the order).

Also some parameters maybe optional.

Example:

```
myconnect ( [ :server = "myserver.com" , :port = 80 ,
              :username = "mahmoud" , :password = "password" ] )
func myconnect mypara

# print connection details
```

(continues on next page)

(continued from previous page)

```
see "User Name : " + mypara[:username] + nl +
      "Password : " + mypara[:password] + nl +
      "Server   : " + mypara[:server] + nl +
      "Port     : " + mypara[:port]
```

17.18 Passing Parameters or Arguments Using List Array

Passing Arguments or Parameters to a Function in an array format

Example:

```
myList = [5, 7, 3, 9]      ## list with args or parms in an array
result = sum(myList)
See "Sum result: "+ result +n

func sum(aList)
acc = 0
sizeList = len(aList)

for i = 1 to sizeList
  See aList[i] +nl
  acc = acc + aList[i]
next
return acc
```

17.19 Return Parameters as List or Hash Table

Return Parameters from a Function in an Array or Hash Format

Example:

```
sudoku = [  [2,9,0],
            [0,0,1],
            [0,0,0] ]

aOutput = myFunctionArray(sudoku)
  See "Return Array: T/F: "+ aOutput[1] +" Row: "+ aOutput[2] +" Col: "+_
→aOutput[3] +nl

aOutput = myFunctionHash(sudoku)
  See "Return Hash.: T/F: "+ aOutput[:lValue] +" Row: "+ aOutput[:nRow] +" Col: "
→"+ aOutput[:nCol] +nl

#####
### isSolvedSoduku - Return ARRAY

Func myFunctionArray(sudoku)
  for Row = 1 to 9
    for Col = 1 to 9
      if sudoku[Row][Col] = 0
        //-----
```

(continues on next page)

(continued from previous page)

```

        // Return Array with 3 fields
        return [False, Row, Col]
    ok
next
next
return [True, Row, Col]

#####
### isSolvedSudoku - Return HASH

Func myFunctionHash(sudoku)
    for Row = 1 to 3
        for Col = 1 to 3
            if sudoku[Row][Col] = 0

                //-----
                // Return Hash Table with 3 fields
                return [ :lValue = False,
                          :nRow   = Row,
                          :nCol   = Col
                ]
            ok
        next
    next

return [ :lValue = False, :nRow = Row, :nCol = Col ]
#####

```

17.20 Creating a Multi-Dimensional Array using List

A Multi-Dimensional Array of any size can be built using recursion in a Function

Example:

```

#####
### Create Array -- Dimensions Any Size: 3D, 4D, 5D etc

dimList = [4,3,4]
bList   = createDimList(dimList)

#####
### Populate the arrays using a counter 1 , 4x4x4 = 256 , 2x3x4x5x6 = 720

Counter = 1

for Col=1 to dimList[1]
    for Row=1 to dimList[2]
        for Dep=1 to dimList[3]
            blist[Col][Row][Dep] = Counter
            Counter++
        next
    next
next

```

(continues on next page)

(continued from previous page)

```

#####-----
### Print the array elements in block format

for Col=1 to dimList[1]
  for Row=1 to dimList[2]
    for Dep=1 to dimList[3]
      See bList[Col][Row][Dep] See " "
    next
    See nl
  next
  See nl
next

#####=====
### FUNCTIONS

#####-----
### Recursive Create a Dimension Array
### Call by passing an array of dimesions: dimList = [2,3,4,5]
### Drop the first entry every iteration call, making newParms
###
### Example:
###   dimList = [4,2,3,2]           <<< Number and size of dimensions in array_
  ↵format
###   bList    = createDimList(dimList)  <<< Call using the array as input

func createDimList(dimArray)

  sizeList = len(dimArray)

  newParms = []
  for i = 2 to sizeList
    Add(newParms, dimArray[i])
  next

  alist = list(dimArray[1])

  if sizeList = 1
    return alist
  ok

  for t in alist
    t = createDimList(newParms)
  next

return alist

```

17.21 Swap Items

We can swap the list items using the Swap() function.

Example:

```
aList = [:one,:two,:four,:three]
see aList
see copy("*",50) + nl
swap(aList,3,4)
see aList
```

Output

```
one
two
four
three
*****
one
two
three
four
```

CHAPTER
EIGHTEEN

STRINGS

In this chapter we are going to learn about strings creation and manipulation.

18.1 String Literals

Syntax:

```
cStr = "This is a string"
cStr2 = 'Another string'
cStr3 = :JustAnotherString
cStr4 = `Yet "another" 'string' !`
```

18.2 Get String Length

We can get the string length (letters count inside a string) using the `len()` function

Syntax:

```
len(string) ---> string length
```

Example:

```
cStr = "How are you?"
see cStr + nl
see "String size : " + len(cStr) + nl
```

18.3 Convert Letters Case

Syntax:

```
lower(string) ---> convert string letters to lower case
upper(string) ---> convert string letters to UPPER case
```

Example:

```
cStr = "Welcome To The Ring Programming Language"
see cStr + nl + upper(cStr) + nl + lower(cStr)
```

18.4 Access String Letters

We can access a letter inside a string by the letter index

Syntax:

```
string[index] ---> get string letter
string[index] = letter # set string letter
```

Example:

```
# print user name letter by letter (each letter in new line)

See "Hello, Enter your name : " give cName
for x = 1 to len(cName)
    see nl + cName[x]
next
```

We can use for in to get string letters.

Example:

```
# print user name letter by letter (each letter in new line)

See "Hello, Enter your name : " give cName
for x in cName
    see nl + x
next
```

We can modify the string letters

Example:

```
# convert the first letter to UPPER case

See "Enter your name : " give cName
cName[1] = upper(cName[1])
see "Hello " + cName
```

18.5 Left() Function

We can get a specified number of characters from a string using the Left() function.

The starting position is 1.

Syntax:

```
Left(string, count)
```

Example:

```
see left("Hello World!", 5) # print Hello
```

18.6 Right() Function

We can get a specified number of characters from a string using the Right() function.

The starting position is the last character on the right.

Syntax:

```
Right (string, count)
```

Example:

```
see Right("Hello World!", 6) # print World!
```

18.7 Trim() Function

We can remove all leading and trailing spaces from a string using the Trim() function.

Syntax:

```
trim(string)
```

Example:

```
cMsg = "      Welcome      "
see trim(cMsg)           # print Welcome
```

18.8 Copy() Function

We can duplicate a string more than one time using the copy() function.

Syntax:

```
copy (string, nCount) ---> string replicated nCount times
```

Example

```
see copy ("***hello***", 3) # print ***hello*****hello*****hello***
```

18.9 Lines() Function

We can count the number of lines inside a string using the Lines() function.

Syntax:

```
lines (string) ---> Number of lines inside the string
```

Example:

```
cStr = "Hello
How are you?
are you fine?"
see lines(cStr)      # print 3
```

18.10 Substr() Function

We can work on sub strings inside a string using the substr() function. Using Substr() we can

- Find substring
- Get substring from position to end
- Get Number of characters from position
- Transform Substring To Another Substring

18.11 Find substring

Syntax:

```
substr(string,substring) ---> the starting position of substring in string
```

Example:

```
cStr = "Welcome to the Ring programming language"
see substr(cStr,"Ring")      # print 16
```

18.12 Get substring from position to end

Syntax:

```
substr(string,position) ---> Get substring starting from position to end
```

Example:

```
cStr = "Welcome to the Ring programming language"
nPos = substr(cStr,"Ring")      # nPos = 16
see substr(cStr,nPos)        # print Ring programming language
```

18.13 Get Number of Characters From Position

Syntax:

```
substr(string,position,count) ---> Get characters starting from position
```

Example:

```
cStr = "Welcome to the Ring programming language"
nPos = substr(cStr,"Ring")           # nPos = 16
see substr(cStr,nPos,4)             # print Ring
```

18.14 Transform Substring To Another Substring

Syntax:

```
substr(string,substring,newsubstring) ---> Transformed string (Match case)
substr(string,substring,newsubstring,1) ---> Transformed string (Ignore case)
```

Example:

```
cStr = "Welcome to the New programming language"
see substr(cStr,"New","Ring") + nl  # print Welcome to the Ring programming language
see substr(cStr,"new","Ring",1)+ nl # print Welcome to the Ring programming language
```

18.15 strcmp() Function

We can compare between two strings using the strcmp() function.

Syntax:

```
strcmp(cString1,cString2) ---> value = 0 if cString1 = cString2
                                value < 0 if cString1 < cString2
                                value > 0 if cString1 > cString2
```

Example:

```
see strcmp("hello","hello") + nl +
      strcmp("abc","bcd") + nl +
      strcmp("bcd","abc") + nl
```

Output:

```
0
-1
1
```

18.16 str2list() and list2str() Functions

We can convert string lines to list items using the str2list() function. Also we can convert the list to a string using list2str() function.

Syntax:

```
str2list(string) ---> list contains the string lines
list2str(list)    ---> string contains the list items
```

Example:

```

/* output:
** Items : 4
** Item : Hello
** Item : How are you ?
** Item : are you fine ?
** Item : ok
** list2Str result = Hello
** How are you ?
** are you fine ?
** ok
** Done
*/
mystr = "Hello
How are you ?
are you fine ?
ok"

mylist = str2list(mystr)
see "Items : " + len(mylist) + nl

for x in mylist
    see "Item : " + x + nl
next

newstr = list2str(mylist)
see "list2Str result = " + newstr

if mystr = newstr
    see nl + "Done"
else
    see nl + "Error!"
ok

```

18.17 Merge binary characters

From Ring 1.0 we can create binary strings and do operations on these strings.

Starting from Ring 1.8, we can get individual characters from these strings and merge them together using the ‘+’ operator.

Example:

```

cStr = "Welcome"
? cstr[1] + cstr[2] + cStr[5]
v = cstr[1] + cstr[2] + cStr[5]
? v
? len(v)
c1 = cStr[1]
? c1
aList = [1,2,3]
cStr = ""
for item in aList
    cStr += int2bytes(item)
next

```

(continues on next page)

(continued from previous page)

```
? "All String"
? len(cStr)
? "First Part"
n1 = cStr[1] + cStr[2] + cStr[3] + cStr[4]
? len(n1)
? "Second Part"
n2 = cStr[5] + cStr[6] + cStr[7] + cStr[8]
? len(n2)
? "Third Part"
n3 = cStr[9] + cStr[10] + cStr[11] + cStr[12]
? len(n3)
? "All String"
cString = cStr[1] + cStr[2] + cStr[3] + cStr[4] +
          cStr[5] + cStr[6] + cStr[7] + cStr[8] +
          cStr[9] + cStr[10] + cStr[11] + cStr[12]
? len(cString)
? ascii(cStr[1])
? len(cStr[2])
```

Output:

```
Weo
Weo
3
W
All String
12
First Part
4
Second Part
4      }
Third Part
4
All String
12
1
1
```

CHAPTER
NINETEEN

DATE AND TIME

In this chapter we are going to learn about the date and time functions.

19.1 Clock() Function

Syntax:

```
Clock() ---> The number of clock ticks from program start
```

Example:

```
See "Calculate performance" + nl
t1 = clock()
for x = 1 to 1000000 next
see clock() - t1
```

19.2 ClocksPerSecond() Function

Return how many clocks in one second

Syntax:

```
clockspersecond() ---> Number of clocks in one second
```

Example:

```
# Wait 1 second
t = clock()
while clock() - t <= clockspersecond() end
```

19.3 Time() Function

We can get the system time using the Time() function.

Example:

```
See "Time : " + time()
```

19.4 Date() Function

We can get the date using the Date() function.

Syntax:

```
Date() ---> String represent the date "dd/mm/yyyy"
```

Example:

```
See "Date : " + date() # Date : 24/05/2015
```

19.5 TimeList() Function

We can print the date and the time information using the TimeList() function.

Syntax:

```
TimeList() ---> List contains the time and date information.
```

The next table presents the list items

index	value
1	abbreviated weekday name
2	full weekday name
3	abbreviated month name
4	full month name
5	Date & Time
6	Day of the month
7	Hour (24)
8	Hour (12)
9	Day of the year
10	Month of the year
11	Minutes after hour
12	AM or PM
13	Seconds after the hour
14	Week of the year (sun-sat)
15	day of the week
16	date
17	time
18	year of the century
19	year
20	time zone
21	percent sign

Example:

```
/* Output:
** Sun               abbreviated weekday name
** Sunday            full weekday name
** May               abbreviated month name
** May               full month name
** 05/24/15 09:58:38 Date & Time
** 24                Day of the month
** 09                Hour (24)
** 09                Hour (12)
** 144               Day of the year
** 05                Month of the year
** 58                Minutes after hour
** AM                AM or PM
** 38                Seconds after the hour
** 21                Week of the year (sun-sat)
** 0                 day of the week
** 05/24/15          date
** 09:58:38          time
** 15                year of the century
** 2015              year
** Arab Standard Time time zone
** %                percent sign
*/
```

See `TimeList()`

Example:

See <code>"Day Name : " + TimeList() [2]</code>	<code># Sunday</code>
--	-----------------------

Example:

```
See "Month Name : " + TimeList() [4]      # May
```

19.6 AddDays() Function

Syntax:

```
AddDays(cDate, nDays) ---> Date from cDate and after nDays
```

Example:

```
cDate = date()
see cDate + nl                      # 24/05/2015
cDate = adddays(cDate, 10)
see cDate + nl                      # 03/06/2015
```

19.7 DiffDays() Function

Syntax:

```
DiffDays(cDate1, cDate2) ---> number of days (Date1 - Date2)
```

Example:

```
cDate1 = date()
see cDate1 + nl                      # 24/05/2015
cDate2 = adddays(cDate1, 10)
see cDate2 + nl                      # 03/06/2015
see "DiffDays = " + diffdays(cDate1, cDate2) + nl    # -10
see "DiffDays = " + diffdays(cDate2, cDate1) + nl    # 10
```

19.8 EpochTime() Function

Syntax:

```
EpochTime( cDate, cTime ) ---> Epoch Seconds
```

Example:

```
#####
# EpochTime()
# Example --- EpochSec = EpochTime( Date(), Time() )
# Call Format: EpochSec = EpochTime( "15/07/2016", "10:15:30" )
#           EpochSec = 1468577730
#---

Func EpochTime(Date, Time)

arrayDate = split(Date, "/")
```

(continues on next page)

(continued from previous page)

```

arrayTime = split(Time, ":")

Year = arrayDate[3] ; Month = arrayDate[2] ; Day     = arrayDate[1]
Hour = arrayTime[1] ; Minute = arrayTime[2] ; Second = arrayTime[3]

cDate1    = Day +"/"+ Month +"/"+ Year
cDate2    = "01/01/" + Year
DayOfYear = DiffDays( cDate1, cDate2)

### Formula
tm_sec   = Second    * 1
tm_min   = Minute    * 60
tm_hour  = Hour      * 3600
tm_yday  = DayOfYear * 86400
tm_year  = Year      - 1900

tm_year1 =          ( tm_year - 70)           * 31536000
tm_year2 = ( floor(( tm_year - 69) / 4 ) ) * 86400
tm_year3 = ( floor(( tm_year - 1) / 100 ) ) * 86400
tm_year4 = ( floor(( tm_year + 299) / 400 ) ) * 86400

### Result
EpochSec = tm_sec + tm_min + tm_hour + tm_yday +
           tm_year1 + tm_year2 - tm_year3 + tm_year4

return EpochSec

```

CHECK DATA TYPE AND CONVERSION

In this chapter we are going to learn about the functions that can be used for

- Checking Data Type
- Checking Character
- Conversion

20.1 Check Data Type

The next functions can be used to check the data type

- isstring()
- isnumber()
- islist()
- type()
- isnull()

20.2 IsString() Function

Using the IsString() function we can know if the value is a string or not

Syntax:

```
IsString(value) ---> 1 if the value is a string or 0 if not
```

Example:

```
see isstring(5) + nl +      # print 0
     isstring("hello") + nl    # print 1
```

20.3 IsNumber() Function

Using the IsNumber() function we can know if the value is a number or not

Syntax:

```
IsNumber(value) ---> 1 if the value is a number or 0 if not
```

Example:

```
see isnumber(5) + nl +      # print 1
    isnumber("hello") + nl   # print 0
```

20.4 IsList() Function

Using the IsList() function we can know if the value is a list or not

Syntax:

```
IsList(value) ---> 1 if the value is a list or 0 if not
```

Example:

```
see islist(5) + nl +      # print 0
    islist("hello") + nl +  # print 0
    islist([1,3,5])        # print 1
```

20.5 Type() Function

We can know the type of a value using the Type() Function.

Syntax:

```
Type(value) ---> The Type as String
```

Example:

```
see Type(5) + nl +      # print NUMBER
Type("hello") + nl +     # print STRING
Type([1,3,5])            # print LIST
```

20.6 IsNULL() Function

We can check the value to know if it's null or not using the IsNULL() function

Syntax:

```
IsNULL(value) ---> 1 if the value is NULL or 0 if not
```

Example:

```
see isnull(5) + nl +      # print 0
isnull("hello") + nl +    # print 0
isnull([1,3,5]) + nl +    # print 0
isnull("") + nl +         # print 1
isnull("NULL")            # print 1
```

20.7 Check Character

The next functions can be used to check character

- isalnum()
- isalpha()
- iscntrl()
- isdigit()
- isgraph()
- islower()
- isprint()
- ispunct()
- isspace()
- isupper()
- isxdigit()

20.8 IsAlNum() Function

We can test a character or a string using the IsAlNum() Function

Syntax:

```
IsAlNum(value) ---> 1 if the value is digit/letter or 0 if not
```

Example:

```
see isalnum("Hello") + nl +      # print 1
      isalnum("123456") + nl +    # print 1
      isalnum("ABCabc123") + nl + # print 1
      isalnum("How are you")     # print 0 because of spaces
```

20.9 IsAlpha() Function

We can test a character or a string using the IsAlpha() Function

Syntax:

```
IsAlpha(value) ---> 1 if the value is a letter or 0 if not
```

Example:

```
see isalpha("Hello") + nl +      # print 1
    isalpha("123456") + nl +      # print 0
    isalpha("ABCabc123") + nl +   # print 0
    isalpha("How are you")       # print 0
```

20.10 IsCntrl() Function

We can test a character or a string using the IsCntrl() Function

Syntax:

```
IsCntrl(value) ---> 1 if the value is a control character (no printing position)
                           or 0 if not
```

Example:

```
See iscntrl("hello") + nl +      # print 0
      iscntrl(nl)                 # print 1
```

20.11 IsDigit() Function

We can test a character or a string using the IsDigit() Function

Syntax:

```
IsDigit(value) ---> 1 if the value is a digit or 0 if not
```

Example:

```
see isdigit("0123456789") + nl +      # print 1
      isdigit("0123a")                  # print 0
```

20.12 IsGraph() Function

We can test a character or a string using the IsGraph() Function

Syntax:

```
IsGraph(value) ---> 1 if the value can be printed (Except space) or 0 if not
```

Example:

```
see isgraph("abcdef") + nl +      # print 1
      isgraph("abc def")          # print 0
```

20.13 IsLower() Function

We can test a character or a string using the IsLower() Function

Syntax:

```
IsLower(value) ---> 1 if the value is lowercase letter or 0 if not
```

Example:

```
see islower("abcDEF") + nl +      # print 0
      islower("ghi")            # print 1
```

20.14 IsPrint() Function

We can test a character or a string using the IsPrint() Function

Syntax:

```
IsPrint(value) ---> 1 if the value occupies a printing position or 0 if not
```

Example:

```
see isprint("Hello") + nl +      # print 1
      isprint("Nice to see you") + nl +  # print 1
      isprint(nl)                      # print 0
```

20.15 IsPunct() Function

We can test a character or a string using the IsPunct() Function

Syntax:

```
IsPunct(value) ---> 1 if the value is a punctuation character or 0 if not
```

Example:

```
see ispunct("hello") + nl +      # print 0
      ispunct(",")            # print 1
```

20.16 IsSpace() Function

We can test a character or a string using the IsSpace() Function

Syntax:

```
IsSpace(value) ---> 1 if the value is a white-space or 0 if not
```

Example:

```
see isspace(" ") + nl +      # print 1
      isspace("test")        # print 0
```

20.17 IsUpper() Function

We can test a character or a string using the IsUpper() Function

Syntax:

```
IsUpper(value) ---> 1 if the value is an uppercase alphabetic letter or 0 if not
```

Example:

```
see isupper("welcome") + nl +      # print 0
      isupper("WELCOME")        # print 1
```

20.18 IsXdigit() Function

We can test a character or a string using the IsXdigit() Function

Syntax:

```
IsXdigit(value) ---> 1 if the value is a hexdecimal digit character or 0 if not
```

Example:

```
see isxdigit("0123456789abcdef") + nl +      # print 1
      isxdigit("123z")            # print 0
```

20.19 Conversion

The next functions can be used for conversion

- number()
- string()
- ascii()
- char()
- hex()

- dec()
- str2hex()
- hex2str()

20.20 Number() Function

We can convert strings to numbers using the Number() function or the + operator.

Syntax:

```
Number(string) ---> Number
0 + string ---> Number
```

Example:

```
see number("5") + 5 + nl      # print 10
see 0 + "10" + 2            # print 12
```

20.21 String() Function

We can convert numbers to strings using the String() function or the + operator.

Syntax:

```
String(number) ---> String
"" + number ---> String
```

Example:

```
see string(5) + 5 + nl      # print 55
see "" + 10 + 2            # print 102
```

20.22 Ascii() Function

We can get the ASCII code for a letter using the Ascii() function

Syntax:

```
Ascii(character) ---> ASCII Code
```

Example:

```
See ascii("m") + nl +    # print 109
      ascii("M")          # print 77
```

20.23 Char() Function

We can convert the ASCII code to character using the Char() function.

Syntax:

```
Char(ASCII Code) ---> character
```

Example:

```
See char(109) + nl +      # print m
      char(77)           # print M
```

20.24 Hex() Function

We can convert decimal to hexadecimal using the Hex() function.

Syntax:

```
Hex(decimal) ---> hexadecimal
```

Example:

```
See hex(10) + nl +      # print a
      hex(200)          # print c8
```

20.25 Dec() Function

We can convert hexadecimal to decimal using the Dec() function

Syntax:

```
Dec(hexadecimal) ---> decimal
```

Example:

```
See dec("a") + nl +      # print 10
      dec("c8")          # print 200
```

20.26 Str2hex() Function

We can convert string characters to hexadecimal characters using the Str2hex() function.

Syntax:

```
Str2hex(string) ---> hexadecimal string
```

Example:

```
See str2hex("hello")      # print 68656c6c6f
```

20.27 Hex2str() Function

We can convert hexadecimal characters to string using the Hex2str() function

Syntax:

```
Hex2Str(Hexadecimal string) ----> string
```

Example:

```
See hex2str("68656c6c6f")      # print hello
```

CHAPTER
TWENTYONE

MATHEMATICAL FUNCTIONS

In this chapter we are going to learn about the mathematical functions

21.1 List of functions

The Ring programming language comes with the next mathematical functions

Function	Description
sin(x)	Returns the sine of an angle of x radians
cos(x)	Returns the cosine of an angle of x radians
tan(x)	Returns the tangent of an angle of x radians
asin(x)	Returns the principal value of the arc sine of x, expressed in radians
acos(x)	Returns the principal value of the arc cosine of x, expressed in radians
atan(x)	Returns the principal value of the arc tangent of x, expressed in radians
atan2(y,x)	Returns the principal arc tangent of y/x, in the interval [-pi,+pi] radians
sinh(x)	Returns the hyperbolic sine of x radians
cosh(x)	Returns the hyperbolic cosine of x radians
tanh(x)	Returns the hyperbolic tangent of x radians
exp(x)	Returns the value of e raised to the xth power
log(x)	Returns the natural logarithm of x
log10(x)	Returns the common logarithm (base-10 logarithm) of x
ceil(x)	Returns the smallest integer value greater than or equal to x
floor(x)	Returns the largest integer value less than or equal to x
fabs(x)	Returns the absolute value of x.
pow(x,y)	Returns x raised to the power of y
sqrt(x)	Returns the square root of x
random(x)	Returns a random number in the range [0,x]
srandom(x)	Initialize random number generator
unsigned(n,n,c)	Perform operation using unsigned numbers
decimals(n)	Determine the decimals digits after the point in float/double numbers

21.2 Example

```

See "Mathematical Functions" + nl
See "Sin(0) = " + sin(0) + nl
See "Sin(90) radians = " + sin(90) + nl
See "Sin(90) degree = " + sin(90*3.14/180) + nl

See "Cos(0) = " + cos(0) + nl
See "Cos(90) radians = " + cos(90) + nl
See "Cos(90) degree = " + cos(90*3.14/180) + nl

See "Tan(0) = " + tan(0) + nl
See "Tan(90) radians = " + tan(90) + nl
See "Tan(90) degree = " + tan(90*3.14/180) + nl

See "asin(0) = " + asin(0) + nl
See "acos(0) = " + acos(0) + nl
See "atan(0) = " + atan(0) + nl
See "atan2(1,1) = " + atan2(1,1) + nl

See "sinh(0) = " + sinh(0) + nl
See "sinh(1) = " + sinh(1) + nl
See "cosh(0) = " + cosh(0) + nl
See "cosh(1) = " + cosh(1) + nl
See "tanh(0) = " + tanh(0) + nl
See "tanh(1) = " + tanh(1) + nl

See "exp(0) = " + exp(0) + nl
See "exp(1) = " + exp(1) + nl
See "log(1) = " + log(1) + nl
See "log(2) = " + log(2) + nl
See "log10(1) = " + log10(1) + nl
See "log10(2) = " + log10(2) + nl
See "log10(10) = " + log10(10) + nl

See "Ceil(1.12) = " + Ceil(1.12) + nl
See "Ceil(1.72) = " + Ceil(1.72) + nl

See "Floor(1.12) = " + floor(1.12) + nl
See "Floor(1.72) = " + floor(1.72) + nl

See "fabs(1.12) = " + fabs(1.12) + nl
See "fabs(1.72) = " + fabs(1.72) + nl

See "pow(2,3) = " + pow(2,3) + nl

see "sqrt(16) = " + sqrt(16) + nl

```

Program Output:

```

Mathematical Functions
Sin(0) = 0
Sin(90) radians = 0.89
Sin(90) degree = 1.00
Cos(0) = 1
Cos(90) radians = -0.45
Cos(90) degree = 0.00

```

(continues on next page)

(continued from previous page)

```

Tan(0) = 0
Tan(90) radians = -2.00
Tan(90) degree = 1255.77
asin(0) = 0
acos(0) = 1.57
atan(0) = 0
atan2(1,1) = 0.79
sinh(0) = 0
sinh(1) = 1.18
cosh(0) = 1
cosh(1) = 1.54
tanh(0) = 0
tanh(1) = 0.76
exp(0) = 1
exp(1) = 2.72
log(1) = 0
log(2) = 0.69
log10(1) = 0
log10(2) = 0.30
log10(10) = 1
Ceil(1.12) = 2
Ceil(1.72) = 2
Floor(1.12) = 1
Floor(1.72) = 1
fabs(1.12) = 1.12
fabs(1.72) = 1.72
pow(2,3) = 8
sqrt(16) = 4

```

21.3 Random() Function

The Random() function generate a random number and we can set the maximum value (optional).

Syntax:

```
Random(x) ---> Random number in the range [0,x]
```

Example:

```

for x = 1 to 20
    see "Random number : " + random() + nl +
        "Random number Max (100) : " + random(100) + nl
next

```

Program Output:

```

Random number : 31881
Random number Max (100) : 80
Random number : 5573
Random number Max (100) : 63
Random number : 2231
Random number Max (100) : 43
Random number : 12946
Random number Max (100) : 39

```

(continues on next page)

(continued from previous page)

```

Random number : 22934
Random number Max (100) : 48
Random number : 4690
Random number Max (100) : 52
Random number : 13196
Random number Max (100) : 65
Random number : 30390
Random number Max (100) : 87
Random number : 4327
Random number Max (100) : 77
Random number : 12456
Random number Max (100) : 17
Random number : 28438
Random number Max (100) : 13
Random number : 30503
Random number Max (100) : 6
Random number : 31769
Random number Max (100) : 94
Random number : 8274
Random number Max (100) : 65
Random number : 14390
Random number Max (100) : 90
Random number : 28866
Random number Max (100) : 12
Random number : 24558
Random number Max (100) : 70
Random number : 29981
Random number Max (100) : 77
Random number : 12847
Random number Max (100) : 63
Random number : 6632
Random number Max (100) : 60

```

21.4 SRandom() Function

The SRandom() function initialize random number generator.

Syntax:

```
SRandom(x)
```

21.5 Unsigned() Function

We can use unsigned numbers using the Unsigned() function.

Syntax:

```
Unsigned(nNum1,nNum2,cOperator) --> result of cOperator operation on nNum1,nNum2
```

Example:

```

see oat_hash("hello") + nl

# Jenkins hash function - https://en.wikipedia.org/wiki/Jenkins_hash_function
func oat_hash cKey
    h = 0
    for x in cKey
        h = unsigned(h, ascii(x), "+")
        h = unsigned(h, unsigned(h, 10, "<<"), "+")
        r = unsigned(h, 6, ">>")
        h = unsigned(h, r, "^")
    next
    h = unsigned(h, unsigned(h, 3, "<<"), "+")
    h = unsigned(h, unsigned(h, 11, ">>"), "^")
    h = unsigned(h, unsigned(h, 15, "<<"), "+")
    return h

```

Output:

```
3372029979.00
```

21.6 Decimals() Functions

We can determine the decimals numbers count after the point in float/double numbers using the decimals() function.

Syntax:

```
Decimals(nDecimalsCount)
```

Example:

```

x = 1.1234567890123
for d = 0 to 14
    decimals(d)
    see x + nl
next

```

Output:

```

1
1.1
1.12
1.123
1.1235
1.12346
1.123457
1.1234568
1.12345679
1.123456789
1.1234567890
1.12345678901
1.123456789012
1.1234567890123
1.12345678901230

```

21.7 Using _ in numbers

We can use `_` between numbers digits.

Example:

```
x = 1_000_000
see type(x)+nl
see x+1+nl
```

Output:

```
NUMBER
10000001
```

21.8 Using f after numbers

We can use the ‘f’ letter after numbers.

Example:

```
x = 19.99f
see type(x) + nl
```

Output:

```
NUMBER
```

CHAPTER
TWENTYTWO

FILES

In this chapter we are going to learn about files functions.

- Read()
- Write()
- Dir()
- Rename()
- Remove()
- fopen()
- fclose()
- fflush()
- freopen()
- tempfile()
- tempname()
- fseek()
- ftell()
- rewind()
- fgetpos()
- fsetpos()
- clearerr()
- feof()
- perror()
- fgetc()
- fgets()
- fputc()
- fputs()
- ungetc()
- fread()

- fwrite()
- fexists()
- Numbers and Bytes

22.1 Read() Function

We can read the file content using the Read() function

Syntax:

```
Read(cFileName) ---> String contains the file content
```

Example:

```
see read("myfile.txt")
```

The read function can read binary files too

Example:

```
see read("myapp.exe")
```

22.2 Write() Function

We can write string to file using the Write() function

The write function can write binary data to binary files.

Syntax:

```
Write(cFileName, cString)           # write string cString to file cFileName
```

Example:

```
# copy file
cFile = read("ring.exe")
write("ring2.exe", cFile)
```

22.3 Dir() Function

We can get the folder contents (files & sub folders) using the Dir() function.

Syntax:

```
Dir(cFolderPath) ---> List contains files & sub folders.
```

This function returns a list and each list item is a list of two items

- File/sub folder name
- Type (0 = File , 1 = Folder/Directory)

Example:

```

see "Testing DIR() " + nl
mylist = dir("C:\myfolder")
for x in mylist
    if x[2]
        see "Directory : " + x[1] + nl
    else
        see "File : " + x[1] + nl
    ok
next
see "Files count : " + len(mylist)

```

22.4 Rename() Function

We can rename files using the Rename() function

Syntax:

```
Rename(cOldFileName, cNewFileName) ----> Number ( Status: Success (0) , Error (-1) )
```

Example:

```
rename ("file.txt", "help.txt")
```

22.5 Remove() Function

We can delete a file using the Remove() function

Syntax:

```
Remove(cFileName)
```

Example:

```
remove ("test.txt")
```

22.6 Fopen() Function

We can open a file using the Fopen() function

Syntax:

```
Fopen(cFileName, cMode) ----> File Handle
```

Mode	Description
“r”	Reading (The file must exist)
“w”	Writing (create empty file / overwrite)
“a”	Appends (create file if it doesn’t exist)
“r+”	update (reading/writing)
“w+”	Create empty file (reading/writing)
“a+”	reading & appending

22.7 Fclose() Function

When we open a file using fopen() function, we can close it using the Fclose() function

Syntax:

```
Fclose(file handle)
```

22.8 Fflush() Function

We can flushes the output buffer of a stream using the Fflush() function

Syntax:

```
Fflush(file handle)
```

22.9 Freopen() Function

We can open another file using the same file handle and at the same time close the old file

Syntax:

```
Freopen(cFileName,cMode,file handle) ---> file handle
```

Example:

```
freopen("myprogoutput.txt", "w+", stdout)
see "welcome" + nl
for x = 1 to 10
    see x + nl
next

/*
** Read : https://en.wikipedia.org/wiki/Device_file#Device_files
** The next code is not portable, we can use iswindows() before
** using it and we can write special code for each operating system.
*/

freopen("CON", "w", stdout)           # For Microsoft Windows
see "Done" + nl                      # print to stdout again
```

Output:

```
# Output to stdout
Done

# Output to file : myprogoutput.txt
welcome
1
2
3
4
5
```

(continues on next page)

(continued from previous page)

```
6
7
8
9
10
```

22.10 Tempfile() Function

The function Tempfile() creates a temp. file (binary).

The file will be deleted automatically when the stream is closed

Syntax:

```
TempFile() ---> file handle
```

22.11 Tempname() Function

We can generate temp. file name using the Tempname() function

The generated name will be different from the name of any existing file

Syntax:

```
Tempname() ---> generated file name as string
```

22.12 Fseek() Function

We can set the file position of the stream using the Fseek() function

Syntax:

```
Fseek(file handle, nOffset, nWhence) ---> zero if successful
```

The next table presents the nWhence values

Value	Description
0	Beginning of file
1	Current position
2	End of file

22.13 Ftell() Function

We can know the current file position of a stream using the Ftell() function

Syntax:

```
Ftell(file handle) ---> file position as number
```

22.14 Rewind() Function

We can set the file position to the beginning of the file using the Rewind() function

Syntax:

```
Rewind(file handle)
```

22.15 Fgetpos() Function

We can get handle to the current file position using the Fgetpos() function

Syntax:

```
Fgetpos(file handle) ---> position handle
```

22.16 Fsetpos() Function

We can set the current file position using the Fsetpos() function

Syntax:

```
Fsetpos(file handle,position handle)
```

22.17 Clearerr() Function

We can clear the EOF error and the error indicators of a stream using the clearerr() function

Syntax:

```
Clearerr(file handle)
```

22.18 Feof() Function

We can test the end-of-file indicator using the Feof() function

Syntax:

```
Feof(file handle) ---> returns 1 if EOF and 0 if not
```

22.19 Ferror() Function

We can test the error indicator of a given stream using the Ferror() function

Syntax:

```
Ferror(file handle) ---> returns 1 if error and 0 if not
```

22.20 Perror() Function

We can print error message to the stderr using the Perror() function

Syntax:

```
Perror(cErrorMessage)
```

22.21 Fgetc() Function

We can get the next character from the stream using the Fgetc() function

Syntax:

```
Fgetc(file handle) ---> returns character or EOF
```

22.22 Fgets() Function

We can read new line from the stream using the Fgets() function

Syntax:

```
Fgets(file handle,nSize) ---> string
```

The function stop when nSize characters are read, new line character is read or EOF.

22.23 Fputc() Function

We can write a character to the stream using the Fputc() function

Syntax:

```
Fputc(file handle,cChar)
```

22.24 Fputs() Function

We can write a string to the stream using the Fputs() function

Syntax:

```
Fputs(file handle,cString)
```

22.25 Ungetc() Function

We can push a character to the stream using the Ungetc() function

The character will be available for the next read

Syntax:

```
Ungetc(file handle,character)
```

22.26 Fread() Function

We can read data from a stream using the Fread() function

Syntax:

```
Fread(file handle,nSize)
```

22.27 Fwrite() Function

We can write data to a stream using the Fwrite() function

Syntax:

```
Fwrite(file handle,cString)
```

22.28 Fexists() Function

We can check if a file exists using the Fexists() function

Syntax:

```
Fexists(cFileName) ---> returns 1 if the file exists
```

Example:

```
see fexists("b:\mahmoud\apps\ring\ring.exe") + nl +
fexists("b:\mahmoud\apps\ring\ring2.exe") + nl
```

Output:

```
1
0
```

22.29 Example

The next program test some of the file functions

```
See "testing file functions" + nl

See "open file" + nl
fp = fopen(exefolder() + ".../tests/scripts/s65.ring", "r")

See "reopen" + nl
fp = freopen(exefolder() + ".../tests/scripts/s78.ring", "r", fp)
See "close file" + nl
fclose(fp)

See "temp file" + nl
fp = tempfile()
fclose(fp)

See "temp name" + nl
see tempname() + nl

remove(exefolder() + ".../tests/scripts/mytest2.txt")
write(exefolder() + ".../tests/scripts/test1.txt", "hello")
rename(exefolder() + ".../tests/scripts/test1.txt", exefolder() +
      ".../tests/scripts/mytests2.txt")

See "print file" + nl
fp = fopen(exefolder() + ".../samples/fromdoc/filefuncs.ring", "r")
r = fgetc(fp)
while isstring(r)
    see r
    r = fgetc(fp)
end
fclose(fp)

See nl+"print line from the file" + nl
fp = fopen(exefolder() + ".../samples/fromdoc/filefuncs.ring", "r")
```

(continues on next page)

(continued from previous page)

```

r = fgets(fp, 33)
see r + nl
fclose(fp)
fp = fopen(exefolder() + "../tests/scripts/test78.txt", "w+")
fseek(fp, 0, 2) # goto end of file
fputc(fp, "t")
fputc(fp, "e")
fputc(fp, "s")
fputc(fp, "t")
fputs(fp, "tests2")
fclose(fp)

see "print file" + nl
see read(exefolder() + "../tests/scripts/test78.txt")

fp = fopen(exefolder() + "../tests/scripts/test78.txt", "r")
see "testing ungetc() " + nl
for x = 1 to 3
    r = fgetc(fp)
    see r + nl
    ungetc(fp, r)
next
fclose(fp)

see "testing fread() " + nl
fp = fopen(exefilename(), "rb")
r = fread(fp, 100)
see r + nl
fclose(fp)

see "testing fwrite() " + nl
fp = fopen(exefolder() + "../tests/scripts/test1.txt", "wb")
fwrite(fp, r)
fclose(fp)

```

The next example print part of the content of a binary file

```

see "Testing: fread() " +" FileName: "+ exefilename() +nl +nl
fp = fopen(exefilename(), "rb")
r = fread(fp, 800)
for n =1 to len(r)
    if isprint(substr(r, n, 1))
        see substr(r, n, 1)
    else
        see "."
    ok
    ## 80 char per line
    if n % 80 = 0
        see nl
    ok
next
fclose(fp)

```

22.30 Numbers and Bytes

The next functions to convert between Numbers and Bytes.

- Int2Bytes()
- Float2Bytes()
- Double2Bytes()
- Bytes2Int()
- Bytes2Float()
- Bytes2Double()

Example:

```
see "Test Int2Bytes() and Bytes2Int() - Value : 77" + nl
r = Int2Bytes(77)
see "Int Size : " + len(r) + nl
see r + nl
see Bytes2Int(r) + nl
see "Test Float2Bytes() and Bytes2Float() - Value 77.12" + nl
r = Float2Bytes(77.12)
see "Float Size : " + len(r) + nl
see r + nl
see Bytes2Float(r) + nl
see "Test Double2Bytes() and Bytes2Double() - Value 9999977.12345" + nl
r = Double2Bytes(9999977.12345)
see "Double Size : " + len(r) + nl
see r + nl
decimals(5)
see Bytes2Double(r) + nl
```

CHAPTER
TWENTYTHREE

SYSTEM FUNCTIONS

In this chapter we are going to learn about the system functions

- System()
- SysGet()
- IsMSDOS()
- IsWindows()
- IsWindows64()
- IsUnix()
- IsMacOSX()
- IsLinux()
- IsFreeBSD()
- IsAndroid()
- Windowsnl()
- Get Command Line Arguments
- Get Active Source File Name
- CurrentDir()
- ExeFileName()
- ChDir()
- ExeFolder()
- Version()
- Shutdown()

23.1 System() Function

We can execute system commands using the system() function

Syntax:

```
System(cCommand)
```

Example:

```
System("myapp.exe")      # Run myapp.exe
System("ls")            # print list of files
```

23.2 SysGet() Function

We can get environment variables using the Get() function

Syntax:

```
SysGet(cVariable)
```

Example:

```
see sysget("path")           # print system path information
```

23.3 IsMSDOS() Function

We can check if the operating system is MSDOS or not using the IsMSDOS() function

Syntax:

```
IsMSDOS() ---> Returns 1 if the operating system is MS-DOS, Returns 0 if it's not
```

23.4 IsWindows() Function

We can check if the operating system is Windows or not using the IsWindows() function

Syntax:

```
IsWindows() ---> Returns 1 if the operating system is Windows, Returns 0 if it's not
```

23.5 IsWindows64() Function

We can check if the operating system is Windows 64bit or not using the IsWindows64() function

Syntax:

```
IsWindows64() ---> Returns 1 if the operating system is Windows64, Returns 0 if it's  
↪not
```

23.6 IsUnix() Function

We can check if the operating system is Unix or not using the IsUnix() function

Syntax:

```
IsUnix() ---> Returns 1 if the operating system is Unix, Returns 0 if it's not
```

23.7 IsMacOSX() Function

We can check if the operating system is macOS or not using the IsMacOSX() function

Syntax:

```
IsMacOSX() ---> Returns 1 if the operating system is Mac OS X, Returns 0 if it's not
```

23.8 IsLinux() Function

We can check if the operating system is Linux or not using the IsLinux() function

Syntax:

```
IsLinux() ---> Returns 1 if the operating system is Linux, Returns 0 if it's not
```

23.9 IsFreeBSD() Function

We can check if the operating system is FreeBSD or not using the IsFreeBSD() function

Syntax:

```
IsFreeBSD() ---> Returns 1 if the operating system is FreeBSD, Returns 0 if it's not
```

23.10 IsAndroid() Function

We can check if the operating system is Android or not using the IsAndroid() function

Syntax:

```
IsAndroid() ---> Returns 1 if the operating system is Android, Returns 0 if it's not
```

23.11 Example

```
see "IsMSDOS()"    ---> " + ismsdos()      + nl
see "IsWindows()"   ---> " + iswindows()     + nl
see "IsWindows64()" ---> " + iswindows64()   + nl
see "IsUnix()"      ---> " + isunix()        + nl
see "IsMacOSX()"    ---> " + ismacosx()      + nl
see "IsLinux()"     ---> " + islinux()       + nl
see "IsFreeBSD()"   ---> " + isfreebsd()     + nl
see "IsAndroid()"   ---> " + isandroid()     + nl
```

Output:

```
IsMSDOS()    ---> 0
IsWindows()   ---> 1
IsWindows64() ---> 0
IsUnix()      ---> 0
IsMacOSX()    ---> 0
IsLinux()     ---> 0
IsFreeBSD()   ---> 0
IsAndroid()   ---> 0
```

23.12 Windowsnl() Function

We can get the windows new line string using the Windowsnl() function.

Syntax:

```
WindowsNL() ---> Returns a string contains CR+LF = CHAR(13) + CHAR(10)
```

Example:

```
cStr = read("input.txt")

if iswindows()
    cStr = substr(cStr,windowsnl(),nl)
ok

aList = str2list(cStr)
# to do - list items processing using "for in"
cStr = list2str(aList)

if iswindows()
    cStr = substr(cStr,nl,windowsnl())
```

(continues on next page)

(continued from previous page)

ok

write("ouput.txt",cStr)

23.13 Get Command Line Arguments

We can get the command line arguments passed to the ring script using the sysargv variable.

The sysargv variable is a list contains the command line parameters.

Example

```
see copy("=",30) + nl
see "Command Line Parameters" + nl
see "Size : " + len(sysargv) + nl
see sysargv
see copy("=",30) + nl
if len(sysargv) < 4 return ok
nStart = sysargv[3]
nEnd = sysargv[4]
for x = nStart to nEnd
    see x + nl
next
```

Output

```
b:\mahmoud\apps\ring>ring tests\syspara.ring 1 10
=====
Command Line Parameters
Size : 4
ring
tests\syspara.ring
1
10
=====
1
2
3
4
5
6
7
8
9
10
```

23.14 Get Active Source File Name

We can get the active source file name (*.ring) using the filename() function

Syntax:

```
filename() ---> String contains the active source file name.
```

Example:

```
see "Active Source File Name : " + filename() + nl
```

Output:

```
Active Source File Name : tests\filename.ring
```

Example:

```
if sysargv[2] = filename()
    see "I'm the main program file!" + nl
    # we can run tests here!
else
    see "I'm a sub file in a program" + nl
ok
```

23.15 PrevFileName() Function

Using the PrevFileName() function we can get the previous active source file name.

The previous file would be the file of the caller function, Or the file of the function that we called before calling PrevFileName().

Syntax:

```
prevfilename() ---> String contains the previous source file name.
```

Example:

The next function in stdlib.ring uses the PrevFileName() to know if the file of the caller function is the main source file of the program or not.

```
Func IsMainSourceFile
    if PrevFileName() = sysargv[2]
        return true
    ok
    return false
```

23.16 CurrentDir() Function

Return the path of the current directory

Syntax:

```
CurrenDir() ---> String contains the path of the currect directory
```

23.17 ExeFileName() Function

Return the Ring executable file name

Syntax:

```
exefilename() ---> String contains the Ring executable file name
```

23.18 ChDir() Function

Change the current directory

Syntax:

```
ChDir(cNewPath)
```

23.19 ExeFolder() Function

Return the Ring executable file path

Syntax:

```
exefolder() ---> String contains the Ring executable path
```

23.20 Version() Function

Return the Ring version

Syntax:

```
version() ---> String contains the Ring version
```

Output:

```
1.13
```

23.21 Shutdown() Function

Close the application

Syntax:

```
shutdown(nStatus) ---> Close the application
```

CHAPTER
TWENTYFOUR

EVAL() AND DEBUGGING

In this chapter we are going to learn about

- Error Handling using Try/Catch/Done
- Eval() function
- Raise() function
- Assert() function

24.1 Try/Catch/Done

Syntax:

```
Try
    Statements...
Catch
    Statements...
Done
```

The statements in the Try block will be executed, if any error happens then the statements in the catch block will be executed.

Inside the catch block we can use the variable cCatchError to get the error message

Example:

```
Try
    see 5/0
Catch
    see "Catch!" + nl + cCatchError
Done
```

Output:

```
Catch!
Error (R1) : Cann't divide by zero !
```

24.2 Eval() Function

We can execute code during the runtime from string using the Eval() function

Syntax:

```
Eval(cCode)
```

Example:

```
Eval("nOutput = 5+2*5 ")
See "5+2*5 = " + nOutput + nl
Eval("for x = 1 to 10 see x + nl next")
Eval("func test see 'message from test!' ")
test()
```

Output:

```
5+2*5 = 15
1
2
3
4
5
6
7
8
9
10
message from test!
```

We can use the Return command to return a value

Example:

```
see Eval("return 5*5")
```

Output:

```
25
```

24.3 Raise() Function

We can raise an exception using the Raise() function

Syntax:

```
Raise(cErrorMessage)
```

The function will display the error message then end the execution of the program.

We can use Try/Catch/Done to avoid exceptions generated by raise() function.

Example:

```
nMode = 10

if nMode < 0 or nMode > 5
    raise("Error : nMode not in the range 1:4")
ok
```

Output:

```
Line 4 Error : nMode not in the range 1:4
In raise in file tests\raise.ring
```

Example:

```
try
    testmode(6)
catch
    see "avoid raise!"
done

testmode(-1)

func testmode nMode

if nMode < 0 or nMode > 5
    raise("Error : nMode not in the range 1:4")
ok
```

Output:

```
avoid raise!
Line 12 Error : nMode not in the range 1:4
In raise In function testmode() in file tests\raise2.ring
called from line 7 in file tests\raise2.ring
```

24.4 Assert() Function

We can use the Assert() function to test conditions before executing the code

If the test fail the program will be terminated with an error message contains the assert condition.

Syntax:

```
Assert( condition )
```

Example:

```
x = 10
assert( x = 10 )
assert( x = 100 )
```

Output:

```
Line 3 Assertion Failed!
In assert in file tests\assert.ring
```

CHAPTER
TWENTYFIVE

DEMO PROGRAMS

In this chapter we will see simple demo programs

- Language Shell
- Main Menu

25.1 Language Shell

We can create simple interactive programming environment using the next program

```
while true
    see nl + "code:> "
    give cCode
    try
        eval(cCode)
    catch
        see cCatchError
    done
end
```

Output:

```
code:> see "hello world"
hello world
code:> for x = 1 to 10 see x + nl next
1
2
3
4
5
6
7
8
9
10

code:> func test see "Hello from test" + nl

code:> test()
Hello from test

code:> bye
```

25.2 Main Menu

Example:

```
# Demo Program

while true

    see "

    Main Menu
    =====
    [1] Say Hello
    [2] Sum two numbers
    [3] Stars
    [4] Fact
    [5] Exit

    " give nMenu see nl

    # we can use Switch-ON-Other-OFF instead of IF-BUT-ELSE-OK

    Switch nMenu
    On 1 sayhello()
    On 2 Sum()
    On 3 Stars()
    On 4
        see "Enter Number : " give x
        see "Output : "

        Try
            see Fact(number(x))
        Catch
            see "Error in parameters!" + nl
        Done

    On "5" return
    Other see "bad option" + nl
    Off

end

func sayhello
    see "Enter your name ? " give fname
    see "Hello " + fname + nl

func sum
    see "number 1 : " give num1 see "number 2 : " give num2
    see "Sum : " see 0 + num1 + num2

func stars
    for x = 1 to 10
        see space(8)
        for y = 1 to x see "*" next see nl
    next

func fact x if x = 0 return 1 else return x * fact(x-1) ok
```

(continues on next page)

(continued from previous page)

```
func space x y = "" for t=1 to y += " " next return y
```

Output:

```
Main Menu
=====
[1] Say Hello
[2] Sum two numbers
[3] Stars
[4] Fact
[5] Exit
```

1

Enter your name ? Mahmoud Fayed
Hello Mahmoud Fayed

```
Main Menu
=====
[1] Say Hello
[2] Sum two numbers
[3] Stars
[4] Fact
[5] Exit
```

2

number 1 : 3
number 2 : 4
Sum : 7

```
Main Menu
=====
[1] Say Hello
[2] Sum two numbers
[3] Stars
[4] Fact
[5] Exit
```

3

```
*
```

```
**
```

```
***
```

```
****
```

```
*****
```

```
*****
```

```
*****
```

```
*****
```

```
*****
```

```
*****
```

```
Main Menu
=====
```

(continues on next page)

(continued from previous page)

```
[1] Say Hello  
[2] Sum two numbers  
[3] Stars  
[4] Fact  
[5] Exit
```

4

Enter Number : 5

Output : 120

Main Menu

=====

```
[1] Say Hello  
[2] Sum two numbers  
[3] Stars  
[4] Fact  
[5] Exit
```

5

CHAPTER
TWENTYSIX

ODBC FUNCTIONS

This chapter contains the ODBC functions provided by the Ring programming language.

- odbc_init()
- odbc_drivers()
- odbc_datasources()
- odbc_close()
- odbc_connect()
- odbc_disconnect()
- odbc_execute()
- odbc_colcount()
- odbc_fetch()
- odbc_getdata()
- odbc_tables()
- odbc_columns()
- odbc_autocommit()
- odbc_commit()
- odbc_rollback()

Before using the next function load the odbc.lib.ring library

```
load "odbc.lib.ring"
# Use ODBC functions
```

26.1 odbc_init() Function

We can create ODBC Handle using the odbc_init() function

Syntax:

```
odbc_init() ---> ODBC Handle
```

26.2 odbc_drivers() Function

We can get a list of ODBC drivers using the odbc_drivers() function

Syntax:

```
odbc_drivers(ODBC Handle) ---> List of Drivers
```

26.3 odbc_datasources() Function

We can get a list of ODBC data sources using the odbc_datasources() function

Syntax:

```
odbc_datasources(ODBC Handle) ---> List of Data sources
```

26.4 odbc_close() Function

After the end of using ODBC functions we can free resources using ODBC_Close() function

Syntax:

```
odbc_close(ODBC Handle)
```

26.5 Print List of ODBC Drivers

The next example print a list of ODBC drivers.

```
See "ODBC test 1" + nl
oODBC = odbc_init()
See "Drivers " + nl
see odbc_drivers(oODBC)
odbc_close(oODBC)
```

Output:

```
ODBC test 1
Drivers
Microsoft Access-Treiber (*.mdb) - SQLLevel=0
Driver do Microsoft Paradox (*.db) - SQLLevel=0
Driver do Microsoft Excel (*.xls) - SQLLevel=0
Microsoft Text Driver (*.txt; *.csv) - SQLLevel=0
Driver da Microsoft para arquivos texto (*.txt; *.csv) - SQLLevel=0
Microsoft dBase-Treiber (*.dbf) - SQLLevel=0
SQL Server - CPTimeout=60
Microsoft Excel Driver (*.xls) - SQLLevel=0
Driver do Microsoft dBase (*.dbf) - SQLLevel=0
Microsoft Paradox-Treiber (*.db) - SQLLevel=0
Microsoft ODBC for Oracle - CPTimeout=120
Microsoft Text-Treiber (*.txt; *.csv) - SQLLevel=0
```

(continues on next page)

(continued from previous page)

```

Microsoft Excel-Treiber (*.xls) - SQLLevel=0
Microsoft Access Driver (*.mdb) - SQLLevel=0
Driver do Microsoft Access (*.mdb) - SQLLevel=0
Microsoft Paradox Driver (*.db) - SQLLevel=0
Microsoft dBase Driver (*.dbf) - SQLLevel=0
Microsoft Access Driver (*.mdb, *.accdb) - UsageCount=3
Microsoft Excel Driver (*.xls, *.xlsx, *.xslm, *.xslb) - UsageCount=3
Microsoft Access Text Driver (*.txt, *.csv) - UsageCount=3
SQL Server Native Client 10.0 - UsageCount=1
SQL Server Native Client 11.0 - UsageCount=1
Microsoft Access dBASE Driver (*.dbf, *.ndx, *.mdx) - UsageCount=3
Microsoft Access Paradox Driver (*.db) - UsageCount=3
MySQL ODBC 5.3 ANSI Driver - UsageCount=1
MySQL ODBC 5.3 Unicode Driver - UsageCount=1
ODBC Driver 11 for SQL Server - UsageCount=1
Lianja ODBC Driver - CPTimeout=60
Microsoft Visual FoxPro Driver - UsageCount=1
Microsoft Visual FoxPro-Treiber - UsageCount=1
Driver para o Microsoft Visual FoxPro - UsageCount=1
Microsoft FoxPro VFP Driver (*.dbf) - UsageCount=1

```

26.6 Print List of ODBC Data Sources

The next example print a list of ODBC data sources.

```

See "ODBC test 2" + nl
pODBC = odbc_init()
See "Data Sources " + nl
see odbc_datasources(pODBC)
odbc_close(pODBC)

```

Output:

```

ODBC test 2
Data Sources
Excel Files - Microsoft Excel Driver (*.xls, *.xlsx, *.xslm, *.xslb)
MS Access Database - Microsoft Access Driver (*.mdb, *.accdb)
Customer - Microsoft Access Driver (*.mdb)
IdCardData - Microsoft Access Driver (*.mdb)
MyProjectData2 - Microsoft Access Driver (*.mdb)
MyData - Microsoft Access Driver (*.mdb)
MonprojetcData - Microsoft Access Driver (*.mdb)
dBASE Files - Microsoft Access dBASE Driver (*.dbf, *.ndx, *.mdx)
myvfpdata - Microsoft Visual FoxPro Driver
FACTORYDATA - Microsoft Access Driver (*.mdb)
TRAININGSYSDATA - Microsoft Access Driver (*.mdb)
RVCSYSDATASQLDB - SQL Server Native Client 11.0
PWCTRVCADATA - Microsoft Access Driver (*.mdb)
MyCompany - Microsoft Access Driver (*.mdb)
HCS - Microsoft Access Driver (*.mdb)
HCS2 - Microsoft Access Driver (*.mdb, *.accdb)
MyProjectData - Microsoft Access Driver (*.mdb)
Xtreme Sample Database 2008 - Microsoft Access Driver (*.mdb)
Lianja_Southwind - Lianja ODBC Driver

```

(continues on next page)

(continued from previous page)

Visual FoxPro Database – Microsoft Visual FoxPro Driver
 Visual FoxPro Tables – Microsoft Visual FoxPro Driver

26.7 odbc_connect() Function

We can connect to the database using the odbc_connect() function.

Syntax:

```
odbc_connect (ODBC Handle, cConnectionString)
```

26.8 odbc_disconnect() Function

We can close the connection to the database using the odbc_disconnect() function.

Syntax:

```
odbc_disconnect (ODBC Handle)
```

26.9 Open and Close Connection

The next example connect to the database then close the connection

```
See "ODBC test 3" + nl
pODBC = odbc_init()
See "Connect to database" + nl
see odbc_connect (pODBC, "DBQ=test.mdb;Driver={Microsoft Access Driver (*.mdb)}") + nl
See "disconnect" + nl
odbc_disconnect (pODBC)
See "Close database..." + nl
odbc_close (pODBC)
```

Output:

```
ODBC test 3
Connect to database
1
disconnect
Close database...
```

26.10 odbc_execute() Function

We can execute SQL Statements on the database using the odbc_execute() function.

Syntax:

```
odbc_execute(ODBC Handle, cSQLStatement)
```

26.11 odbc_colcount() Function

We can get columns count in the query result using the odbc_colcount() function.

Syntax:

```
odbc_colcount(ODBC Handle) ---> Columns Count as Number
```

26.12 odbc_fetch() Function

We can fetch a row from the query result using the odbc_fetch() function.

Syntax:

```
odbc_fetch(ODBC Handle)
```

26.13 odbc_getdata() Function

We can get column value from the fetched row using the odbc_getdata() function.

Syntax:

```
odbc_getdata(ODBC Handle, nColumnNumber) ---> Column Value
```

26.14 Execute Query and Print Result

The next example execute query then print the query result.

```
See "ODBC test 4" + nl
pODBC = odbc_init()
See "Connect to database" + nl
see odbc_connect(pODBC, "DBQ=test.mdb;Driver={Microsoft Access Driver (*.mdb)}") + nl
See "Select data" + nl
see odbc_execute(pODBC, "select * from person") + nl
nMax = odbc_colcount(pODBC)
See "Columns Count : " + nMax + nl
while odbc_fetch(pODBC)
    See "Row data:" + nl
    for x = 1 to nMax
        see odbc_getdata(pODBC, x) + " - "
```

(continues on next page)

(continued from previous page)

```

next
end
See "Close database..." + nl
odbc_disconnect(pODBC)
odbc_close(pODBC)

```

26.15 odbc_tables() Function

We can get a list of tables inside the database using the odbc_tables() function.

We can access the result of this function as we get any query result.

Syntax:

```
odbc_tables(ODBC Handle)
```

Example:

```

See "ODBC test - Get Database Tables" + nl
pODBC = odbc_init()
See "Connect to database" + nl
odbc_connect(pODBC, "DBQ=test.mdb;Driver={Microsoft Access Driver (*.mdb)}") + nl
See "Select data" + nl
odbc_tables(pODBC) + nl
nMax = odbc_colcount(pODBC)
See "Columns Count : " + nMax + nl
while odbc_fetch(pODBC)
    for x = 1 to nMax
        see odbc_getdata(pODBC, x)
        if x != nMax see " - " ok
    next
    See nl
end
See "Close database..."
odbc_disconnect(pODBC)
odbc_close(pODBC)

```

Output:

```

ODBC test - Get Database Tables
Connect to database
Select data
Columns Count : 5
.\test - NULL - Customer - TABLE - NULL
.\test - NULL - employee - TABLE - NULL
.\test - NULL - person - TABLE - NULL
.\test - NULL - tel - TABLE - NULL
Close database...

```

26.16 odbc_columns() Function

We can get a list of columns inside the table using the odbc_columns() function.

Syntax:

```
odbc_columns(ODBC Handle, cTableName)
```

Example:

```
See "ODBC test - Get Table Columns" + nl
pODBC = odbc_init()
See "Connect to database" + nl
odbc_connect(pODBC, "DBQ=test.mdb;Driver={Microsoft Access Driver (*.mdb)}") + nl
See "Get Columns inside the Person Table" + nl
odbc_columns(pODBC, "person") + nl
while odbc_fetch(pODBC)
    see odbc_getdata(pODBC, 4) + nl
end
See "Close database..." + nl
odbc_disconnect(pODBC)
odbc_close(pODBC)
```

Output:

```
ODBC test - Get Table Columns
Connect to database
Get Columns inside the Person Table
FIRST
LAST
STREET
CITY
STATE
ZIP
HIREDATE
MARRIED
AGE
SALARY
NOTES
Close database...
```

26.17 odbc_autocommit() Function

We can enable or disable the auto commit feature using the odbc_autocommit() function.

Syntax:

```
odbc_autocommit(ODBC Handle, lStatus) # lStatus can be True or False
```

26.18 odbc_commit() Function

We can commit updates to the database using the odbc_commit() function.

Syntax:

```
odbc_commit (ODBC Handle)
```

26.19 odbc_rollback() Function

We can rollback updates to the database using the odbc_rollback() function.

Syntax:

```
odbc_rollback (ODBC Handle)
```

26.20 Transactions and Using Commit and Rollback

Example:

```
See "ODBC Test - Transactions and using Commit and Rollback" + nl
pODBC = odbc_init()
See "Connect to database" + nl
see odbc_connect(pODBC, "DBQ=test.mdb;Driver={Microsoft Access Driver (*.mdb)}") + nl
see "insert data..." + nl
odbc_autocommit(pODBC, 0)
for x = 1 to 10000
    odbc_execute(pODBC, "insert into tel values (" + x + ", 'mahmoud')")
next
for x = 10001 to 15000
    odbc_execute(pODBC, "insert into tel values (" + x + ", 'samir')")
next
odbc_commit (pODBC)

for x = 15001 to 20000
    odbc_execute(pODBC, "insert into tel values (" + x + ", 'fayed')")
next

ODBC_ROLLBACK (pODBC)
odbc_execute(pODBC, "insert into tel values (" + x + ", 'fayed')")
odbc_commit (pODBC)

See "Close database..." + nl
odbc_disconnect (pODBC)
odbc_close (pODBC)
```

Output:

```
ODBC Test - Transactions and using Commit and Rollback
Connect to database
1
insert data...
Close database...
```

26.21 Save and Restore images

The next example save an image inside the database

```
See "ODBC test - Save image in the database" + nl
pODBC = odbc_init()
See "Connect to database" + nl
 odbc_connect(pODBC, "DBQ=test.mdb;Driver={Microsoft Access Driver (*.mdb)}") + nl
 "Read Image File..." + nl
cFile = str2hex(read("tests\mahmoud.jpg"))
 "size " + len(CFile)+nl
 "Save image in the database..." + nl
stmt = "insert into tel values (20000,'mahmoud','" + cFile + "');"
odbc_execute(pODBC,stmt)
See "Close database..." + nl
odbc_disconnect (pODBC)
odbc_close (pODBC)
```

The next example restore the image from the database

```
See "ODBC Test - Restore image from the database" + nl
pODBC = odbc_init()
See "Connect to database" + nl
 odbc_connect(pODBC, "DBQ=test.mdb;Driver={Microsoft Access Driver (*.mdb)}") + nl
See "Select data" + nl
 odbc_execute(pODBC, "select * from tel where id = 20000") + nl
nMax = odbc_colcount (pODBC)
See "Columns Count : " + nMax + nl
 odbc_fetch(pODBC)
    See "Write image file" + nl
    write("tests\great.jpg",hex2str( odbc_getdata(pODBC,3) ) )

See "Close database..." + nl
odbc_disconnect (pODBC)
odbc_close (pODBC)
```

CHAPTER
TWENTYSEVEN

MYSQL FUNCTIONS

In this chapter we are going to learn about the MySQL functions provided by the Ring programming language.

- MySQL_Info()
- MySQL_Init()
- MySQL_Error()
- MySQL_Connect()
- MySQL_Close()
- MySQL_Query()
- MySQL_Insert_ID()
- MySQL_Result()
- MySQL_Next_Result()
- MySQL_Columns()
- MySQL_Result2()
- MySQL_Escape_String()
- MySQL_AutoCommit()
- MySQL_Commit()
- MySQL_Rollback()

Before using the next function load the mysql.lib.ring library

```
load "mysql.lib.ring"
# Use MySQL functions
```

27.1 MySQL_Info() Function

We can get the MySQL Client version using the MySQL_Info() function.

Syntax:

```
MySQL_Info() ---> string contains the MySQL Client version
```

Example:

```
see "MySQL Client Version : " + mysql_info()
```

Output:

```
MySQL Client Version : 6.1.5
```

27.2 MySQL_Init() Function

We can start using MySQL Client through the MySQL_Init() function.

Syntax:

```
MySQL_Init() ---> MySQL Handle
```

27.3 MySQL_Error() Function

We can get the error message from the MySQL Client using the MySQL_Error() function.

Syntax:

```
MySQL_Error(MySQL Handle) ---> Error message as string
```

27.4 MySQL_Connect() Function

We can connect to the MySQL database server using the MySQL_Connect() function.

Syntax:

```
MySQL_Connect (MySQL Handle, cServer, cUserName, cPassword) ---> lStatus
```

27.5 MySQL_Close() Function

We can close the connection to the MySQL database using the MySQL_Close() function

Syntax:

```
MySQL_Close (MySQL Handle)
```

27.6 MySQL_Query() Function

We can execute SQL queries using the MySQL_Query() function

Syntax:

```
MySQL_Query (MySQL Handle, cSQLQuery)
```

27.7 Create Database

The next example connect to MySQL Server then create new database.

```
See "MySQL Test - Create Database" + nl
con = mysql_init()

See "Connect" + nl
if mysql_connect(con, "localhost", "root", "root") = 0
    see "Can't connect" + nl
    see "Error : " + mysql_error(con) + nl
    mysql_close(con)
    bye
ok

See "Create Database..." + nl
mysql_query(con, "CREATE DATABASE mahdb")

See "Close Connection" + nl
mysql_close(con)
```

Output:

```
MySQL Test - Create Database
Connect
Create Database...
Close Connection
```

27.8 Create Table and Insert Data

The next example create new table and insert records

```
func main
    see "Create Table and Insert Records" + nl
    con = mysql_init()

    see "Connect" + nl
    if mysql_connect(con, "localhost", "root", "root", "mahdb") = 0
        system_error(con)
    ok

    see "Drop table" + nl
    if mysql_query(con, "DROP TABLE IF EXISTS Employee") system_error(con) ok
```

(continues on next page)

(continued from previous page)

```

see "Create table" + nl
if mysql_query(con, "CREATE TABLE Employee(Id INT, Name TEXT, Salary INT)")
    system_error(con) ok

see "Insert data" + nl
if mysql_query(con, "INSERT INTO Employee VALUES(1,'Mahmoud',15000)")
    system_error(con) ok

if mysql_query(con, "INSERT INTO Employee VALUES(2,'Samir',16000)")
    system_error(con) ok

if mysql_query(con, "INSERT INTO Employee VALUES(3,'Fayed',17000)")
    system_error(con) ok

see "Close connection" + nl
mysql_close(con)

func system_error con
    see mysql_error(con)  mysql_close(con)  bye

```

Output:

```

Create Table and Insert Records
Connect
Drop table
Create table
Insert data
Close connection

```

27.9 MySQL_Insert_ID() Function

We can get the inserted row id using the MySQL_Insert_ID() function

Syntax:

```
MySQL_Insert_ID() ---> Inserted row id as number
```

Example:

```

con = mysql_init()
see "connect to database" + nl
mysql_connect(con,"localhost","root","root","mahdb")
see "drop table" + nl
mysql_query(con, "DROP TABLE IF EXISTS Customers")
see "create table" + nl
mysql_query(con, "CREATE TABLE Customers(Id INT PRIMARY KEY AUTO_INCREMENT, Name TEXT"
    ↵")
see "insert record" + nl
mysql_query(con, "INSERT INTO Customers(Name) VALUES('Mahmoud')")
see "insert record" + nl
mysql_query(con, "INSERT INTO Customers(Name) VALUES('Samir')")
see "insert record" + nl
mysql_query(con, "INSERT INTO Customers(Name) VALUES('Fayed')")
see "insert record" + nl

```

(continues on next page)

(continued from previous page)

```
mysql_query(con, "INSERT INTO Customers(Name) VALUES('Test 2015')")

see "inserted row id : " + mysql_insert_id(con) + nl
see "close database" + nl
mysql_close(con)
```

Output:

```
connect to database
drop table
create table
insert record
insert record
insert record
insert record
insert record
inserted row id : 4
close database
```

27.10 MySQL_Result() Function

We can get the query result (data without column names) using the MySQL_Result() function.

Syntax:

```
MySQL_Result(MySQL Handle) ---> List contains the query result
```

27.11 MySQL_Next_Result() Function

We can move to the next query result using the MySQL_Next_Result() function. We use this function when we have multiple SQL statements in the same query.

Syntax:

```
MySQL_Next_Result(MySQL Handle)
```

27.12 Print Query Result

The next example execute a query on the database then print the result.

```
con = mysql_init()
see "Connect to database" + nl
mysql_connect(con, "localhost", "root", "root", "mahdb")
see "Execute Query" + nl
mysql_query(con, "SELECT Name FROM Employee WHERE Id=1;" +
            "SELECT Name FROM Employee WHERE Id=3")
see "Print Result" + nl
see mysql_result(con)
mysql_next_result(con)
see mysql_result(con)
```

(continues on next page)

(continued from previous page)

```
see "close database" + nl
mysql_close(con)
```

Output:

```
Connect to database
Execute Query
Print Result
Mahmoud
Fayed
close database
```

27.13 MySQL_Columns() Function

We can get a list of columns names using the MySQL_Columns() function.

Syntax:

```
MySQL_Columns (MySQL Handle) ---> List contains columns information
```

Example:

```
con = mysql_init()
see "Connect to database" + nl
mysql_connect(con, "localhost", "root", "root", "mahdb")
see "Execute Query" + nl
mysql_query(con, "SELECT * FROM Employee")
see "Result" + nl
see mysql_columns(con)
see "Close database" + nl
mysql_close(con)
```

Output:

```
Connect to database
Execute Query
Result
Id
11
3
32768
Name
65535
252
16
Salary
11
3
32768
Close database
```

27.14 MySQL_Result2() Function

Instead of using MySQL_Result() to get the result data without columns names, we can use the MySQL_Result2() to get all of the column names then the query result in one list.

Syntax:

```
MySQL_Result2(MySQL Handle) ---> List (query result starts with columns names)
```

Example:

```
con = mysql_init()
see "Connect to database" + nl
mysql_connect(con, "localhost", "root", "root", "mahdb")
see "Execute Query" + nl
mysql_query(con, "SELECT * FROM Employee")
see "Print Result" + nl
see mysql_result2(con)
see "Close database" + nl
mysql_close(con)
```

Output:

```
Connect to database
Execute Query
Print Result
Id
Name
Salary
1
Mahmoud
15000
2
Samir
16000
3
Fayed
17000
Close database
```

27.15 MySQL_Escape_String() Function

We can store binary data and special characters in the database after processing using MySQL_Escape_String() function

Syntax:

```
MySQL_Escape_String(MySQL Handle, cString) ---> String after processing
```

27.16 Save Image inside the database

Example:

```
See "Read file" + nl
cFile = read("tests\mahmoud.jpg")
con = mysql_init()
See "Connect to database..." + nl
mysql_connect(con, "localhost", "root", "root", "mahdb")
See "Escape string..." + nl
cFile = mysql_escape_string(con, cFile)
stmt = "INSERT INTO photo(id, data) VALUES(1, '" + cFile + "')"
See "Insert data..." + nl
mysql_query(con, stmt)
See "Close database..." + nl
mysql_close(con)
```

Output:

```
Read file
Connect to database...
Escape string...
Insert data...
Close database...
```

27.17 Restore Image From The Database

Example:

```
con = mysql_init()
See "Connect to database..." + nl
mysql_connect(con, "localhost", "root", "root", "mahdb")
See "Read data from database..." + nl
mysql_query(con, "SELECT data FROM photo WHERE id=1")
See "Write new file" + nl
result = mysql_result(con)
write("tests\mahmoud2.jpg", result[1][1])
See "Close database..." + nl
mysql_close(con)
```

Output:

```
Connect to database...
Read data from database...
Write new file
Close database...
```

27.18 MySQL_AutoCommit() Function

We can enable or disable the auto commit feature using the MySQL_AutoCommit() function.

Syntax:

```
MySQL_AutoCommit(MySQL Handle, lStatus) # lstatus can be True/False
```

27.19 MySQL_Commit() Function

We can commit updates to the database using the MySQL_Commit() function.

Syntax:

```
MySQL_Commit(MySQL Handle)
```

27.20 MySQL_Rollback() Function

We can rollback updates to the database using the MySQL_Rollback() function.

Syntax:

```
MySQL_Rollback(MySQL Handle)
```

27.21 Transaction Example

The next example presents the usage of MySQL_Autocommit(), MySQL_Commit() & MySQL_RollBack() functions.

Example:

```
func main

    con = mysql_init()

    see "Connect" + nl
    if mysql_connect(con, "localhost", "root", "root", "mahdb") = 0
        system_error(con) ok

    see "Drop table" + nl
    if mysql_query(con, "DROP TABLE IF EXISTS Employee2")
        system_error(con) ok

    see "Create table" + nl
    if mysql_query(con, "CREATE TABLE Employee2(Id INT, Name TEXT, Salary INT)")
        system_error(con) ok

    see "Insert data" + nl
    if mysql_query(con, "INSERT INTO Employee2 VALUES(1, 'Mahmoud', 15000)")
        system_error(con) ok

    if mysql_query(con, "INSERT INTO Employee2 VALUES(2, 'Samir', 16000)")
```

(continues on next page)

(continued from previous page)

```

system_error(con) ok

if mysql_query(con, "INSERT INTO Employee2 VALUES(3,'Fayed',17000)")
    system_error(con) ok

mysql_autocommit(con,False)
mysql_query(con, "INSERT INTO Employee2 VALUES(4,'Ahmed',5000)")
mysql_query(con, "INSERT INTO Employee2 VALUES(5,'Ibrahim',50000)")
mysql_query(con, "INSERT INTO Employee2 VALUES(6,'Mohammed',50000)")
See "Save transaction (y/n)" give nChoice
if upper(nChoice) = "Y"
    mysql_commit(con)
else
    mysql_rollback(con)
ok

see "Close connection" + nl
mysql_close(con)

func system_error con

    see mysql_error(con)
    mysql_close(con)
    bye

```

Output:

```

Connect
Drop table
Create table
Insert data
Save transaction (y/n) y
Close connection

```

CHAPTER
TWENTYEIGHT

SQLITE FUNCTIONS

In this chapter we will learn about using the SQLite database in the Ring programming language.

Before using the next function load the `sqlitelib.ring` library

```
load "sqlitelib.ring"
# Use SQLite functions
```

28.1 `sqlite_init()` function

Syntax:

```
sqlite_init() ---> SQLite Object
```

28.2 `sqlite_open()` function

Syntax:

```
sqlite_open(SQLite Object, cFileName)
```

28.3 `sqlite_execute()` function

Syntax:

```
sqlite_execute(SQLite Object, cSQLStatement)
```

28.4 `sqlite_close()` function

Syntax:

```
sqlite_close(SQLite Object)
```

28.5 Example

The next code create a SQLite database, add new records then display the data.

```
load "sqlitelib.ring"

oSQLite = sqlite_init()

sqlite_open(oSQLite, "mytest.db")

sql = "
    CREATE TABLE COMPANY (
        ID INT PRIMARY KEY      NOT NULL,
        NAME          TEXT      NOT NULL,
        AGE           INT       NOT NULL,
        ADDRESS       CHAR(50),
        SALARY        REAL );
"
sqlite_execute(oSQLite, sql)

sql = "
    INSERT INTO COMPANY (ID,NAME,AGE,ADDRESS,SALARY)
    VALUES  (1, 'Mahmoud' , 29, 'Jeddah' , 20000.00 ),
            (2, 'Ahmed'   , 27, 'Jeddah' , 15000.00 ),
            (3, 'Mohammed' , 31, 'Egypt'  , 20000.00 ),
            (4, 'Ibrahim' , 24, 'Egypt'  , 65000.00 );
"
sqlite_execute(oSQLite, sql)

aResult = sqlite_execute(oSQLite, "select * from COMPANY")
for x in aResult
    for t in x
        ? t[2] + nl
    next
next
? copy("*,50)
for x in aResult
    ? x[:name]
next
sqlite_close(oSQLite)
```

Output:

```
1
Mahmoud
29
Jeddah
20000.0
2
Ahmed
27
Jeddah
15000.0
3
Mohammed
31
```

(continues on next page)

(continued from previous page)

```
Egypt
20000.0
4
Ibrahim
24
Egypt
65000.0
*****
Mahmoud
Ahmed
Mohammed
Ibrahim
```

POSTGRESQL FUNCTIONS

In this chapter we will learn about using the PostgreSQL database in the Ring programming language.

29.1 Loading the library

Before using the next function load the postgresql.lib.ring library

```
load "postgresql.lib"
# Use PostgreSQL functions
```

29.2 Examples

Example (1):

```
load "postgresql.lib"

conninfo = "user=postgres password=sa dbname = postgres"

exit_nicely = func conn {
    PQfinish(conn)
    shutdown(1)
}

conn = PQconnectdb(conninfo)

if (PQstatus(conn) != CONNECTION_OK)
    fputs(stderr, "Connection to database failed: "+PQerrorMessage(conn))
    call exit_nicely(conn)
ok

res = PQexec(conn, "select * from pg_database")
if PQresultStatus(res) != PGRES_TUPLES_OK
    fputs(stderr, "Select failed: " + PQerrorMessage(conn))
    PQclear(res)
    exit_nicely(conn)
ok

nFields = PQnfields(res)
for i = 1 to nFields
    ? PQfname(res, i-1)
```

(continues on next page)

(continued from previous page)

```

next

? copy("*", 60)

for i = 1 to PQntuples(res)
    for j=1 to nFields
        see PQgetvalue(res, i-1, j-1) + " "
    next
    see nl
next

PQclear(res)

PQfinish(conn)

```

Output:

```

datname
datdba
encoding
datcollate
datctype
datistemplate
dataallowconn
datconnlimit
datlastsysoid
datfrozenxid
datminmxid
dattablespace
datacl
*****
postgres 10 6 English_United States.1252
    English_United States.1252 f t -1 12937 549 1 1663
template1 10 6 English_United States.1252 English_United States.1252
    t t -1 12937 549 1 1663 {=c/postgres,postgres=CTc/postgres}
template0 10 6 English_United States.1252 English_United States.1252
    t f -1 12937 549 1 1663 {=c/postgres,postgres=CTc/postgres}
mahdb 10 6 English_United States.1252 English_United States.1252
    f t -1 12937 549 1 1663

```

Example(2):

```

load "postgresqlib.ring"

conninfo = "user=postgres password=sa dbname = mahdb"

exit_nicely = func conn {
    PQfinish(conn)
    shutdown(1)
}

conn = PQconnectdb(conninfo)

if (PQstatus(conn) != CONNECTION_OK)
    fputs(stderr, "Connection to database failed: "+PQerrorMessage(conn))
        call exit_nicely(conn)
ok

```

(continues on next page)

(continued from previous page)

```

res = PQexec(conn, "
    DROP DATABASE mahdb;
")
if PQresultStatus(res) != PGRES_TUPLES_OK
    fputs(stderr, "Remove failed: " + PQerrorMessage(conn))
    PQclear(res)
ok
PQclear(res)

res = PQexec(conn, "CREATE DATABASE mahdb;")
if PQresultStatus(res) != PGRES_TUPLES_OK
    fputs(stderr, "Create database failed: " + PQerrorMessage(conn))
    PQclear(res)
ok

res = PQexec(conn, "
CREATE TABLE COMPANY (
    ID INT PRIMARY KEY      NOT NULL,
    NAME      TEXT      NOT NULL,
    AGE       INT      NOT NULL,
    ADDRESS   CHAR(50),
    SALARY    REAL );
")
if PQresultStatus(res) != PGRES_TUPLES_OK
    fputs(stderr, "Create Table failed: " + PQerrorMessage(conn))
    PQclear(res)
ok
PQclear(res)

res = PQexec(conn, "
    INSERT INTO COMPANY (ID,NAME,AGE,ADDRESS,SALARY)
        VALUES  (1, 'Mahmoud' , 31, 'Jeddah', 10.00 ),
                (2, 'Ahmed'    , 27, 'Jeddah', 20.00 ),
                (3, 'Mohammed' , 33, 'Egypt'  , 30.00 ),
                (4, 'Ibrahim'  , 24, 'Egypt'  , 40.00 );
")
if PQresultStatus(res) != PGRES_TUPLES_OK
    fputs(stderr, "Insert Table failed: " + PQerrorMessage(conn))
    PQclear(res)
ok
PQclear(res)

res = PQexec(conn, "
    select * from COMPANY
")
if PQresultStatus(res) != PGRES_TUPLES_OK
    fputs(stderr, "Select failed: " + PQerrorMessage(conn))
    PQclear(res)
    call exit_nicely(conn)
ok

nFields = PQnfields(res)
for i = 1 to nFields

```

(continues on next page)

(continued from previous page)

```

        ? PQfname(res, i-1)
next

? copy("*", 60)

for i = 1 to PQntuples(res)
    for j=1 to nFields
        see PQgetvalue(res, i-1, j-1) + " "
    next
    see nl
next

PQclear(res)

PQfinish(conn)

```

Output:

```

id
name
age
address
salary
*****
1 Mahmoud 31 Jeddah 10
2 Ahmed 27 Jeddah 20
3 Mohammed 31 Egypt 30
4 Ibrahim 24 Egypt 40

```

29.3 RingPostgreSQL Constants

The next constants are define by the RingPostgreSQL Library

```

CONNECTION_STARTED
CONNECTION_MADE
CONNECTION_AWAITING_RESPONSE
CONNECTION_AUTH_OK
CONNECTION_SSL_STARTUP
CONNECTION_SETEENV
CONNECTION_OK

PQPING_OK
PQPING_REJECT
PQPING_NO_RESPONSE
PQPING_NO_ATTEMPT

PGRES_EMPTY_QUERY
PGRES_COMMAND_OK
PGRES_TUPLES_OK
PGRES_COPY_OUT
PGRES_COPY_IN
PGRES_BAD_RESPONSE
PGRES_NONFATAL_ERROR
PGRES_FATAL_ERROR

```

(continues on next page)

(continued from previous page)

```

PGRES_COPY_BOTH
PGRES_SINGLE_TUPLE

PG_DIAG_SEVERITY
PG_DIAG_SQLSTATE
PG_DIAG_MESSAGE_PRIMARY
PG_DIAG_MESSAGE_DETAIL
PG_DIAG_MESSAGE_HINT
PG_DIAG_STATEMENT_POSITION
PG_DIAG_INTERNAL_POSITION
PG_DIAG_INTERNAL_QUERY
PG_DIAG_CONTEXT
PG_DIAG_SCHEMA_NAME
PG_DIAG_TABLE_NAME
PG_DIAG_COLUMN_NAME
PG_DIAG_DATATYPE_NAME
PG_DIAG_CONSTRAINT_NAME
PG_DIAG_SOURCE_FILE
PG_DIAG_SOURCE_LINE
PG_DIAG_SOURCE_FUNCTION

```

29.4 RingPostgreSQL Functions

The next functions are define by the RingPostgreSQL Library

Reference : <https://www.postgresql.org/docs/9.1/static/libpq.html>

```

PGconn *PQconnectdbParams(const char **keywords,
                           const char **values, int expand_dbname);
PGconn *PQconnectdb(const char *conninfo)
PGconn *PQsetdbLogin(const char *ghost, const char *port,
                     const char *options, const char *pgtty,
                     const char *dbName, const char *login, const char *pwd)
PGconn *PQsetdb(char *ghost, char *port, char *options,
                char *pgtty, char *dbName)
PGconn *PQconnectStartParams(const char **keywords,
                             const char **values, int expand_dbname)
PGconn *PQconnectStart(const char *conninfo)
PostgresPollingStatusType PQconnectPoll(PGconn *conn)
PQconninfoOption *PQconndefaults(void)
PQconninfoOption *PQconninfo(PGconn *conn)
PQconninfoOption *PQconninfoParse(const char *conninfo, char **errmsg)
void PQfinish(PGconn *conn)
void PQreset(PGconn *conn)
int PQresetStart(PGconn *conn)
PostgresPollingStatusType PQresetPoll(PGconn *conn)
PGPing PQpingParams(const char **keywords, const char **values,
                     int expand_dbname)
PGPing PQping(const char *conninfo)
char *PQdb(const PGconn *conn)
char *PQuser(const PGconn *conn)
char *PQpass(const PGconn *conn)
char *PQhost(const PGconn *conn)
char *PQport(const PGconn *conn)

```

(continues on next page)

(continued from previous page)

```

char *PQtty(const PGconn *conn)
char *PQoptions(const PGconn *conn)
ConnStatusType PQstatus(const PGconn *conn)
PGTransactionStatusType PQtransactionStatus(const PGconn *conn)
const char *PQparameterStatus(const PGconn *conn, const char *paramName)
int PQprotocolVersion(const PGconn *conn)
int PQserverVersion(const PGconn *conn)
char *PQerrorMessage(const PGconn *conn)
int PQsocket(const PGconn *conn)
int PQbackendPID(const PGconn *conn)
int PQconnectionNeedsPassword(const PGconn *conn)
int PQconnectionUsedPassword(const PGconn *conn)
int PQsslInUse(const PGconn *conn)
const char *PQsslAttribute(const PGconn *conn, const char *attribute_name)
const char **PQsslAttributeNames(const PGconn *conn)
void *PQsslStruct(const PGconn *conn, const char *struct_name)
void *PQgetssl(const PGconn *conn)
PGresult *PQexec(PGconn *conn, const char *command);
PGresult *PQexecParams(PGconn *conn, const char *command, int nParams,
    const Oid *paramTypes, const char **paramValues,
    const int *paramLengths, const int *paramFormats, int resultFormat)
PGresult *PQprepare(PGconn *conn, const char *stmtName,
    const char *query, int nParams, const Oid *paramTypes)
PGresult *PQexecPrepared(PGconn *conn, const char *stmtName,
    int nParams, const char **paramValues,
    const int *paramLengths, const int *paramFormats, int resultFormat)
PGresult *PQdescribePrepared(PGconn *conn, const char *stmtName)
PGresult *PQdescribePortal(PGconn *conn, const char *portalName)
ExecStatusType PQresultStatus(const PGresult *res)
char *PQresStatus(ExecStatusType status)
char *PQresultErrorMessage(const PGresult *res)
char *PQresultErrorField(const PGresult *res, int fieldcode)
void PQclear(PGresult *res)
int PQntuples(const PGresult *res)
int PQnfields(const PGresult *res)
char *PQfname(const PGresult *res, int column_number)
int PQfnumber(const PGresult *res, const char *column_name)
Oid PQftable(const PGresult *res, int column_number)
int PQftablecol(const PGresult *res, int column_number)
int PQfformat(const PGresult *res, int column_number)
Oid PQftype(const PGresult *res, int column_number)
int PQfmod(const PGresult *res, int column_number)
int PQfsize(const PGresult *res, int column_number)
int PQbinaryTuples(const PGresult *res)
char *PQgetvalue(const PGresult *res, int row_number, int column_number)
int PQgetisnull(const PGresult *res, int row_number, int column_number)
int PQgetlength(const PGresult *res, int row_number, int column_number)
int PQnparams(const PGresult *res)
Oid PQparamtype(const PGresult *res, int param_number)
void PQprint(FILE *fout, const PGresult *res, const PQprintOpt *po)
char *PQcmdStatus(PGresult *res)
char *PQcmdTuples(PGresult *res)
Oid PQoidValue(const PGresult *res)
char *PQoidStatus(const PGresult *res)
char *PQescapeLiteral(PGconn *conn, const char *str, size_t length)
char *PQescapeIdentifier(PGconn *conn, const char *str, size_t length)
size_t PQescapeStringConn(PGconn *conn, char *to,

```

(continues on next page)

(continued from previous page)

```

    const char *from, size_t length,int *error)
size_t PQescapeString(char *to, const char *from, size_t length)
unsigned char *PQescapeByteaConn(PGconn *conn,
    const unsigned char *from,size_t from_length,size_t *to_length)
unsigned char *PQescapeBytea(const unsigned char *from,
    size_t from_length,size_t *to_length)
unsigned char *PQunescapeBytea(const unsigned char *from, size_t *to_length)
int PQsendQuery(PGconn *conn, const char *command)
int PQsendQueryParams(PGconn *conn,const char *command,
    int nParams,const Oid *paramTypes,const char **paramValues,
    const int *paramLengths,const int *paramFormats,int resultFormat)
int PQsendPrepare(PGconn *conn,const char *stmtName,
    const char *query,int nParams,const Oid *paramTypes)
int PQsendQueryPrepared(PGconn *conn,const char *stmtName,
    int nParams,const char **paramValues,
    const int *paramLengths,const int *paramFormats,int resultFormat)
int PQsendDescribePrepared(PGconn *conn, const char *stmtName)
int PQsendDescribePortal(PGconn *conn, const char *portalName)
PGresult *PQgetResult(PGconn *conn)
int PQconsumeInput(PGconn *conn)
int PQisBusy(PGconn *conn)
int PQsetnonblocking(PGconn *conn, int arg)
int PQisnonblocking(const PGconn *conn)
int PQflush(PGconn *conn)
int PQsetSingleRowMode(PGconn *conn)
PGcancel *PQgetCancel(PGconn *conn)
void PQfreeCancel(PGcancel *cancel)
int PQcancel(PGcancel *cancel, char *errbuf, int errbufsize)
int PQrequestCancel(PGconn *conn)
PGresult *PQfn(PGconn *conn,int fnid,int *result_buf,
    int *result_len,int result_is_int,const PQArgBlock *args,int nargs)
PGnotify *PQnotifies(PGconn *conn)
int PQputCopyData(PGconn *conn,const char *buffer,int nbytes)
int PQputCopyEnd(PGconn *conn,const char *errormsg)
int PQgetCopyData(PGconn *conn,char **buffer,int async)
int PQgetline(PGconn *conn,char *buffer,int length)
int PQgetlineAsync(PGconn *conn,char *buffer,int bufsize)
int PQputline(PGconn *conn,const char *string)
int PQputnbytes(PGconn *conn,const char *buffer,int nbytes)
int PQendcopy(PGconn *conn)
int PQclientEncoding(const PGconn *conn)
char *pg_encoding_to_char(int encoding_id)
int PQsetClientEncoding(PGconn *conn, const char *encoding)
void PQtrace(PGconn *conn, FILE *stream)
void PQuntrace(PGconn *conn)
void PQfreemem(void *ptr)
void PQconninfoFree(PQconninfoOption *connOptions)
char *PQencryptPasswordConn(PGconn *conn, const char *passwd,
    const char *user, const char *algorithm)
char *PQencryptPassword(const char *passwd, const char *user)
PGresult *PQmakeEmptyPGresult(PGconn *conn, ExecStatusType status)
int PQfireResultCreateEvents(PGconn *conn, PGresult *res)
PGresult *PQcopyResult(const PGresult *src, int flags)
int PQ setResultAttrs(PGresult *res, int numAttributes, PGresAttDesc *attDescs)
int PQsetvalue(PGresult *res, int tup_num, int field_num,
    char *value, int len)
void *PQresultAlloc(PGresult *res, size_t nBytes)

```

(continues on next page)

(continued from previous page)

```
int PQlibVersion(void)
PQnoticeReceiver PQsetNoticeReceiver(PGconn *conn,
                                     PQnoticeReceiver proc,void *arg)
PQnoticeProcessor PQsetNoticeProcessor(PGconn *conn,
                                       PQnoticeProcessor proc,void *arg)
void PQinitOpenSSL(int do_ssl, int do_crypto)
void PQinitSSL(int do_ssl)
int PQisthreadsafe(void)
```

SECURITY AND INTERNET FUNCTIONS

This chapter contains the security and internet functions provided by the Ring programming language for Hashing, Encryption & Decryption.

Before using the next function load the openssllib.ring library

```
load "openssllib.ring"
# Use OpenSSL functions
```

- MD5()
- SHA1()
- SHA256()
- SHA512()
- SHA384()
- SHA224()
- Encrypt()
- Decrypt()
- Randbytes()

Before using the next function load the internetlib.ring library

```
load "internetlib.ring"
# Use the Internet functions
```

- Download()
- SendEmail()

30.1 MD5() Function

We can calculate the MD5 hash using the MD5() Function

Syntax:

```
MD5(cString) ---> String contains the MD5 hash of the string cString
```

Example:

```
see "md5('happy') = " + md5("happy") + nl +
      "md5('Hello') = " + md5("Hello") + nl
```

Output:

```
md5('happy') = 56ab24c15b72a457069c5ea42fcfc640
md5('Hello') = 8b1a9953c4611296a827abf8c47804d7
```

30.2 SHA1() Function

We can calculate the SHA1 hash using the SHA1() Function

Syntax:

```
SHA1(cString) ---> String contains the SHA1 hash of the string cString
```

Example:

```
see "sha1('hello') : " + sha1("hello") + nl +
      "sha1('apple') : " + sha1("apple") + nl
```

Output:

```
sha1('hello') : aaf4c61ddcc5e8a2dabede0f3b482cd9aea9434d
sha1('apple') : d0be2dc421be4fc0172e5afceea3970e2f3d940
```

30.3 SHA256() Function

We can calculate the SHA256 hash using the SHA256() Function

Syntax:

```
SHA256(cString) ---> String contains the SHA256 hash of the string cString
```

Example:

```
see "sha256('hello') : " + sha256("hello") + nl +
      "sha256('apple') : " + sha256("apple") + nl
```

Output:

```
sha256('hello') : 2cf24dba5fb0a30e26e83b2ac5b9e29e1b161e5c1fa7425e73043362938b9824
sha256('apple') : 3a7bd3e2360a3d29eea436fcfb7e44c735d117c42d1c1835420b6b9942dd4f1b
```

30.4 SHA512() Function

We can calculate the SHA512 hash using the SHA512() Function

Syntax:

```
SHA512(cString) ---> String contains the SHA512 hash of the string cString
```

Example:

```
see "sha512('hello') : " + sha512("hello") + nl +
      "sha512('apple') : " + sha512("apple") + nl +
      "sha512('hello world') : " + sha512("hello world") + nl
```

Output:

```
sha512('hello') : 9b71d224bd62f3785d96d46ad3ea3d73319bfbc2890caadae2dff72519673c
a72323c3d99ba5c11d7c7acc6e14b8c5da0c4663475c2e5c3adef46f73bcd043
sha512('apple') : 844d8779103b94c18f4aa4cc0c3b4474058580a991fba85d3ca698a0bc9e52
c5940feb7a65a3a290e17e6b23ee943ecc4f73e7490327245b4fe5d5efb590feb2
sha512('hello world') : 309ecc489c12d6eb4cc40f50c902f2b4d0ed77ee511a7c7a9bcd3ca8
6d4cd86f989dd35bc5ff499670da34255b45b0cf830e81f605dcf7dc5542e93ae9cd76f
```

30.5 SHA384() Function

We can calculate the SHA384 hash using the SHA384() Function

Syntax:

```
SHA384(cString) ---> String contains the SHA384 hash of the string cString
```

Example:

```
see "sha384('hello') : " + sha384("hello") + nl +
      "sha384('apple') : " + sha384("apple") + nl +
      "sha384('hello world') : " + sha384("hello world") + nl
```

Output:

```
sha384('hello') : 59e1748777448c69de6b800d7a33bbfb9ff1b463e44354c3553bcd9c666fa
90125a3c79f90397bd5f6a13de828684f
sha384('apple') : 3d8786fc588c93348756c6429717dc6c374a14f7029362281a3b21dc10250
ddf0d0578052749822eb08bc0dc1e68b0f
sha384('hello world') : fdbd8e75a67f29f701a4e040385e2e23986303ea10239211af907fc
b83578b3e417cb71ce646efd0819dd8c088de1bd
```

30.6 SHA224() Function

We can calculate the SHA224 hash using the SHA224() Function

Syntax:

```
SHA224(cString) ---> String contains the SHA224 hash of the string cString
```

Example:

```
see "sha224('hello') : " + sha224("hello") + nl +
      "sha224('apple') : " + sha224("apple") + nl +
      "sha224('hello world') : " + sha224("hello world") + nl
```

Output:

```
sha224('hello') : ea09ae9cc6768c50fce0903ed054556e5bfc8347907f12598aa24193
sha224('apple') : b7bbfdf1a1012999b3c466fdeb906a629caa5e3e022428d1eb702281
sha224('hello world') : 2f05477fc24bb4faefd86517156dafdeceec45b8ad3cf2522a563582b
```

30.7 Encrypt() Function

We can use the Encrypt() function to encrypts the data using the Blowfish algorithm.

Syntax:

```
Encrypt(cString, cKey, cIV) ---> Encrypted string
```

30.8 Decrypt() Function

We can use the Decrypt() function to decrypt the data encrypted using the Encrypt() function.

Syntax:

```
Decrypt(cCipher, cKey, cIV) ---> Decrypted string
```

30.9 Encryption and Decryption Example

The next example demonstrates how to use the Encrypt() and Decrypt() functions.

These functions use the Blowfish algorithm.

```
See "Enter a string : " give cStr
list = 0:15 cKey="" for x in list cKey += char(x) next
list = 1:8 cIV = "" for x in list cIV += char(x) next
cStr = Encrypt(cStr,cKey,cIV)
See "Cipher Text : " + cStr + nl +
      "Plain Text : " + Decrypt(cStr,cKey,cIV) + nl
```

We can write the same example using normal for loop

```

See "Enter a string : " give cStr

cKey=""                                # 16 bytes
for x = 0 to 15
    cKey += char(x)
next

cIV = ""
for x = 1 to 8
    cIV += char(x)
next

cStr = Encrypt(cStr,cKey,cIV)
See "Cipher Text      : " + cStr + nl +
      "Plain Text       : " + Decrypt(cStr,cKey,cIV) + nl

```

Also we can write the password and the IV directly using strings

```

See "Enter a string : " give cStr

# Note: Don't use simple password in real applications!
cKey = "1234567890@#$%^&"
cIV = "87654321"

cStr = Encrypt(cStr,cKey,cIV)
See "Cipher Text      : " + cStr + nl +
      "Plain Text       : " + Decrypt(cStr,cKey,cIV) + nl

```

30.10 File Hash

The next example demonstrates how to calculate the hash functions for files

```

cStr = read("myapp.exe")
see "Size : " + len(cStr) + nl +
      "md5 : " + md5(cStr) + nl +
      "sha1 : " + sha1(cStr) + nl +
      "sha256 : " + sha256(cStr) + nl +
      "sha224 : " + sha224(cStr) + nl +
      "sha384 : " + sha384(cStr) + nl +
      "sha512 : " + sha512(cStr) + nl

```

Output:

```

Size : 58079876
md5 : 762eee15d8d2fd73b71ea52538b28667
sha1 : 9212c0c7258bad89a62bd239e1358a9276a9d070
sha256 : 7d6724e69b6c553da749ba31b6185dddc965129b64d9e9bf3de88f67df3b1cdc
sha224 : 5a9c8a7d662bce4f880ba94f90a79362b672528b9efd5abc718c7a3d
sha384 : 18e23f973abedbeb3981c423f12aeadecf96f9c6fb28aeabe3be4c484f8540afcc3861b
b370ce2b59cf3c99c130b856b
sha512 : da3d5e997d06f8b2a7a9964b77f7d82eedb76b245c611082c1639f83f51d83880bcd08f
cd53dcab1167bdca0b82fec5071971ac17c76479d76985ced4ab0d18e

```

30.11 Randbytes() Function

We can generate a string of pseudo-random bytes using the Randbytes() function.

Syntax:

```
Randbytes(nSize) ---> String contains random bytes (bytes count = nSize)
```

Example:

```
salt = randbytes(32)
password = "SecretPassWord@%123"
see salt + nl
see sha256("test" + salt) + nl
```

30.12 Download() Function

Syntax:

```
Download(cURL) ---> String contains the server response
```

Example:

```
cStr= download("http://doublesvsoop.sourceforge.net/")
see cStr
write("download.txt",cStr)
```

30.13 SendEmail() Function

Syntax:

```
SendEmail(cSMTPServer,cEmail,cPassword,cSender,cReceiver,cCC,cTitle,cContent)
```

Example:

```
See "Send email..." + nl
sendemail("smtp://smtp.gmail.com:587",
          "email@gmail.com",
          "password",
          "email@gmail.com",
          "somebody@yahoo.com",
          "somebodyelse@yahoo.com",
          "Sending email from Ring",
          "Hello
          How are you?
          Are you fine?
          Thank you!
          Greetings,
          Mahmoud")
see "Done..." + nl
```

CHAPTER
THIRTYONE

OBJECT ORIENTED PROGRAMMING (OOP)

In this chapter we are going to learn how to use the Object-Oriented programming paradigm inside the Ring programming language.

We will learn about

- Classes and Objects
- Access Objects Using Braces
- Composition
- Setter and Getter
- Private Attributes and Methods
- Operator Overloading
- Inheritance
- Dynamic Attributes
- Packages
- Printing Objects
- Find() and List of Objects
- Sort() and List of Objects
- Using Self.Attribute and Self.Method()
- Using This.Attribute and This.Method()

31.1 Classes and Objects

We can define new classes using the next syntax

Syntax:

```
Class <Class Name> [From|<| : <Parent Class Name>]
    [Attributes]
    [Methods]
    [Private
        [Attributes]
        [Methods]
    ]
```

And we can create objects using the next syntax

Syntax:

```
New <Object Name> [ (init method parameters) ] |  
[ { access object data and methods } ] ---> Object
```

Example:

```
New point { x=10 y=20 z=30 print() }  
Class Point x y z func print see x + nl + y + nl + z + nl
```

Note: We can use { } to access object data and methods.

Tip: we can declare the class attributes directly after the class name.

Output:

```
10  
20  
30
```

We can rewrite the same program in another style

```
New point # create new object using the point class  
{ # access the new object attributes and methods  
    x = 10 # set the x attribute to 10  
    y = 20 # set the y attribute to 20  
    z = 30 # set the z attribute to 30  
    print() # call the print method  
} # end of object access  
  
Class Point # define the Point class  
    x y z # the class contains three attributes x, y & z  
    func print # define the print method  
        see x + nl + # print the x attribute  
        y + nl + # print the y attribute  
        z + nl # print the z attribute
```

Also we can write the same program in another way

```
P1 = New Point  
P1.x = 10  
P1.y = 20  
P1.z = 30  
P1.Print()  
Class Point x y z func print see x + nl + y + nl + z + nl
```

Note: we can use the dot operator after the object name to access object members.

Also we can write the same program in another way

```
new point { print() }
Class Point
    x = 10  y = 20  z = 30
    func print see x + nl + y + nl + z + nl
```

Note: we can set the default values for the class attributes when we declare them.

Also we can write the same program in another way

```
new point(10,20,30)
Class Point
    x y z
    func init p1,p2,p3 x=p1 y=p2 z=p3 print()
    func print see x + nl + y + nl + z + nl
```

Note: we can call the init method directly using () when we create new objects

Also we can write the same program in another way

```
new point( [ :x = 10 , :y = 20 , :z = 30 ] )
Class Point x y z
    func init aPara x = aPara[:x] y = aPara[:y] z = aPara[:z] print()
    func print see x + nl + y + nl + z + nl
```

Tip: using Hash for passing method parameters enable us to create optional parameters and change the order of parameters when adding them to the Hash.

31.2 Access Objects Using Braces

We can access the object at any time using braces { }

Inside the braces we can use the object attributes and methods directly

This can be done when we create the object using the New keyword or at any time using the next syntax

```
ObjectName { access object data and methods }
```

Example:

```
See "Creating the Object" + nl
o1 = new Point
See "Using the Object" + nl
o1 {
    x=5
    y=15
    z=25
    print()
}
Class Point x y z func print see x + nl + y + nl + z
```

We can use braces to access objects when we call functions or methods

Example:

```
o1 = new Point
print( o1 { x=10 y=20 z=30 } )

func print object
    see object.x + nl +
        object.y + nl +
        object.z

Class Point x y z
```

We can mix between using braces and the dot operator to access the object in the same expression.

Example:

```
o1 = new Point
o1 { x=10 y=20 z=30 }.print()

Class Point x y z
    func print see x + nl + y + nl + z
```

31.3 Composition

The object may contains other objects as attributes.

Using braces to access objects can be nested.

Example:

```
R1 = New Rectangle
{
    Name = "Rectangle 1"

    P1
    {
        X = 10
        Y = 20
    }

    P2
    {
        X = 200
        Y = 300
    }

    Color = "Blue"
}

see "Name : " + R1.Name + nl +
    "Color: " + R1.Color + nl +
```

(continues on next page)

(continued from previous page)

```

"P1    : (" + R1.P1.X + "," + R1.P1.Y + ")" + nl +
"P2    : (" + R1.P2.X + "," + R1.P2.Y + ")" + nl

Class Rectangle
    name  color
    p1 = new Point
    p2 = new Point

Class Point x y

```

Output:

```

Name : Rectangle 1
Color: Blue
P1   : (10,20)
P2   : (200,300)

```

31.4 Setter and Getter

We can define methods to be used when we set and get object attributes.

Syntax:

```

Class ClassName

    AttributeName
    ...

    Func SetAttributeName
    ...

    Func GetAttributeName
    ...

```

Example:

```

o1 = new person

o1.name = "Mahmoud" see o1.name + nl

o1 { name = "Ahmed" see name }

Class Person

    name family = "Fayed"

    func setname value
        see "Message from SetName() Function!" + nl
        name = value + " " + family

    func getname
        see "Message from GetName() Function!" + nl
        return "Mr. " + name

```

Output:

```

Message from SetName() Function!
Message from GetName() Function!
Mr. Mahmoud Fayed
Message from SetName() Function!
Message from GetName() Function!
Mr. Ahmed Fayed

```

31.5 Private Attributes and Methods

We can define private attributes and methods after the keyword `private` inside the class body

Example:

```

o1 = new person {
    name = "Test"
    age = 20
    print()
    o1.printsalary()
}

try
    see o1.salary
catch
    see cCatchError + nl
done

try
    o1.increasesalary(1000)
catch
    see cCatchError + nl
done

Class Person

    name age

    func print
        see "Name : " + name + nl +
            "Age : " + age + nl

    func printsalary
        see "Salary : " + salary + nl

    private

    salary = 15000

    func increasesalary x
        salary += x

```

Output:

```

Name : Test
Age : 20
Salary : 15000

```

(continues on next page)

(continued from previous page)

```
Error (R27) : Using private attribute from outside the class : salary
Error (R26) : Calling private method from outside the class : increasesalary
```

31.6 Operator Overloading

We can add the operator method to our class to enable using operators with the class objects.

Syntax:

```
Class ClassName

    ...

    Func operator cOperator,Para

    ...
```

The function operator takes two parameters, the first represent the operator and the second represent the second parameter after the operator.

Example:

```
o1 = new point { x = 10 y = 10 print("P1      : ") }
o2 = new point { x = 20 y = 40 print("P2      : ") }

o3 = o1 + o2
o3.print("P1+P2 : ")

class point x y

    func operator cOperator,Para
        result = new point
        switch cOperator
        on "+"
            result.x = x + Para.x
            result.y = y + Para.y
        on "-"
            result.x = x - Para.x
            result.y = y - Para.y
        off
        return result

    func print cPoint
        see cPoint + "X : " + x + " Y : " + y + nl
```

Output:

```
P1      : X : 10 Y : 10
P2      : X : 20 Y : 40
P1+P2 : X : 30 Y : 50
```

The next example from the List class in the stdlib.ring

```
Func operator cOperator,Para
    result = new list
```

(continues on next page)

(continued from previous page)

```

switch cOperator
    on "+"
        if isobject(para)
            for t in Para.vValue
                vValue + t
            next
        but islist(para)
            for t in Para
                vValue + t
            next
        ok
        on "len"
            return len( vValue )
        on "[ ]"
            return &vValue[para]
    off
return result

```

The “len” operator is used with (for in) control structure.

The “[]” operator is used when we try to access the list items, In this case we use the & operator to return the item values like strings an numbers by reference, so we can update it when we access the items.

Another Example

```

func main

See "----1"+nl
    a1 = new BigNumber( "123" )
    a2 = new BigNumber( "456" )
    a3 = new BigNumber( "789" )
See nl+"----2"+nl
    a1.print()
    a2.print()
    a3.print()
See nl+"----3"+nl
    a2 = a1 + "45"
See nl+"----4"+nl
    a2.print()
See nl+"----5"+nl
    a3 = a1 + a2
See nl+"----6"+nl
    a3.print()
See nl+"----7"+nl

##=====
Func FuncAdd( num1, num2 )
    Sum = 0 + num1 + num2      ### Para.aData isNumber
    Sum = " " +Sum             ### Para.adata isString
return Sum                  ### return to Class
##=====

class BigNumber

    ### Variables
    aData = "468"

```

(continues on next page)

(continued from previous page)

```

### Functions INIT default values
func init aPara
? "INIT aPara: " ? aPara
if isString(aPara)
 aData = aPara
else
 aData = "" + aPara
ok

### Other Functions
func operator cOperator, Para
whatType = Type(Para)
? nl+"WhatType-PARA: "+ whatType ? Para
? nl+"Operator: " ? cOperator ? nl+"PARA: " ? Para ? " _____" ? nl
  if whatType = "STRING"
    dataInfo = Para
    ? "dataInfo String: " ? dataInfo
  but whatType = "NUMBER"
    datinfo = "" + Para
    ? "dataInfo Number: " ? dataInfo
  else whatType = "OBJECT"
    dataInfo = "" + para.aData
    ? "dataInfo OBJECT: " ? dataInfo
  ok
  ? "dataInfo USING: " ? dataInfo
### Para.aData does NOT exist on first pass ( Object with member)
### Result isObject when assigned "self"
result = self
switch cOperator
on "+"
  answer = FuncAdd( aData, dataInfo )
  ? nl+"AnswerString - FunAdd aData, dataInfo: " ? answer
  ### result = self, is Object, populate Object with aData member
  result.aData = answer
off
### Result = Self is Object
return result

func print
? nl+"ClassPrint aData: " ? aData

```

31.7 Inheritance

We can create class from another class in the class definition using the keyword from.

Syntax:

```
Class <Class Name> [From <Parent Class Name>]
```

We can call a method in the parent class from the child class using the super object.

Syntax:

```
func methodname
  ...
```

(continues on next page)

(continued from previous page)

```
super.methodname()
...
```

Example:

```
Func main
    e1 = new Employee {
        Name = "test"
        age = 20
        job = "programmer"
        salary = 20000000
        print()
    }

Class Human
    Name Age
    func print
        see "Name : " + name + nl + "Age : " + age + nl

Class Employee from Human
    Job Salary
    func print
        super.print()
        see "Job : " + job + nl + "Salary : " + salary + nl
```

Output:

```
Name : test
Age : 20
Job : programmer
Salary : 20000000
```

31.8 Dynamic Attributes

We can write instructions after the class name to be executed when we create new objects

Example:

```
o1 = new dynamicClass
see o1.var5 + nl      # output 5

Class DynamicClass
    for x = 1 to 10
        cStr = "var" + x + " = " + x
        eval(cStr)
    next
```

Tip: in the previous example var1, var2, ..., var10 will be defined as attributes.

Tip: The problem with the previous example is that x and cStr will be defined as attributes too!

Note: we can write class definitions inside a string then using eval() we can execute the string to define the classes

31.9 Packages

We can create a package (a group of classes under a common name) using the next syntax

```
package PackageName
    Class Class1
        ...
    Class Class2
        ...
    Class Class3
        ...
    ...
```

Example

```
o1 = new System.output.console
o1.print("Hello World")

Package System.Output
    Class Console
        Func Print cText
            see cText + nl
```

Note: we can use the dot operator as part of the package name

Instead of typing the long name PackageName.ClassName we can use the import command

When we import a package, we can use any class inside this package directly.

Example

```
import system.output
o1 = new console {
    print("Hello World")
}
Package System.Output
    Class Console
        Func Print cText
            see cText + nl
```

31.10 Printing Objects

We can print the object state (attributes and values) using the see command.

Example:

```
see new point { x=10 y=20 z=30 }
class point x y z
```

Output:

```
x: 10.000000
y: 20.000000
z: 30.000000
```

31.11 Find() and List of Objects

We can use the find() function to search inside a list of objects.

Syntax:

```
Find(List, ItemValue, nColumn, cAttribute) ---> Item Index
```

Example:

```
myList1 = [new Company {position=3 name="Mahmoud" symbol="MHD"},
           new Company {position=2 name="Bert" symbol="BRT"},
           new Company {position=1 name="Ring" symbol="RNG"}]

see find(mylist1, "Bert", 1, "name") + nl
see find(mylist1, "Ring", 1, "name") + nl
see find(mylist1, "Mahmoud", 1, "name") + nl
see find(mylist1, "RNG", 1, "symbol") + nl
see find(mylist1, "MHD", 1, "symbol") + nl
see find(mylist1, "BRT", 1, "symbol") + nl
see find(mylist1, 3, 1, "position") + nl
see find(mylist1, 1, 1, "position") + nl
see "Other" + nl
see find(mylist1, "test", 1, "name") + nl
see find(mylist1, "test", 0, "name") + nl
see find(mylist1, "test", 5, "name") + nl

class company position name symbol
```

Output:

```
2
3
1
3
1
2
1
3
```

(continues on next page)

(continued from previous page)

```
Other
0
0
0
```

31.12 Sort() and List of Objects

We can sort a list of objects based on an object attribute using the Sort() function.

Syntax:

```
Sort(List, nColumn, cAttribute) ---> Sorted List based on Object Attribute
```

Example:

```
myList1 = [
    new Company {position=3 name="Mahmoud" symbol="MHD"}, 
    new Company {position=2 name="Bert" symbol="BRT"}, 
    new Company {position=8 name="Charlie" symbol="CHR"}, 
    new Company {position=6 name="Easy" symbol="FEAS"}, 
    new Company {position=7 name="Fox" symbol="EFOX"}, 
    new Company {position=5 name="Dog" symbol="GDOG"}, 
    new Company {position=4 name="George" symbol="DGRG"}, 
    new Company {position=1 name="Ring" symbol="RNG"}]

see sort(mylist1,1,"name")
see copy("*",70) + nl
see sort(mylist1,1,"symbol")
see copy("*",70) + nl
see sort(mylist1,1,"position")

class company position name symbol
```

Output:

```
position: 2.000000
name: Bert
symbol: BRT
position: 8.000000
name: Charlie
symbol: CHR
position: 5.000000
name: Dog
symbol: GDOG
position: 6.000000
name: Easy
symbol: FEAS
position: 7.000000
name: Fox
symbol: EFOX
position: 4.000000
name: George
symbol: DGRG
```

(continues on next page)

(continued from previous page)

```
position: 3.000000
name: Mahmoud
symbol: MHD
position: 1.000000
name: Ring
symbol: RNG
*****
position: 2.000000
name: Bert
symbol: BRT
position: 8.000000
name: Charlie
symbol: CHR
position: 4.000000
name: George
symbol: DGRG
position: 7.000000
name: Fox
symbol: EFOX
position: 6.000000
name: Easy
symbol: FEAS
position: 5.000000
name: Dog
symbol: GDOG
position: 3.000000
name: Mahmoud
symbol: MHD
position: 1.000000
name: Ring
symbol: RNG
*****
position: 1.000000
name: Ring
symbol: RNG
position: 2.000000
name: Bert
symbol: BRT
position: 3.000000
name: Mahmoud
symbol: MHD
position: 4.000000
name: George
symbol: DGRG
position: 5.000000
name: Dog
symbol: GDOG
position: 6.000000
name: Easy
symbol: FEAS
position: 7.000000
name: Fox
symbol: EFOX
position: 8.000000
name: Charlie
symbol: CHR
```

31.13 Using Self.Attribute and Self.Method()

Inside the class region (After the class name and before any method) and the class methods we can use self.attribute and self.method()

```
Class Point
    self.x = 10
    self.y = 20
    self.z = 30
    func print
        see self.x + nl + self.y + nl + self.z + nl
```

Note: using self.attribute in the class region to define the class attribute protect the class attributes from conflict with global variables.

Tip: if you typed the class attributes with self.attribute and there are a global variable with the same name it will be used and the attribute will not be defined.

Check the “Scope Rules” chapter to know about the conflict between the global variable name and the attribute name
Whay this may happens?

Because

- Because in the class region we can access global variables.
- Before defining any variable, Ring try to find the variable and use it if it's found.

Note: Try to avoid the global variables, use the main function and start their names with \$

Tip: In large programs protect your classes and define their members using self.attribute

31.14 Using This.Attribute and This.Method()

Inside class methods we have access to the object scope directly. we don't need to use Self.attribute or Self.method to read/write attribute and call methods.

But we can use braces {} while we are inside methods to access another object, In this case the current object scope will be changed while we are inside the brace.

How we can get access to our class attributes and methods while we are inside braces?

This can be done using This.Attribute and This.Method()

Example:

```
new point

class point
    x=10 y=20 z=30
```

(continues on next page)

(continued from previous page)

```

print()
func print
    new UI {
        display(this.x,this.y,this.z)
    }

Class UI
    func display x,y,z
        see x + nl + y + nl + z + nl

```

31.15 Using This in the class region as Self

The class region is the region that comes after the class name and before any method.

We can use This in the class region as Self.

Example:

```

func main

    o1 = new program {
        test()
    }

    ? o1

class program

    this.name = "My Application"
    this.version = "1.0"
    ? name ? version

    func test
        ? "Name      = " + name
        ? "Version = " + version

```

Output

```

My Application
1.0
Name      = My Application
Version = 1.0
name: My Application
version: 1.0

```

Note: When we use braces to change the current active object, Using This we can still point to the class.

Tip: The difference between This and Self is that Self point to the current active object that we can change using braces.

Remember that in most cases we don't need to use This or Self in the class region

We can write

```
class program name version
```

Or

```
class program name="My Application" version="1.0"
```

Note: We use This or Self in the class region just to avoid conflict with global variables that are defined with the same name.

31.16 Default value for object attributes

The default value for object attributes is NULL

In Ring, the NULL value is just an empty string or a string that contains “NULL”

We can check for NULL values using the isNULL() function

Example:

```
oProgram = new Program
? oProgram.name
? oProgram.version
? isNULL(oProgram.name)
? isNULL(oProgram.version)
oProgram { name="My Application" version="1.0" }
? isNULL(oProgram.name)
? isNULL(oProgram.version)
? oProgram

class program
    name
    version
```

Output:

```
NULL
NULL
1
1
0
0
name: My Application
version: 1.0
```

CHAPTER
THIRTYTWO

FUNCTIONAL PROGRAMMING

In previous chapters we learned about Functions and Recursion.

In this chapter we are going to learn about more Functional Programming (FP) concepts like

- Pure Functions
- First-class functions
- Higher-order functions
- Anonymous and nested functions.
- Equality of functions

32.1 Pure Functions

We can create pure functions (functions that doesn't change the state) by the help of the assignment operator to copy variables (Lists & Objects) by value to create new variables instead of working on the original data that are passed to the function by reference.

Example:

```
Func Main
    aList = [1,2,3,4,5]
    aList2 = square(aList)
    see "aList" + nl
    see aList
    see "aList2" + nl
    see aList2

Func Square aPara
    a1 = aPara          # copy the list
    for x in a1
        x *= x
    next
    return a1           # return new list
```

Output:

```
aList
1
2
3
4
```

(continues on next page)

(continued from previous page)

```
5
aList2
1
4
9
16
25
```

32.2 First-class Functions

Functions inside the Ring programming language are first-class citizens, you can pass functions as parameters, return them as value or store them in variables.

We can pass/return the function by typing the function name as literal like “FunctionName” or :FunctionName for example.

We can pass/return functions using the variable that contains the function name.

We can call function from variables contains the function name using the Call command

Syntax:

```
Call Variable([Parameters])
```

Example:

```
Func Main
    see "before test2()" + nl
    f = Test2(:Test)
    see "after test2()" + nl
    call f()

Func Test
    see "Message from test!" + nl

Func Test2 f1
    call f1()
    See "Message from test2!" + nl
    return f1
```

Output:

```
before test2()
Message from test!
Message from test2!
after test2()
Message from test!
```

32.3 Higher-order Functions

Higher-order functions are the functions that takes other functions as parameters.

Example:

```
Func Main
    times(5,:test)

Func Test
    see "Message from the test function!" + nl

Func Times nCount,F

    for x = 1 to nCount
        Call F()
    next
```

Output:

```
Message from the test function!
```

32.4 Anonymous and Nested Functions

Anonymous Functions are functions without names that can be passed as parameters to other functions or stored in variables.

Syntax:

```
Func [Parameters] { [statements] }
```

Example:

```
test( func x,y {
            see "hello" + nl
            see "Sum : " + (x+y) + nl
        } )

new great { f1() }

times(3, func { see "hello world" + nl } )

func test x
    call x(3,3)
    see "wow!" + nl

func times n,x
    for t=1 to n
        call x()
    next
```

(continues on next page)

(continued from previous page)

```
Class great
  func f1
    f2( func { see "Message from f1" + nl } )

  func f2 x
    call x()
```

Output:

```
hello
Sum : 6
wow!
Message from f1
hello world
hello world
hello world
```

Example:

```
Func Main
  aList = [1,2,3,4]
  Map (aList , func x {
    return x*x
  ) )
  see aList
  aList = [4,9,14,25]
  Map(aList, :myfilter )
  see aList
  aList = [11,12,13,14]
  Map (aList , func x {
    if x%2=0
      return "even"
    else
      return "odd"
    ok
  ) )
  see aList

Func myfilter x
  if x = 9
    return "True"
  else
    return "False"
  ok

Func Map aList,cFunc
  for x in aList
    x = call cFunc(x)
  next
```

Output:

```
1
4
9
16
False
```

(continues on next page)

(continued from previous page)

```
True
False
False
odd
even
odd
even
```

32.5 Equality of functions

We can test if function = function or not using the '=' or '!=>' operators

Example:

```
f1 = func { see "hello" + nl }

f2 = func { see "how are you?" + nl }

f3 = f1

call f1()
call f2()
call f3()

see (f1 = f2) + nl
see (f2 = f3) + nl
see (f1 = f3) + nl
```

Output:

```
hello
how are you?
hello
0
0
1
```

CHAPTER
THIRTYTHREE

REFLECTION AND META-PROGRAMMING

Since the Ring programming language is a dynamic language, we can get answers about the program code and we can modify our code during the runtime.

In this chapter we will learn about this and the available functions to use.

- locals()
- globals()
- functions()
- cfunctions()
- islocal()
- isglobal()
- isfunction()
- iscfunction()
- packages()
- ispackage()
- classes()
- isclass()
- packageclasses()
- ispackageclass()
- classname()
- objectid()
- isobject()
- attributes()
- methods()
- isattribute()
- isprivateattribute()
- ismethod()
- isprivatemethod()
- addattribute()
- addmethod()

- getattribute()
- setattribute()
- mergemethods()
- packagename()

33.1 locals() Function

We can get a list of variables names in the current scope using the locals() function.

Syntax:

```
locals() --> a list contains the variables names in the current scope
```

Example:

```
test("hello")

func test cMsg

    see cMsg + nl

    x = 10
    y = 20
    z = 30

    see locals()
```

Output:

```
hello
cmsg
x
y
z
```

33.2 globals() Function

We can get a list of variables names in the global scope using the globals() function.

Syntax:

```
globals() --> a list contains variables names in the global scope
```

Example:

```
x=10 y=20 z=30
test()

func test
    see "message from test()" + nl +
        "Global Variables:" + nl
    see globals()
```

Output:

```
message from test()
Global Variables:
x
y
z
```

33.3 functions() Function

We can get a list of functions names written in the Ring language using the functions() function.

Syntax:

```
functions() --> a list contains functions names
```

Example:

```
see functions()

func f1
    see "f1" + nl

func f2
    see "f2" + nl

func f3
    see "f3" + nl
```

Output:

```
f1
f2
f3
```

33.4 cfunctions() Function

We can get a list of functions names written in the C language using the cfunctions() function.

Syntax:

```
cfunctions() --> a list contains functions names
```

Example:

```
aList = cfunctions()
See "Count : " + len(aList) + nl
for x in aList
    see x + "()" + nl
next
```

Output:

```
Count : 228
len()
add()
del()
get()
clock()
...
```

Note: The complete list is removed from the previous output.

33.5 islocal() Function

We can check if a variable is defined in the local scope or not using the islocal() function.

Syntax:

```
islocal(cVariableName) --> returns 1 if the variable is defined in the local scope
                                returns 0 if the variable is not defined in the local scope
```

Example:

```
test()

func test
    x=10 y=20
    see islocal("x") + nl +
        islocal("y") + nl +
        islocal("z") + nl
```

Output:

```
1
1
0
```

33.6 isglobal() Function

We can check if a variable is defined in the global scope or not using the isglobal() function.

Syntax:

```
isglobal(cVariableName) --> returns 1 if the variable is defined in the global scope
                                returns 0 if the variable is not defined in the global
                                ↵scope
```

Example:

```
x=10 y=20

test()
```

(continues on next page)

(continued from previous page)

```
func test
    see isglobal("x") + nl +
        isglobal("y") + nl +
            isglobal("z") + nl
```

Output:

```
1
1
0
```

33.7 isfunction() Function

We can check if a Ring function is defined or not using the isfunction() function.

Syntax:

```
isfunction(cFunctionName) --> returns 1 if the Ring function is defined
                                returns 0 if the Ring function is not defined
```

Example:

```
see isfunction("f1") + nl +
    isfunction("f2") + nl +
        isfunction("f3") + nl

func f1
    see "message from f1()" + nl

func f2
    see "message from f2()" + nl
```

Output:

```
1
1
0
```

33.8 iscfunction() Function

We can check if a C function is defined or not using the iscfunction() function.

Syntax:

```
iscfunction(cFunctionName) --> returns 1 if the C function is defined
                                returns 0 if the C function is not defined
```

Example:

```
see iscfunction("len") + nl +
    iscfunction("add") + nl +
        iscfunction("test") + nl
```

Output:

```
1
1
0
```

33.9 packages() Function

We can get a list of packages names using the packages() function.

Syntax:

```
packages() --> a list contains packages names
```

Example:

```
See packages()

Package Package1
    Class class1
        Func f1

Package Package2
    Class class1
        Func f1

Package Package3
    Class class1
        Func f1

Package Package4
    Class class1
        Func f1
```

Output:

```
package1
package2
package3
package4
```

33.10 ispackage() Function

We can check if a package is defined or not using the ispackage() function.

Syntax:

```
ispackage(cPackageName) --> returns 1 if the Package is defined
                                returns 0 if the Package is not defined
```

Example:

```
See ispackage("package1") + nl +
      ispackage("package4") + nl +
      ispackage("package5") + nl +
      ispackage("package3") + nl

Package Package1
  Class class1
    Func f1

Package Package2
  Class class1
    Func f1

Package Package3
  Class class1
    Func f1

Package Package4
  Class class1
    Func f1
```

Output:

```
1
1
0
1
```

33.11 classes() Function

We can get a list of classes names using the classes() function.

Syntax:

```
classes() --> a list contains classes names
```

Example:

```
See classes()

Class class1
  Func f1

Class class2
  Func f1

Class class3
  Func f1
```

Output:

```
class1
class2
class3
```

33.12 isclass() Function

We can check if a class is defined or not using the isclass() function.

Syntax:

```
isclass(cClassName) --> returns 1 if the Class is defined
                           returns 0 if the Class is not defined
```

Example:

```
see isclass("class4") + nl +
    isclass("class3") + nl +
    isclass("class2") + nl

Class class1
    func f1

class class2
    func f1

class class3
    func f1
```

Output:

```
0
1
1
```

33.13 packageclasses() Function

We can get a list of classes names inside a package using the packageclasses() function.

Syntax:

```
packageclasses(cPackageName) --> a list contains classes names inside the package
```

Example:

```
see "classes in Package1" + nl
see packageclasses("Package1")
see "classes in Package2" + nl
see packageclasses("Package2")

Package Package1
    Class class1
        Func f1

Package Package2
    Class class1
        Func f1
    Class class2
        Func f1
    Class class3
        func f1
```

Output:

```
classes in Package1
class1
classes in Package2
class1
class2
class3
```

33.14 ispackageclass() Function

We can check if a class is defined inside package or not using the ispackageclass() function.

Syntax:

```
ispackageclass(cPackageName,cClassName) --> returns 1 if the Class is defined
                                                 returns 0 if the Class is not defined
```

Example:

```
see ispackageclass("package1","class1") + nl +
      ispackageclass("package1","class2") + nl +
      ispackageclass("package2","class1") + nl +
      ispackageclass("package2","class2") + nl

Package Package1
      Class class1
            Func f1

Package Package2
      Class class1
            Func f1
      Class class2
            Func f1
      Class class3
            func f1
```

Output:

```
1
0
1
1
```

33.15 classname() Function

We can know the class name of an object using the classname() function

Syntax:

```
classname(object) --> Returns the object class name
```

Example:

```

o1 = new point
o2 = new rect

see classname(o1) + nl          # print point
see classname(o2) + nl          # print rect

class point
class rect

```

33.16 objectid() Function

We can know the object id using the objectid() function

Syntax:

```
objectid(object) --> Returns the object id
```

Example:

```

o1 = new point
see objectid(o1) + nl
test(o1)

func test v
    see objectid(v) + nl

Class point x y z

```

Output:

```
021B5808
021B5808
```

33.17 isobject() Function

We can check the variable to know if it's an object or not using the isobject() function

Syntax:

```
isobject(variable) --> Returns True if it's an object, False if it's not
```

33.18 attributes() Function

We can get the object attributes using the attributes() function

Syntax:

```
attributes(object) --> Returns a list contains the object attributes
```

Example:

```

o1 = new point
aList = attributes(o1)           # we can use see attributes(o1)
for t in aList see t next       # print xyz
Class Point x y z

```

33.19 methods() Function

We can get the object methods using the methods() function

Syntax:

```
methods(object) --> Returns a list contains the object methods
```

Example:

```

o1 = new test
aList = methods(o1)

for x in aList
    cCode = "o1."+x+"()"
    eval(cCode)
next

Class Test
    func f1
        see "hello from f1" + nl
    func f2
        see "hello from f2" + nl
    func f3
        see "hello from f3" + nl
    func f4
        see "hello from f4" + nl

```

Output:

```

hello from f1
hello from f2
hello from f3
hello from f4

```

33.20 isattribute() Function

We can test if the object contains an attribute or not using the isattribute() function

Syntax:

```
isattribute(object,cAttributeName) --> Returns True if the object contains the ↵attribute
```

Example:

```
o1 = new point

see isattribute(o1,"x") + nl      # print 1
see isattribute(o1,"t") + nl      # print 0
see isattribute(o1,"y") + nl      # print 1
see isattribute(o1,"z") + nl      # print 1

class point x y z
```

33.21 isprivateattribute() Function

We can test if the object contains a private attribute or not using the isprivateattribute() function

Syntax:

```
isprivateattribute(object,cAttributeName) --> Returns True if the object
                                              contains the private attribute
```

Example:

```
o1 = new person

see isprivateattribute(o1,"name") + nl +
    isprivateattribute(o1,"address") + nl +
    isprivateattribute(o1,"phone") + nl +
    isprivateattribute(o1,"job") + nl +
    isprivateattribute(o1,"salary")

Class Person
    name address phone
    private
        job salary
```

Output:

```
0
0
0
1
1
```

33.22 ismethod() Function

We can test if the object class contains a method or not using the ismethod() function

Syntax:

```
ismethod(object,cMethodName) --> Returns True if the object class contains the method
```

Example:

```

o1 = new point

see ismethod(o1,"print") + nl          # print 1

mylist = []
mylist + new point

see ismethod(mylist[1],"print") + nl    # print 1

class point x y z
  func print
    see x + nl + y + nl + z + nl

```

33.23 isprivatemethod() Function

We can test if the object class contains a private method or not using the isprivatemethod() function

Syntax:

```
isprivatemethod(object,cMethodName) --> Returns True if the object class contains  
the private method
```

Example:

```

o1 = new Test

see isprivatemethod(o1,"f1") + nl +
  isprivatemethod(o1,"f2")

Class Test
  func f1
    see "message from f1()" + nl
  private
    func f2
      see "message from f2()" + nl

```

Output:

```
0
1
```

33.24 addattribute() Function

We can add an attribute (or a group of attributes) to the object state (not the class) using the addattribute() function

Syntax:

```
AddAttribute(object,cAttributeName|aAttributesList)
```

Example(1):

```
see new point {x=10 y=20 z=30}
Class Point
    AddAttribute(self, ["x", "y", "z"])
```

Example(2):

```
o1 = new point
addattribute(o1, "x")
addattribute(o1, "y")
addattribute(o1, "z")
see o1 {x=10 y=20 z=30}
class point
```

Output:

```
x: 10.000000
y: 20.000000
z: 30.000000
```

33.25 addmethod() Function

We can add a method to the object class using the addmethod() function This method can be used with any object from the same class.

Syntax:

```
AddMethod(Object, cNewMethodName, cMethodName | AnonymousFunction)
```

Example:

```
o1 = new point { x=10 y=20 z=30 }

addmethod(o1, "print", func { see x + nl + y + nl + z + nl } )

o1.print()

Class point
    x y z
```

Output:

```
10
20
30
```

Instead of using anonymous function to add new method to the class, we can use the function name

Example:

```
o1 = new point { x=10 y=20 z=30 }

myfunc = func { see x + nl + y + nl + z + nl }

addmethod(o1, "print", myfunc)
addmethod(o1, "display", myfunc)
```

(continues on next page)

(continued from previous page)

```
addmethod(o1,"show", myfunc )
o1.print()
o1.display()
o1.show()

Class point
    x y z
```

Output:

```
10
20
30
10
20
30
10
20
30
```

Since we add the method to the class, any object from that class can use this method

Example:

```
o1 = new point { x=10 y=20 z=30 }
o2 = new point { x=100 y=200 z=300 }
o3 = new point { x=50 y=150 z=250 }

addmethod(o1,"print", func { see x + nl + y + nl + z + nl } )

o1.print()
o2.print()
o3.print()

Class point
    x y z
```

Output:

```
10
20
30
100
200
300
50
150
250
```

33.26 getattribute() function

We can get the object attribute value using the getattribute() function

Syntax:

```
GetAttribute(oObject,cAttributeName) ---> Attribute Value
```

Example:

```
o1 = new point

see getattribute(o1,"name") + nl +
    getattribute(o1,"x") + nl +
    getattribute(o1,"y") + nl +
    getattribute(o1,"z") + nl

Class Point
    x=10 y=20 z=30
    name = "3D-Point"
```

Output:

```
3D-Point
10
20
30
```

Example:

We can Find a Class List Member using GetAttribute() using a function findclass() The Find uses the member name, rather than the column number

```
myList =
    [new Company {position=3 name="Mahmoud" symbol="MHD"} ,
     new Company {position=2 name="Bert" symbol="BRT"} ,
     new Company {position=1 name="Ring" symbol="RNG"}]
]

see myList
see nl +"======" + nl + nl

for i = 1 to len(myList)
    see "Pos: "+ i +" | "+ myList[i].position +" | "+ myList[i].name +
        " | "+ myList[i].symbol +" | "+ nl
next

See findclass(myList, "MHD", "symbol") +nl    ### Specify Member class name
#####
func findclass classList, cValue, classMember

    See nl + "FindClass: " +" "+ cValue + nl + nl

    for i = 1 to len(classList)
        result = getattribute( classList[i], classMember )
```

(continues on next page)

(continued from previous page)

```

See "Result-Attr: " + i +" "+ result +nl
if result = cValue
    j = i
ok
next
return j

# # #-----#
class company position name symbol

```

Output:

```

Pos: 1 | 3 | Mahmoud | MHD |
Pos: 2 | 2 | Bert | BRT |
Pos: 3 | 1 | Ring | RNG |

FindClass: MHD

Result-Attr: 1 MHD
Result-Attr: 2 BRT
Result-Attr: 3 RNG

1

```

33.27 setattribute() function

We can set the object attribute value using the setattribute() function

Syntax:

```
SetAttribute(oObject,cAttributeName,Value)
```

Example:

```

o1 = new person
setAttribute(o1,"cName","Mahmoud")
setAttribute(o1,"nSalary",1000000)
setAttribute(o1,"aColors",["white","blue","yellow"])

see o1
see o1.aColors

Class Person
    cName
    nSalary
    aColors

```

Output:

```

cname: Mahmoud
nsalary: 1000000.000000
acolors: List...

```

(continues on next page)

(continued from previous page)

```
white
blue
yellow
```

33.28 mergemethods() Function

We can share methods between classes without inheritance using the MergeMethods() function

This function merge class methods to another class.

Syntax:

```
MergeMethods(cClassNameDestination, cClassNameSource)
```

Example:

```
mergemethods("count", "share")
mergemethods("count2", "share")

o1 = new count { test() }
o1 = new count2 { test() }

Class Share
    func one
        see "one" + nl
    func two
        see "two" + nl
    func three
        see "three" + nl

Class Display
    Func printline
        see copy("*", 20) + nl

Class Count from Display
    Func test
        printline()
        one()
        two()
        three()
        printline()

Class Count2 from Display
    Func test
        three()
        two()
        one()
        printline()
```

Output:

```
*****
one
two
three
```

(continues on next page)

(continued from previous page)

```
*****
three
two
one
*****
```

33.29 packagename() Function

We can know the package name of the latest sucessful import command using the packagename() function

Syntax:

```
packagename() --> Returns the package name of the latest sucessful import
```

Example:

```
load "weblib.ring"
import System.web
see packagename()      # system.web
```

CHAPTER
THIRTYFOUR

DECLARATIVE PROGRAMMING USING NESTED STRUCTURES

In this chapter we are going to learn how to build declarative programming world using nested structures on the top of object oriented.

We will learn about

- Creating Objects inside Lists
- Composition and Returning Objects and Lists by Reference
- Executing code after the end of object access
- Declarative Programming on the top of Object-Oriented

34.1 Creating Objects inside Lists

We can create objects inside lists during list definition. Also we can add objects to the list at any time using the Add() function or the + operator.

Example:

```
alist = [new point, new point, new point]      # create list contains three objects
alist + [1,2,3]                                # add another item to the list

see "Item 4 is a list contains 3 items" + nl
see alist[4]

add(alist , new point)
alist + new point

alist[5] { x = 100 y = 200 z = 300 }
alist[6] { x = 50 y = 150 z = 250 }

see "Object inside item 5" + nl
see alist[5]
see "Object inside item 6" + nl
see alist[6]

class point x y z
```

Output:

```
Item 4 is a list contains 3 items
1
2
3
Object inside item 5
x: 100.000000
y: 200.000000
z: 300.000000
Object inside item 6
x: 50.000000
y: 150.000000
z: 250.000000
```

34.2 Composition and Returning Objects and Lists by Reference

When we use composition and have object as one of the class attributes, when we return that object it will be returned by reference.

if the caller used the assignment operator, another copy of the object will be created.

The caller can avoid using the assignment operator and use the returned reference directly to access the object.

The same is done also if the attribute is a list (not object).

Note: Objects and Lists are treated using the same rules. When you pass them to function they are passed by reference, when you return them from functions they are returned by value except if it's an object attribute where a return by reference will be done.

Example:

```
o1 = new Container
myobj = o1.addobj()          # the assignment will create another copy
myobj.x = 100
myobj.y = 200
myobj.z = 300
see o1.aobjs[1]            # print the object inside the container
see myobj                  # print the copy

Class Container
    aObjs = []
    func addobj
        aObjs + new point
        return aObjs[len(aObjs)]      # return object by reference

Class point
    x = 10
    y = 20
    z = 30
```

Output:

```
x: 10.000000
y: 20.000000
z: 30.000000
```

(continues on next page)

(continued from previous page)

```
x: 100.000000
y: 200.000000
z: 300.000000
```

Example(2):

```
func main
    o1 = new screen {
        content[point()] {
            x = 100
            y = 200
            z = 300
        }
        content[point()] {
            x = 50
            y = 150
            z = 250
        }
    }
    see o1.content[1]
    see o1.content[2]

Class Screen
    content = []
    func point
        content + new point
        return len(content)

Class point
    x = 10
    y = 20
    z = 30
```

Output:

```
x: 100.000000
y: 200.000000
z: 300.000000
x: 50.000000
y: 150.000000
z: 250.000000
```

Example(3):

```
func main
    o1 = New Screen {
        point() {                      # access the object using reference
            x = 100
            y = 200
            z = 300
        }
        point() {                      # access the object using reference
            x = 50
            y = 150
            z = 250
        }
    }
```

(continues on next page)

(continued from previous page)

```

see o1.content[1]
see o1.content[2]

Class Screen
    content = []
    func point
        content + new point
        return content[len(content)]      # return the object by reference

Class point x=10 y=20 z=30

```

Output:

```

x: 100.000000
y: 200.000000
z: 300.000000
x: 50.000000
y: 150.000000
z: 250.000000

```

34.3 Executing code after the end of object access

We can access an object using { } to use object attributes and methods.

If the object contains a method called BraceEnd(), it will be executed before the end of the object access.

Example:

```

New Point { See "How are you?" + nl }

Class Point x y z
    func braceend
        see "I'm fine, Thank you!" + nl

```

Output:

```

How are you?
I'm fine, Thank you!

```

34.4 Declarative Programming on the top of Object-Oriented

The next features enable us to build and use declarative programming environment using nested structures on the top of object oriented

- using {} to access the object attributes and methods
- BraceEnd() Method
- returning objects by reference
- Setter/Getter Methods (optional)

Example:

```
# Declarative Programming (Nested Structures)

Screen()
{
    point()
    {
        x = 100
        y = 200
        z = 300
    }

    point()
    {
        x = 50
        y = 150
        z = 250
    }
}

# Functions and Classes

Func screen return new screen

Class Screen

    content = []

    func point
        content + new point
        return content[len(content)]

    func braceend
        see "I have " + len(content) + " points!"

Class point

    x=10 y=20 z=30

    func braceend
        see self
```

Output:

```
x: 100.000000
y: 200.000000
z: 300.000000
x: 50.000000
y: 150.000000
z: 250.000000
I have 2 points!
```

34.5 More beautiful Code

We can get better results and a more beautiful code when we can avoid writing () after the method name when the methods doesn't take parameters. This feature is not provided directly by the Ring language because there is a difference between object methods and object attributes. We can get a similar effect on the syntax of the code when we define a getter method for the object attribute. For example instead of defining the point() method. we will define the point attribute then the getpoint() method that will be executed once you try to get the value of the point attribute. since we write the variable name directly without () we can write point instead of point() and the method getpoint() will create the object and return the object reference for us.

Example:

```
new Container
{
    Point
    {
        x=10
        y=20
        z=30
    }
}

Class Container
    aObjs = []
    point
    func getpoint
        aObjs + new Point
        return aObjs[len(aObjs)]

Class Point x y z
    func braceend
        see "3D Point" + nl + x + nl + y + nl + z + nl
```

Output

```
3D Point
10
20
30
```

NATURAL LANGUAGE PROGRAMMING

Using the Ring programming language, we can create Natural programming languages based on classes and objects.

35.1 History

In 2010, I developed a new programming language called Supernova (developed using PWCT). This language uses a code that looks similar to Natural Language statements to create simple GUI applications. Now after five years, In the Ring programming language, we can get similar results, but now we have the ability to create/use code similar to Natural language statements in any domain that we like or need.

The Ring programming language comes with the Supernova spirit, but with more generalization and with mix of other languages spirits.

35.2 Example

The next example presents how to create a class that define two instructions

The first instruction is : I want window

The second instruction is : Window title = <expr>

Also keywords that can be ignored like the ‘the’ keyword

```
New App
{
    I want window
    The window title = "hello world"
}

Class App

    # Attributes for the instruction I want window
    i want window
    nIwantwindow = 0
    # Attributes for the instruction Window title
    # Here we don't define the window attribute again
    title
    nWindowTitle = 0
    # Keywords to ignore, just give them any value
    the=0

    func geti
```

(continues on next page)

(continued from previous page)

```

if nWantwindow = 0
    nWantwindow++
ok

func getwant
    if nWantwindow = 1
        nWantwindow++
ok

func getwindow
    if nWantwindow = 2
        nWantwindow= 0
        see "Instruction : I want window" + nl
ok
if nWindowTitle = 0
    nWindowTitle++
ok

func setttitle cValue
    if nWindowTitle = 1
        nWindowTitle=0
        see "Instruction : Window Title = " + cValue + nl
ok

```

Output:

```

Instruction : I want window
Instruction : Window Title = hello world

```

35.3 Change the Ring Keyword ‘And’

What if we want to connect between the two instructions using ‘and’

We have a problem because in Ring ‘and’ is a keyword

We can change that using the ChangeRingKeyword command.

Syntax:

```
ChangeRingKeyword <oldkeyword> <newkeyword>
```

Note: remember to restore the keyword again

Tip: The ChangeRingKeyword command is executed in the scanner stage by the compiler (before parsing).

Example:

```

ChangeRingKeyword      and _and
New App
{

```

(continues on next page)

(continued from previous page)

```

        I want window and the window title = "hello world"
}

Class App

    # Attributes for the instruction I want window
        i want window
        nIwantwindow = 0
    # Attributes for the instruction Window title
    # Here we don't define the window attribute again
        title
        nWindowTitle = 0
    # Keywords to ignore, just give them any value
        the=0 and=0

ChangeRingKeyword      _and and

    func geti
        if nIwantwindow = 0
            nIwantwindow++
        ok

    func getwant
        if nIwantwindow = 1
            nIwantwindow++
        ok

    func getwindow
        if nIwantwindow = 2
            nIwantwindow= 0
            see "Instruction : I want window" + nl
        ok
        if nWindowTitle = 0
            nWindowTitle++
        ok

    func setttitle cValue
        if nWindowTitle = 1
            nWindowTitle=0
            see "Instruction : Window Title = " + cValue + nl
        ok

    func getand
        see "Using : and" + nl

```

Output:

```

Instruction : I want window
Using : and
Instruction : Window Title = hello world

```

35.4 Change the Ring Operator ‘+’

What if we want to define a new behavior for any operator like the “+” operator.

We can do this change using the ChangeRingOperator command to hide operator (change it's name)

Then we can use the operator as identifier that we can handle it's behaviour

Syntax:

```
ChangeRingOperator <oldoperator> <newoperator>
```

Note: remember to restore the operator again

Tip: The ChangeRingOperator command is executed in the scanner stage by the compiler (before parsing).

Example:

```
ChangeRingOperator + _+
New App {
    +
}
Class App
    +
    func get+
        see "Plus operator"
ChangeRingOperator _+ +
```

Output:

```
Plus operator
```

35.5 Change the ‘=’ operator to ‘is’

Example:

```
ChangeRingKeyword      and _and
ChangeRingOperator     =     is

New App
{
    I want window and the window title is "hello world"
}

ChangeRingOperator     is     =
Class App

# Attributes for the instruction I want window
```

(continues on next page)

(continued from previous page)

```

        i want window
        nIWantwindow = 0
    # Attributes for the instruction Window title
    # Here we don't define the window attribute again
        title
        nWindowTitle = 0
    # Keywords to ignore, just give them any value
        the=0 and=0

ChangeRingKeyword      _and   and

    func geti
        if nIWantwindow = 0
            nIWantwindow++
        ok

    func getwant
        if nIWantwindow = 1
            nIWantwindow++
        ok

    func getwindow
        if nIWantwindow = 2
            nIWantwindow= 0
            see "Instruction : I want window" + nl
        ok
        if nWindowTitle = 0
            nWindowTitle++
        ok

    func settitle cValue
        if nWindowTitle = 1
            nWindowTitle=0
            see "Instruction : Window Title = " + cValue + nl
        ok

```

35.6 Using Eval() with our Natural Code

Example:

```

func Main

    cProgram = ' I want window and the window title is "hello world" '

    MyLanguage(cProgram)

Func MyLanguage cCode

    # We add to the code the instructions that change keywords and operators
    # Because Eval() uses a new Compiler Object (the original keywords and operators).

    cCode =
        ChangeRingKeyword and _and
        ChangeRingOperator = is

```

(continues on next page)

(continued from previous page)

```

' + cCode

New App
{
    eval(cCode)
}

Class App

    # Attributes for the instruction I want window
    i want window
    nIwantwindow = 0
    # Attributes for the instruction Window title
    # Here we don't define the window attribute again
    title
    nWindowTitle = 0
    # Keywords to ignore, just give them any value
    the=0

    ChangeRingKeyword and _and
        and=0
    ChangeRingKeyword _and and

    func geti
        if nIwantwindow = 0
            nIwantwindow++
        ok

    func getwant
        if nIwantwindow = 1
            nIwantwindow++
        ok

    func getwindow
        if nIwantwindow = 2
            nIwantwindow= 0
            see "Instruction : I want window" + nl
        ok
        if nWindowTitle = 0
            nWindowTitle++
        ok

    func setttitle cValue
        if nWindowTitle = 1
            nWindowTitle=0
            see "Instruction : Window Title = " + cValue + nl
        ok

```

35.7 BraceStart and BraceEnd Methods

We can write code that will be executed before/after using { }

Example:

```
ol = new test {
    see "Hello" + nl
}

ol {}

class test

    func bracestart
        see "start" + nl

    func braceend
        see "end" + nl
```

Output:

```
start
Hello
end
start
end
```

35.8 BraceExprEval Method

The next example demonstrates how to use the “BraceExprEval” method to get expressions in Natural code.

Example:

```
new natural {
    create 5
}

class natural
    create=0
    lkeyword = false
    func braceexpreval r
        if lkeyword lkeyword=false return ok
        see "expr eval" + nl
        see "type: " + type(r) see nl
        see "value : " see r see nl
    func getcreate
        lkeyword = true
        see "create" + nl
```

Output:

```
create
expr eval
type: NUMBER
value : 5
```

35.9 Real Natural Code

The next example is a more advanced example

```
# Natural Code
new program {
    Accept 2 numbers then print the sum
}

# Natural Code Implementation
class program
    # Keywords
        Accept=0 numbers=0 then=0 print=0 the=0 sum=0

    # Execution
    func braceexpr eval x
        value = x
    func getnumbers
        for x=1 to value
            see "Enter Number (" + x + ") :" give nNumber
            aNumbers + nNumber
        next
    func getsum
        nSum = 0
        for x in aNumbers nSum+= x next
        see "The Sum : " + nSum
    private
        value=0 aNumbers=[]
```

Output:

```
Enter Number (1) :3
Enter Number (2) :4
The Sum : 7
```

35.10 BraceError() Method

The next examples demonstrates how to use the “BraceError” method to handle errors when accessing the object using braces {}.

Example:

```
func main
    o1 = new point {
        x=10 y=20 z=30
        TEST
        SEE test
    }

class point x y z
    func braceerror
        see "Handle Error!" + nl
        SEE "Message :" + cCatchError + nl
        if ( left(cCatchError,11) = "Error (R24)" ) and not isattribute(self,
        ↵"test")
```

(continues on next page)

(continued from previous page)

```

        see "add attribute" + nl
        addattribute(self,"test")
        test = 10
ok
see "done" + nl
return

```

Output:

```

Handle Error!
Message :Error (R24) : Using uninitialized variable : test
add attribute
done
10

```

Example:

```

new point {
    x=10 y=20 z=30
    test()
    see "mmm..." + NL
}

class point x y z
    func braceerror
        see "Handle Error!" + nl
        see "Message :" + cCatchError + nl
        see self
        see "Done" + NL

```

Output:

```

Handle Error!
Message :Error (R3) : Calling Function without definition !: test
x: 10.000000
y: 20.000000
z: 30.000000
Done
mmm...

```

35.11 Clean Natural Code

Instead of typing the literal as “literal” we can accept the words directly.

Example:

The next example accept hello world instead of “hello world”

But this example uses braceend() to check the end of the instruction

This means that this class process only one natural statement that end with literal.

ChangeRingKeyword	and	_and
New App		

(continues on next page)

(continued from previous page)

```

{
    I want window and the window title is hello world
}

Class App

    # Attributes for the instruction I want window
        i want window
        nWantwindow = 0
    # Attributes for the instruction Window title
    # Here we don't define the window attribute again
        title is
        nWindowTitle = 0
    # Keywords to ignore, just give them any value
        the=0 and=0
    # Data
        literal = ""

ChangeRingKeyword      _and and

    func geti
        if nWantwindow = 0
            nWantwindow++
        ok

    func getwant
        if nWantwindow = 1
            nWantwindow++
        ok

    func getwindow
        if nWantwindow = 2
            nWantwindow= 0
            see "Instruction : I want window" + nl
        ok
        if nWindowTitle = 0
            nWindowTitle++
        ok

    func gettitle
        if nWindowTitle = 1
            nWindowTitle=2
        ok

    func getis
        if nWindowTitle = 2
            nWindowTitle=3
        ok

    func braceend
        if nWindowTitle = 3
            see "Instruction : Window Title = " + literal + nl
            nWindowTitle = 0
        ok

    func braceerror
        c= substr(cCatchError,":")

```

(continues on next page)

(continued from previous page)

```
while c > 0
    c= substr(cCatchError,:)
    cCatchError=substr(cCatchError,c+1)
end
literal += substr(cCatchError,1)
```

CHAPTER
THIRTYSIX

USING THE NATURAL LIBRARY

In this chapter we will learn how to use the Natural Library to quickly define a language that contains a group of commands.

To start using the library, We need to call naturallib.ring

```
load "naturallib.ring"
```

After loading the library, We can use the NaturalLanguage class that contains the next methods :-

- SetLanguageName(cLanguageName)
- setCommandsPath(cFolder)
- SetPackageName(cPackageName)
- UseCommand(cCommandName)
- SetOperators(cOperators)
- RunFile(cFileName)
- RunString(cString)

36.1 Natural Library - Demo Program

We will write the natural code in a Text file, for example program.txt

File: program.txt

```
Welcome to the Ring programming language!
What you are reading now is not comments, I swear!
```

```
After many years of programming I decided to think different about
programming and solve the problems in a better way.
```

```
We are writing commands or code and the Ring language is reading
it to understand us! Sure, What you are seeing now is
just ***part of the code - Not the Complete Program***
You have to write little things before and after this
part to be able to run it!
```

```
It is the natural part of our code where we can write in English,
Arabic or any Natural Language Then we will tell the computer
through the Ring language what must happens! in a way that we can scale
for large frameworks and programs.
```

(continues on next page)

(continued from previous page)

Just imagine what will happens to the world of programming once we create many powerful frameworks using the Ring language that uses this way (Natural Programming).

For example When we say Hello to the Machine, It can reply! and when we say count from 1 to 5 it will understand us, Also if we said count from 5 to 1 it will understand us too! You can see the Output window!

This Goal is not new, but the Ring language comes with an innovative solution to this problem.

Output:

```
Hello, Sir!
```

```
The Numbers!
```

```
1  
2  
3  
4  
5
```

```
I will count Again!
```

```
5  
4  
3  
2  
1
```

To execute the natural code, We have start.ring

In start.ring we define the language and the commands.

File: start.ring

```
load "stdlib.ring"
load "naturallib.ring"

New NaturalLanguage {
    SetLanguageName (:MyLanguage)
    SetCommandsPath(CurrentDir () +"/../command")
    SetPackageName ("MyLanguage.Natural")
    UseCommand(:Hello)
    UseCommand(:Count)
```

(continues on next page)

(continued from previous page)

```
RunFile("program.txt")
}
```

We defined a language called MyLanguage, We have folder for the language commands.

Each command will define a class that belong to the MyLanguage.Natural package.

We will define two commands, Hello and Count.

So we must have two files for defining the commands in the CurrentDir() + "./command" folder

File: hello.ring

```
DefineNaturalCommand.SyntaxIsKeyword([
    :Package = "MyLanguage.Natural",
    :Keyword = :hello,
    :Function = func {
        See "Hello, Sir!" + nl + nl
    }
])
```

File: count.ring

```
DefineNaturalCommand.SyntaxIsKeywordNumberNumber([
    :Package = "MyLanguage.Natural",
    :Keyword = :count,
    :Function = func {
        if not isattribute(self,:count_times) {
            AddAttribute(self,:count_times)
            Count_Times = 0
        }
        if Expr(1) > Expr(2) {
            nStep = -1
        }
        else
            nStep = 1
        if Count_Times = 0 {
            see nl+"The Numbers!" + nl
            Count_Times++
        }
        else
            see nl + "I will count Again!" +nl
        }
        for x = Expr(1) to Expr(2) step nStep {
            see nl+x+nl
        }
        CommandReturn(fabs(Expr(1)-Expr(2))+1)
    }
])
```

36.2 Defining Commands

To define new command we can use the DefineNaturalCommand object

This object provides the next methods :-

- SyntaxIsKeyword(aPara)
- SyntaxIsKeywordNumber(aPara)
- SyntaxIsKeywordNumberNumber(aPara)
- SyntaxIsKeywordNumbers(aPara,nCount)
- SyntaxIsKeywordString(aPara)
- SyntaxIsKeywordStringString(aPara)
- SyntaxIsKeywordStrings(aPara,nCount)
- SyntaxIsKeywordExpression(aPara)
- SyntaxIsKeywordExpressionExpression(aPara)
- SyntaxIsKeywordExpressions(aPara,nCount)
- SyntaxIsCommand(aPara)
- SyntaxIsCommandNumber(aPara)
- SyntaxIsCommandNumberNumber(aPara)
- SyntaxIsCommandNumbers(aPara,nCount)
- SyntaxIsCommandString(aPara)
- SyntaxIsCommandStringString(aPara)
- SyntaxIsCommandStrings(aPara,nCount)
- SyntaxIsCommandExpression(aPara)
- SyntaxIsCommandExpressionExpression(aPara)
- SyntaxIsCommandExpressions(aPara,nCount)

File: mylanguage.ring

```
load "stdlib.ring"
load "naturallib.ring"

MyLanguage = New NaturalLanguage {
    SetLanguageName(:MyLanguage)
    setCommandsPath(CurrentDir() +"/../command")
    SetPackageName("MyLanguage.Natural")
    UseCommand(:Hello)
    UseCommand(:Count)
    UseCommand(:Print)
    UseCommand(:IWantWindow)
    UseCommand(:WindowTitleIs)
    UseCommand(:IWantButton)
}
```

Example (1)

In the next example we will define the Print command.

We will use the SyntaxIsKeywordExpression() Method.

We pass list (as Hash) to the method. We determine the package name, the keyword and the function that will be executed.

Inside this function we uses the Expr(nExprNumber) function to get the expression value that the user will write after the keyword.

File: print.ring

```
DefineNaturalCommand.SyntaxIsKeywordExpression([
    :Package = "MyLanguage.Natural",
    :Keyword = :print,
    :Function = func {
        See Expr(1)
    }
])
```

Usage:

```
load "mylanguage.ring"

MyLanguage.RunString('
    print "Hello, World!"
')
```

Output:

```
Hello, World!
```

Example (2)

File: iwantwindow.ring

```
DefineNaturalCommand.SyntaxIsCommand([
    :Package = "MyLanguage.Natural",
    :Command = "i want window",
    :Function = func {
        See "Command: I want window" + nl
    }
])
```

Usage:

```
load "mylanguage.ring"

MyLanguage.RunString('
    i want window
')
```

Output:

```
Command: I want window
```

Example (3)

File: windowtitleis.ring

```
DefineNaturalCommand.SyntaxIsCommandString([
    :Package = "MyLanguage.Natural",
    :Command = "window title is",
    :Function = func {
        See "Command: Window title is " + Expr(1) + nl
    }
])
```

Usage:

```
load "mylanguage.ring"

MyLanguage.RunString('
    I want window and the window title is "Hello World"
')
```

Output:

```
Command: I want window
Command: Window title is Hello World
```

36.3 Natural Library - Operators

In the next example we uses the Count command without using operators

```
load "mylanguage.ring"

MyLanguage.RunString("
    Hello
    Count 1 5
    Count 5 1
")
```

We can add more description

```
load "mylanguage.ring"

MyLanguage.RunString("
    Hello, Please    Count from 1 to 5 then count from 5 to 1
")
```

Also we can use operators like “(” and “)” around the instruction

```
load "mylanguage.ring"

MyLanguage {
    SetOperators("() ")
    RunString("
        Here we will play and will try something
        that looks like Lisp Syntax
        (count (count 1 5) (count 20 15))
        Just for fun!
    ")
}
```

36.4 Defining commands using classes

This section is related to the implementation details.

When we define new command, Each command is defined by the Natural Library as a class.

We have the choice to define commands using the simple interface provided by the DefineNaturalCommand object or by defining new class as in the next examples.

If we used DefineNaturalCommand (More Simple), The class will be defined during the runtime.

File: hello.ring

```
Package MyLanguage.Natural

class Hello

    func AddAttributes_Hello
        AddAttribute(self,:hello)

    func GetHello
        See "Hello, Sir!" + nl + nl
```

File: count.ring

```
Package MyLanguage.Natural

class Count

    func Getcount
        StartCommand()
        CommandData()[:name] = :Count
        CommandData()[:nExpr] = 0
        CommandData()[:aExpr] = []

    func BraceExprEval_Count nValue
        if isCommand() and CommandData()[:name] = :Count {
            if isNumber(nValue) {
                CommandData()[:nExpr]++
                CommandData()[:aExpr] + nValue
                if CommandData()[:nExpr] = 2 {
                    Count_Execute()
                }
            }
        }

    func AddAttributes_Count
        AddAttribute(self,:count)

    func Count_Execute
        if not isattribute(self,:count_times) {
            AddAttribute(self,:count_times)
            Count_Times = 0
        }
        if Expr(1) > Expr(2) {
            nStep = -1
        } else
            nStep = 1
```

(continues on next page)

(continued from previous page)

```
        }
if Count_Times = 0 {
    see nl+"The Numbers!" + nl
    Count_Times++
else
    see nl + "I will count Again!" +nl
}
for x = Expr(1) to Expr(2) step nStep {
    see nl+x+nl
}
CommandReturn(fabs(Expr(1)-Expr(2))+1)
```

CHAPTER
THIRTYSEVEN

SCOPE RULES FOR VARIABLES AND ATTRIBUTES

In this chapter we will learn about scope rules and how Ring find variables.

Also we will learn about conflicts and how to solve/avoid them.

The next information are important once you start developing large applications using Ring

These application may uses

- Global variables (Try to avoid them)
- Classes (Object-Oriented)
- braces { } to access objects
- Declarative Programming
- Natural Programming

37.1 Three Scopes

In Ring we have three scopes :-

- (1) Public/Global Scope - Each variable you define in the statements part (before functions and classes)
- (2) Object Scope - When you are inside an object (Inside class method or using { } to access the object)
- (3) Local Scope - Related to functions and methods

37.2 Defining Variables and Variables Access

- (1) Ring uses lexical scoping, i.e. the scope of the variable is based on where we defined the variable.
- (2) Inside braces { } when you access an object, You will change the current active object scope to this object scope but you still can access the global scope and the local scope.
- (3) After the 'Class' keyword and the class name, when you write variable names to be defined as attributes, You still can access the global scope.

In this region (class region - after the class name and before methods) we have

- Global Scope —> The Global Scope
- Object Scope —> The Object Scope
- Local Scope —> The Object Scope

Note: Since the local scope in the class region point also to the object scope in this region, we can use nested braces and still have access to the object scope of the class through the local scope.

Tip: You can create windows and controls as attributes by defining them in this region.

Tip: In the class region if you created objects and used braces {} to access them then using self.attribute inside braces will use the class (not the object that you access) because you have access to the class through the local scope.

(4) Function Parameters are automatically defined in the local scope.

37.3 How Ring find the variable?

1 - Search First in the Local Scope

if not found !

2 - Search in the Object Scope

if not found !

3 - Search in the public scope

if not found —> Runtime Error

if found —> Check if we can do optimization to avoid searching next time (Cache / Pointers for performance).

37.4 Using Object.Attribute

When we use object.attribute the search will be in the object attributes only.

I.e. no search will be done in the local scope or in the global scope for the object attribute.

Note: Using self.attribute will search for the first self before searching for attributes.

37.5 The Self Object

The self object is a reference to the current object that we can use from the class methods.

When we are inside class method and use Self we mean the object that will be created from this class.

Inside the class methods if we used Braces {} this will change the current object scope and self will be changed also inside braces to reference the object that we access using Braces.

Inside the Class Region (after the class name and before any method) we have access to the object through the object scope and the local scope also. In this region using Self will always be a reference to the class object. if we used Braces to change the object scope then used Self inside Braces, Also self will be a reference to the class object (not the object that we already access using braces) because in the class region we have :-

- Global Scope —> Global Scope
- Object Scope —> Object Scope
- Local Scope —> Object Scope

And using Braces changes the object scope only (not the local scope) and when Ring search for variables it will search in the Local Scope first so it will find self in the class that we are inside.

37.6 How Ring Define Variables and Attributes

Ring will use the variable name in the Assignment operation

1 - Search using the variable name

2 - If not found —> Avoid the runtime error and define the variable in the current scope

3 - If found —> Use the variable and don't define anything in the current scope

- In the global region (before any function or class) the current scope is the global scope.
- In the class region (after the class name and before any method) the current scope is the object attributes.
- In Functions and methods the current scope is the local scope.

37.7 Conflict between Global Variables and Class Attributes

Look at this example:

```
name = "test"
o1 = new person
see o1

class person
    name
    address
    phone
```

In the previous example we have a global variable called 'name' inside the class person.

when we use the variable 'name', Ring will start the search operation and will try to find it.

if found —> Use it

if not found —> Define new attribute

But the variable name is a global variable, so it will be found and used!

We will not have the attribute name! added to the object.

Solution (1) - Use the Main Function

```
func main
    name = "test"
    o1 = new person
    see o1

class person
    name
```

(continues on next page)

(continued from previous page)

address
phone

Solution (2) - Use special mark for global variable names like \$

```
$name = "test"
o1 = new person
see o1

class person
    name
    address
    phone
```

Solution (3) - Use the AddAttribute() Method

```
name = "test"
o1 = new person
see o1

class person
    AddAttribute(self, "name")
    address
    phone
```

Solution (4) - Use self before the attribute name

```
name = "test"
o1 = new person
see o1

class person
    self.name
    address
    phone
```

So what is the best solution to this conflict?

- 1 - Use the \$ Mark for global variables
- 2 - Optional : Try to avoid global variables and use the Main function

In practice i do both of them.

The other solution

- Use self before the attribute name or use AddAttribute()

37.8 Conflict between Class Attributes and Local Variables

This conflict may happen when we access the object using braces

Example:

```
func main
    name = "nice"
    o1 = new person {name="mahmoud" address="Egypt" phone = 000 }
    see o1

class person
    name
    address
    phone
```

In the previous example we have the local variable name.

The value of this variable will be set to “mahmoud” instead of the object attribute.

Solution (1) : Just use Self

```
func main
    name = "nice"
    o1 = new person {self.name="mahmoud" address="Egypt" phone = 000 }
    see o1

class person
    name
    address
    phone
```

Solution (2) : Change the Local variable name

```
func main
    cName = "nice"
    o1 = new person {name="mahmoud" address="Egypt" phone = 000 }
    see o1

class person
    name
    address
    phone
```

Solution (3) : Change Braces and use the Dot operator

```
func main
    name = "nice"
    o1 = new person
    o1.name ="mahmoud"
    o1.address ="Egypt"
    o1.phone = 000
    see o1

class person
    name
    address
    phone
```

37.9 Using Braces to access objects inside Class Methods

Remember that we have Three scopes (Local Scope, Object Scope and Global Scope) and when we are inside a class method, we expect that we have access to the object attributes and methods and this is true until we use braces to access another object attributes and methods because in this case our object scope will be switched to another object.

```
new point { test() }

class point
    x=10 y=20
    func test
        see x + nl + y + nl # works fine
        myobj = new otherclass {
            see name + nl
            see x + nl + y + nl # error !
        }

class otherclass
    name = "test"
```

Output:

```
10
20
test

Line 8 Error (R24) : Using uninitialized variable : x
In method test() in file methodbraceerror.ring
called from line 5 in file methodbraceerror.ring
```

Now what we will do to solve the previous problem?

Solution (1) : Write the code that access the class attributes outside braces.

```
new point { test() }

class point
    x=10 y=20
    func test
        see x + nl + y + nl # works fine
        myobj = new otherclass {
            see name + nl
        }
        see x + nl + y + nl # Outside braces - works fine

class otherclass
    name = "test"
```

Output:

```
10
20
test
10
20
```

Solution (2) : Don't Use Braces

```

new point { test() }

class point
    x=10 y=20
    func test
        see x + nl + y + nl
        myobj = new otherclass
        see myobj.name
        see x + nl + y + nl

class otherclass
    name = "test"

```

Solution (3) : Copy the self object

We may use this solution if we want to use braces and get access to the class attributes (Just Reading).

```

new point { test() }

class point
    x=10 y=20
    func test
        oSelf = self
        see x + nl + y + nl
        myobj = new otherclass {
            see name + nl
            see oself.x + nl + oself.y + nl
        }

class otherclass
    name = "test"

```

Output:

```

10
20
test
10
20

```

Now look at this line

```
oself = self
```

The problem with the previous line is that we will have a new copy from the object Because in Ring the assignment operator copy lists and objects by value (not by reference).

When we access the new object attributes (reading) we don't have problems

But if we modified the object attributes (Then we will modify the copy!).

Note: We can use braces again with the copy

```

new point { test() }

class point

```

(continues on next page)

(continued from previous page)

```

x=10 y=20
func test
    oSelf = self
    see x + nl + y + nl
    myobj = new otherclass {
        see name + nl
        oSelf {
            see x + nl + y + nl
        }
    }

class otherclass
    name = "test"

```

In a GUI application, we may create a class contains the window objects as attributes to be able to access the controls from different methods. Remember the previous information when you try to access objects using braces inside methods because in this case you can't access the object attributes directly and if you copied the self object you will work on a copy and the new controls that you create will be related to the copy and you can't access them.

37.10 Accessing the class attributes from braces inside class methods

We access the class attributes directly from the class methods, also we have the choice to use the Self reference before the attribute/method name. Using Braces {} inside class method change the active object scope and prevent us from getting direct access to the class attributes. Also using Self will not help because the Self reference will be changed to the object that we access using Braces.

In this case if you want to read an attribute you have to copy the Self object before using Braces and if you want to modify an attribute you have to the copy from local variable to the object attribute after using Braces.

This case happens when you want to read/modify attribute instead braces.

```

Class MyApp

    oCon # Attribute

    # some code here

    Func OpenDatabase
        # some code here
        new QSqlDatabase() {
            oCon = addDatabase("QSQLITE") {
                setDatabaseName("weighthistory.db")
                open()
            }
        }
        self.oCon = oCon
        # some code here

```

In the previous example we want to create the connection object and save it inside the oCon attribute.

The object is an output from the addDatabase() method that we use after accessing the QSqlDatabase() object.

Inside braces we can't use the Self reference to use the object created from the MyApp class, Because the Self reference here will be to the object that we access using Braces.

We solved the problem in the previous example by creating a local variable called oCon then after Braces we copied that variable to the oCon attribute.

The next code is another solution.

```
Class MyApp

    oCon    # Attribute

    # some code here

    Func OpenDatabase
        # some code here
        oCon = new QSqlDatabase()
        oCon = oCon.addDatabase("QSQLITE") {
            setDatabaseName("weighthistory.db")
            Open()
        }
        # some code here
```

The next code is a better solution.

```
Class MyApp

    oCon    # Attribute

    # some code here

    Func OpenDatabase
        # some code here
        new QSqlDatabase() {
            this.oCon = addDatabase("QSQLITE") {
                setDatabaseName("weighthistory.db")
                Open()
            }
        }
        # some code here
```

Note: We used this.attribute to access the class attribute (oCon) while we are inside Braces.

37.11 Creating a Class for each Window in GUI applications

A good way for creating classes for windows is to define the window directly after the class name

In this area you can use nested braces without problems to define the window and the controls, and they will be attributes that you can access from methods.

Example:

```
Load "guilib.ring"

new qApp
{
    $ObjectName = "oFirstWindow"
```

(continues on next page)

(continued from previous page)

```

oFirstWindow = new FirstWindow

$ObjectName = "oSecondWindow"
oSecondWindow = new SecondWindow

exec()
}

Class FirstWindow

    win = new QWidget() {
        setgeometry(0,50,300,200)
        setWindowTitle("First Window")
        label1 = new QLabel(win)
        {
            setgeometry(10,10,300,30)
            setText("0")
        }
        btn1 = new QPushButton(win)
        {
            move(100,100)
            setText("Increment")
            setClickEvent($ObjectName+".increment()")
        }
        show()
    }

Func Increment
    label1 {
        setText(" " + ( 0 + text() + 1 ) )
    }
}

Class SecondWindow

    win = new QWidget() {
        setgeometry(400,50,300,200)
        setWindowTitle("Second Window")
        label1 = new QLabel(win)
        {
            setgeometry(10,10,300,30)
            setText("0")
        }
        btn1 = new QPushButton(win)
        {
            move(100,100)
            setText("Decrement")
            setClickEvent($ObjectName+".decrement()")
        }
        show()
    }

Func Decrement
    label1 {
        setText(" " + ( 0 + text() - 1 ) )
    }
}

```

37.12 Conflict between self inside braces and self in the class region

In the class region (after the class name and before any methods) we define the attributes.

In this region we have access to the global scope and the local scope will point to the object scope.

Three Scopes

- Global Scope —> Global Scope
- Object Scope —> Object Scope
- Local Scope —> Object Scope

Look at this example

```
New Account {
    see aFriends
}

Class Account
    name = "Mahmoud"
    aFriends = []
    aFriends + new Friend {
        name = "Gal"
    }
    aFriends + new Friend {
        name = "Bert"
    }

Class Friend
    name
```

Output:

```
name: NULL
name: NULL
```

The problem in the previous example is that the Class account contains an attribute called “name” and the Friend class contains an attribute called “name” also.

If you tried using self.name inside braces you will get the same result!

```
New Account {
    see aFriends
}

Class Account
    name = "Mahmoud"
    aFriends = []
    aFriends + new Friend {
        self.name = "Gal"
    }
    aFriends + new Friend {
        self.name = "Bert"
    }

Class Friend
    name
```

So why using self.name inside braces doesn't solve this conflict?

Because after the class region we have

- global scope —> global scope
- object scope —> object scope (Account Class)
- local scope —> local scope (Account Class)

When we use braces we change the object scope, so we have

- global scope —> global scope
- object scope —> object scope (Friend Class)
- local scope —> local scope (Account Class)

Ring search in the local scope first, so using self.name will use the Account class.

There are many solution

Solution (1) : Access the object through the list

```
New Account {
    see aFriends
}

Class Account
    name = "Mahmoud"
    aFriends = []
    aFriends + new Friend
    aFriends[len(aFriends)] {
        aFriends[len(aFriends)].name = "Gal"
    }
    aFriends + new Friend
    aFriends[len(aFriends)] {
        aFriends[len(aFriends)].name = "Bert"
    }

Class Friend
    name
```

Solution (2) : Create Method in the friend class to set the name attribute.

```
New Account {
    see aFriends
}

Class Account
    name = "Mahmoud"
    aFriends = []
    aFriends + new Friend {
        setname("Gal")
    }
    aFriends + new Friend {
        setname("Bert")
    }

Class Friend
    name
```

(continues on next page)

(continued from previous page)

```
func setname cName
    name = cName
```

Solution (3) : Create a method in the account class to set the attribute

```
New Account {
    see aFriends
}

Class Account
    name = "Mahmoud"
    aFriends = []
    friend("Gal")
    friend("Bert")

    func friend cName
        aFriends + new Friend {
            name = cName
        }

Class Friend
    name
```

Solution (4) : Declarative Programming

```
New Account {
    name = "mahmoud"
    friend {
        name = "Gal"
    }
    friend {
        name = "Bert"
    }
    see aFriends
}

Class Account
    name
    aFriends = []
    friend
    func getfriend
        aFriends + new Friend
        return aFriends[len(aFriends)]

Class Friend
    name
```

Output:

```
name: Gal
name: Bert
```

37.13 Using braces to escape from the current object scope

Since braces change the current object scope to another object. we can use it to do some work without modifying the class attributes and using the same variable names.

```
new point {x=10 y=20 z=30 start() }
class point x y z
    func start
        see self # print the x y z values (10,20,30)
        new Local {
            x = 100
            y = 200
            z = 300
        }
        see self # print the x y z values (10,20,30)
        see x + nl # will print 100
        see y + nl # will print 200
        see z + nl # will print 300
        Self { # NO Advantage - Search is done in local scope first
            see x + nl # will print 100
            see y + nl # will print 200
            see z + nl # will print 300
        }
        see self.x + nl # will print 10
        see self.y + nl # will print 20
        see self.z + nl # will print 30

class Local
```

Output:

```
x: 10.000000
y: 20.000000
z: 30.000000
x: 10.000000
y: 20.000000
z: 30.000000
100
200
300
100
200
300
10
20
30
```

37.14 The For Loops uses the local scope

Starting from Ring 1.8, when the For Loop defines new identifier (variable) it will define it in the local scope.

Example:

```
x = 10
? x          # Print 10
test1()
? x          # Print 10
test2()
? x          # Print 10

func test1
    for x = 1 to 5
    next
    ? x      # Print 6

func test2
    list = 1:5
    for x in list
    next
    ? x      # Print NULL (The "For In" loop will kill the reference after the
    ↪loop)
```

Output:

```
10
6
10
NULL
10
```

37.15 Summary of Scope Rules

At first remember that

- 1 - Each programming language comes with its scope rules based on the language goals
- 2 - Programming in the small is different than Programming in the Large
- 3 - Some programming languages are designed for developing small programs while others are designed for large programs
- 4 - In programming, If we have access to more than one scope - Then problems may come if we don't manage things correctly
- 5 - It's always more secure to reduce the number of visible scopes
- 6 - Some programming languages force you to manage the scope in some way, while others not!

In Ring

- 1 - Special and *very simple* scope rules that are designed for Flexibility first then Security
- 2 - Ring is designed to support programming in the small and programming in the large.

3 - The language provide the different programming paradigms that you may select from based on the project size. Errors comes only if you selected a bad paradigm for the target project or you are using the paradigm in a way that is not correct or at least not common.

4 - In Ring you have the choice, you can use global variables or avoid them. you can give them a special \$ mark or leave them. you can use object-oriented or stay with procedures. you can use the class region (after the class name and before any method) just for attributes or use it for code too.

5 - Just read the next scope rules and think about them then use them in your favorite way.

Scope Rules:

1 - At any place in our program code we have only at maximum Three Scopes (Local Scope, Object Scope and Global Scope).

2 - When Ring find a variable it will search in the local scope first then in the object scope then in the global scope.

3 - At any time inside procedures or methods you can use braces { } to access an object and change the current object scope.

4 - In the class region (After the class name and before any method) this is a special region where both of the object scope and the local scope point to the object scope. I.e. No local variables where each variable you define in this region will become an attribute.

5 - Before defining any variable (in any scope and in the class region too) a search process will be done to use the variable if it's found.

6 - Functions and Methods parameters are defined automatically as local variables to these functions or methods.

7 - Using Object.Attribute will search in the object attributes only.

8 - Using Self.Attribute will lead to a search for Self first then search in Self Attributes.

9 - The Self reference inside class region (after the class name and before any method) always point to the object scope created from the class.

10- The Self reference inside methods will be changed when we uses Braces to be a reference to the object that we access.

11- Writing variable names directly in the class region (after the class name and before any method) means using them or define them (in order).

12- Using self.attribute in the class region reduce search to the object scope (avoid conflict with global scope).

From these rules you can understand all types of conflicts and why you may have them and how to avoid them

Simple advices to avoid any conflict and use the scope rules in a better way

1 - Try to avoid global variables

2 - Use the Main Function - This will help you to avoid global variables

3 - If you are going to use many global variables use the \$ mark before the variable name

4 - In the class region if you don't respect the advice number three (\$) then use self.attribute when you define your attributes

5 - You can use object.attribute and object.method() instead of object { attribute } and object { method() } if you don't like changing the object scope.

6 - If you will use nested braces in a class - think about using the class region if possible because in this region you will have access to the object that you access using { } + access to the class attributes

7 - If you are inside a class method and used nested braces you will change the object scope with each brace and you will loss the access to the class attributes directly but you have access to the local scope before and after using brace

{ } , if you will read/modify the class attribute from braces then use This.Attribute because using ‘This’ means (The object created from this class) while using ‘Self’ means (The object in the current object scope).

After understanding all of the previous points, You will master this topic.

CHAPTER
THIRTYEIGHT

SCOPE RULES FOR FUNCTIONS AND METHODS

In this chapter we will learn about the scope rules for functions and methods.

You need to know the next information once you started using Ring for large applications.

These applications may contains and use

- Many Packages and Classes written in Ring
- Many Functions written in Ring
- Standard Ring Functions (Written in C language)
- Functions and Classes written in C/C++ languages

38.1 How Ring find the Functions and Methods?

When you call a method or function, Ring will start a search process to find this function

If found → Call the function and store the function pointer in the cache so Ring can use it again with doing another search.

If not found → Runtime error message (That you can avoid using Try/Catch)

How the search process is done?

Search for functions/methods follow the next order

- 1 - Search in methods (if we are inside class method or object using braces {})
- 2 - Search in functions written by the programmer using Ring Code
- 3 - Search in functions written in C/C++ like standard Ring functions

This enable us to write clean code inside classes methods and avoid any conflict with functions.

If we want to call a function with the same name as a method in the class we will need a wrapper function or we will access a temp. object using { } then call that function there.

We can replace C/C++ Functions with Ring Functions.

We can replace Ring Functions with Ring Methods.

Note: Using self.method() is not necessary in any use case.

Tip: We can use this.method() to escape from the current active scope that we access using braces {} and call a method in the class that we are inside.

38.2 Example about Sharing Names between Functions and Methods

Look at the next example

```

func main
    o1 = new myclass { test() test2() }
    test2()

func f1
    see "f1 function" + nl

func f2
    see "f2 function" + nl

func f3
    see "f3 function" + nl

func test2
    myline()
    see "test2 function" + nl
    new myclass {
        f1()
        f2()
        f3()
        self.f3()
    }
    myobj = new myclass
    myobj.f3()
    myline()

func myline
    see copy("=", 40) + nl

Class myclass

    func test
        myline()
        see "test method" + nl
        f1()
        f2()
        f3()
        myline()

    func f3
        see "f3 method" + nl

    func test2
        myline()
        see "test2 method" + nl
        self {
            f1()
        }
    }
}

```

(continues on next page)

(continued from previous page)

```

        f2()
        f3()
    }
myline()

```

Output:

```

=====
test method
f1 function
f2 function
f3 method
=====

=====
test2 method
f1 function
f2 function
f3 method
=====

=====
test2 function
f1 function
f2 function
f3 method
f3 method
f3 method
=====
```

38.3 Calling a function sharing the name with a method in the current class

In the previous example we have a function called f3() and we have a method called f3()

How we can call the f3() function from the test() method ?

Solution (1) : Change the current object scope to another object scope

In this solution we will have an empty class called local that we will use to change the current object scope.

```

func main
    o1 = new myclass { test() }

func f1
    see "f1 function" + nl

func f2
    see "f2 function" + nl

func f3
    see "f3 function" + nl

func myline
    see copy("=", 40) + nl

```

(continues on next page)

(continued from previous page)

```
Class myclass

    func test
        myline()
        see "test method" + nl
        f1()
        f2()
        f3()           # call f3() method
        new local { f3() } # call f3() function
        myline()

    func f3
        see "f3 method" + nl

class local
```

Output:

```
=====
test method
f1 function
f2 function
f3 method
f3 function
=====
```

SYNTAX FLEXIBILITY

In this chapter we will learn about some options that are provided automatically by the Ring compiler for syntax flexibility.

39.1 Change Language Keywords

We can change any keyword using the `ChangeRingKeyword` command.

Note: Remember to restore the keyword again if the team will mix between styles in the same project.

Tip: The `ChangeRingKeyword` command is executed in the scanner stage by the compiler (before parsing).

Syntax:

```
ChangeRingKeyword <oldkeyword> <newkeyword>
```

Example:

```
ChangeRingKeyword see print
print "welcome" + nl
ChangeRingKeyword print see
see "Welcome" + nl
```

Example:

```
ChangeRingKeyword func function
ChangeRingKeyword see print
ChangeRingKeyword ok endif
ChangeRingKeyword next endfor
ChangeRingKeyword end endwhile

x = 10
while x > 0
    print "x = " + x + nl
    for t = 1 to 10
        if t = 3
```

(continues on next page)

(continued from previous page)

```

        print "number three" + nl
    endif
endfor

x--
endwhile

test()

function test
    print "message from test" + nl

ChangeRingKeyword function func
ChangeRingKeyword print see
ChangeRingKeyword endif ok
ChangeRingKeyword endfor next
ChangeRingKeyword endwhile end

```

39.2 Change Language Operators

We can change any operator using the ChangeRingOperator command.

Note: Remember to restore the operator again if the team will mix between styles in the same project.

Tip: The ChangeRingOperartor command is executed in the scanner stage by the compiler (before parsing).

Syntax:

```
ChangeRingOperator <oldkeyword> <newkeyword>
```

Example:

The next program hide the + operator by changing it to _+

```

changeringoperator + _+
changeringkeyword SEE PRINT

try
    print 5 + 10
catch
    print nl print "error" print nl
done

changeringoperator _+ +

```

The next program change the + operator to “plus”.

```
changeringoperator + plus
changeringkeyword SEE PRINT
```

```
Print 5 plus 5
```

(continues on next page)

(continued from previous page)

```
changeringoperator plus +
changeringkeyword PRINT SEE
```

39.3 Load Syntax Files

You may store a group of ChangeRingKeyword and ChangeRingOperator commands in a file to use later in many source files. You can't use the Load command to call these files because

- ChangeRingKeyword and ChangeRingOperator commands are executed in the scanner phase by the compiler (before parsing).
- The load command is executed in the parsing phase (after the scanner phase).

Solution: Use the LoadSyntax Command which is executed in the scanner phase.

Syntax:

```
LoadSyntax "syntaxfile.ring"
```

Example:

File : StyleBasicOn.ring

```
ChangeRingKeyword see print
ChangeRingKeyword ok endif
ChangeRingKeyword next endfor
ChangeRingKeyword end endwhile
```

File : StyleBasicOff.ring

```
ChangeRingKeyword print see
ChangeRingKeyword endif ok
ChangeRingKeyword endfor next
ChangeRingKeyword endwhile end
```

File : UseStyleBasic.ring

```
LoadSyntax "stylebasicon.ring"

x = 10
while x > 0
    print "x = " + x + nl
    for t = 1 to 10
        if t = 3
            print "number three" + nl
        endif
    endfor
    x-
endwhile

LoadSyntax "stylebasicoff.ring"

see "done" + nl
```

Note: files called by the LoadSyntax command must contains ChangeRingKeyword and ChangeRingOperator commands only.

Tip: files called by the LoadSyntax command doesn't support functions, packages and classes. just imperative commands only.

Note: Using this feature you can create many styles that you can use in the same project and you can support Ring translation to other languages like Arabic, French and so on.

Tip: The effect of LoadSyntax command is related to the current source code file only.

39.4 Using “()” around the function parameters

We can use () around the function parameters (optional).

Example:

```
hello()
sum(3,4)

func hello()
    see "Hello" + nl

func sum(x,y)
    see x+y+nl
```

Output:

```
Hello
7
```

Example:

```
myfunc = func x,y { see x + y + nl }

call myfunc (3,4)

myfunc2 = func (x,y) { see x+y+nl }

call myfunc(3,4)
```

Output:

```
7
7
```

39.5 Using Semi-colon after and between statements

In Ring we can use semi-colon after and between statements (optional).

Example:

```
# Using semi-colon is optional

see "Hello" + nl ; see "How are you?" + nl ; see "Welcome to Ring" + nl ;
one() ; two() ; three() ;
func one ; see "one" + nl ;
func two ; see "two" + nl ;
func three ; see "three" + nl ;
```

Output:

```
Hello
How are you?
Welcome to Ring
one
two
three
```

39.6 Using \$ and @ in the start of the variable name

You can use any unicode character in the variable name also we can use \$ and @ in the name.

This feature may help, for example we can start global variables with \$ and the object attributes with @.

In other languages like Ruby this is the rule, In the Ring language this is just an option without any force from the Compiler.

example:

```
$global_variable = 5

new test { hello() }

class test

    @instance_variable = 10

    func hello

        local_variable = 15

        see "Global : " + $global_variable + nl +
            "Instance : " + @instance_variable + nl +
            "Local : " + local_variable + nl
```

Output:

```
Global : 5
Instance : 10
Local : 15
```

39.7 Using the ‘elseif’ keyword as ‘but’ in if statement

if you don’t like the ‘but’ keyword in if statement Then you can use the ‘elseif’ keyword.

Example:

```
give x
if x = 1 see "one"
elseif x=2 see "two"
elseif x=3 see "three"
elseif x=4 see "four"
else see "other"
ok
see nl
```

39.8 Using the ‘else’ keyword as ‘other’ in switch statement

if you don’t like the ‘other’ keyword in switch statement Then you can use the ‘else’ keyword.

Also you can replace ‘else’ with ‘other’ in if statement.

i.e. ‘other’ keyword is the same as ‘else’ keyword.

Example:

```
x = 1
switch x
    on 10
        see "10" + nl
    else
        see "not 10" + nl
end
```

Output:

```
not 10
```

39.9 Using the ‘end’ keyword in different control structures

We can use the ‘end’ keyword to close different control structures

- If statement
- For loop
- Switch
- While
- Try-Catch

Example:

```

see "if statement.." + nl
x = 1
if x = 1
    see "one" + nl
elseif x=2
    see "two" + nl
elseif x=3
    see "three" + nl
end
see "for loop.." + nl
for t = 1 to 10
    see t
end
see nl
see "switch..." + nl
x = 1

switch x
    on 1 see "one" + nl
    on 2 see "two" + nl
end

see "try catch..." + nl
try
    x = 1 / 0
catch
    see "catching error" + nl
end

```

Output:

```

if statement..
one
for loop..
12345678910
switch...
one
try catch...
catching error

```

39.10 Using braces to start and end different control structures

We can use braces { } to start and end different control structures

- If statement
- For loop
- Switch
- While
- Try-Catch

Example:

```

see "if statement.." + nl
x = 1
if x = 1 {
    see "one" + nl
elseif x=2
    see "two" + nl
elseif x=3
    see "three" + nl
}
see "for loop.." + nl
for t = 1 to 10 {
    see t
}
see nl
see "switch..." + nl
x = 1

switch x {
    on 1 see "one" + nl
    on 2 see "two" + nl
}

see "try catch..." + nl
try {
    x = 1 / 0
catch
    see "catching error" + nl
}

```

Output:

```

if statement..
one
for loop..
12345678910
switch...
one
try catch...
catching error

```

39.11 Using ‘put’ and ‘get’ as ‘see’ and ‘give’

We can replace the ‘see’ keyword with the ‘put’ keyword.

Also we can replace the ‘give’ keyword with the ‘get’ keyword.

Example:

```

put "Hello World" + nl
put "Enter Your Name ? " Get Name
Put "Hello " + Name

```

39.12 Using ‘case’ as ‘on’ in switch statements

We can replace the ‘on’ keyword with ‘case’ keyword in the switch statement.

Example (1) :

```
for x=1 to 10
    switch x
        case 1 put "one" + nl
        case 2 put "two" + nl
        case 3 put "thre" + nl
        else put "else" + nl
    end
end
```

Example (2) :

```
for x=1 to 10 {
    switch x {
        case 1 put "one" + nl
        case 2 put "two" + nl
        case 3 put "thre" + nl
        else put "else" + nl
    }
}
```

39.13 Using ‘def’ as ‘func’ in functions/methods definition

We can use the ‘def’ keyword as the ‘func’ keyword to define functions and methods.

Example:

```
one() two()

def one put "one" + nl
def two put "two" + nl
```

39.14 Using braces { } in Packages/Classes/Functions

Example:

```
load "stdlib.ring"

import mypackage

new myclass {
    myfunc()
}

package mypackage
{
    class myclass
{}
```

(continues on next page)

(continued from previous page)

```

func myfunc
{
    print("Hello, World!\n")
}
}
```

39.15 Using ‘end’ keyword after Packages/Classes/Functions

Example:

```

import mypackage

new myclass {
    myfunc()
}

package mypackage
    class myclass
        def myfunc
            put "Hello, World!"
        end
    end
end
```

39.16 Using ‘endpackage’/‘endclass’/‘endfunc’ keywords after Packages/Classes/Functions

Example:

```

import mypackage

new myclass { myfunc() }

package mypackage
    class myclass
        func myfunc
            see "welcome" + nl
        endfunc
    endclass
endpackage
```

39.17 Ignore new lines after keywords

Starting from Ring 1.8 the compiler will ignore new lines after keywords that expect tokens after it

Example:

```
see
"
    Hello, World!
"
test()

func
=====
    Test
=====

?
"

Hello from the Test function

"
```

Output:

```
Hello, World!

Hello from the Test function
```

INTRODUCTION TO THE TYPE HINTS LIBRARY

In this chapter we will learn about the Type Hints Library

40.1 Why Type Hints?

Using this library we can add the type information to the source code which will be very useful for tools like

- Code Editors
- Static-Analysis

Note: Ring is a dynamic language, No type checking will be done by the compiler.

40.2 Example

The next example will use the Type Hints library

```
load "typehints.ring"

see sum(3,4) + nl ;
see sayHello("Mahmoud");

int func sum(int x,int y) {
    return x+y ;
}

string func sayHello(string name) {
    return "Hello " + name ;
}
```

40.3 User Types

The Type Hints library is very powerful and will support user types (Classes) automatically

Example:

```
load "typehints.ring"

import mypackage

test() { main([:one,:two,:three]) }

myclass func test() {
    see "Testing User Types!" + nl
    return new myclass
}

package mypackage {
    public class myclass {
        public static void func main(list args) {
            see "welcome" + nl
            see args
        }
    }
}
```

40.4 Using Types inside Code

Also you can use the types inside the code (not only the function prototype)

Example:

```
load "typehints.ring"

int      sum = sum(3,4)
string   msg = sayHello("Mahmoud")

see "Sum = " + sum + nl + msg + nl

int func sum(int x,int y) {
    return x+y ;
}

string func sayHello(string name) {
    return "Hello " + name ;
}
```

40.5 Rules

- To use the types in the function prototype you must use ‘(‘ and ‘)’ around parameters
- To use the types in the function code, You must set the variable value (Assignment).

The next types are defined by the library

```
# Low Level Types
char
unsigned
signed
int
short
long
float
double
void

# High Level Types
string
list
number
object

# Other
public
static
abstract
protected
override
```

CHAPTER
FORTYONE

THE TRACE LIBRARY AND THE INTERACTIVE DEBUGGER

In this chapter we will learn about the Trace Library and the Interactive Debugger

41.1 Loading the Trace library

To start using the Trace library, We must load it first!

```
load "tracelib.ring"
```

41.2 Trace All Events

The next example demonstrates the Trace library usage to trace all events.

```
# Trace All Events
trace(:AllEvents)

see "Hello, world!" + nl
see "Welcome" + nl
see "How are you?" +nl

mytest()

new myclass { mymethod() }

func mytest
    see "Message from mytest" + nl

class myclass
    func mymethod
        see "Message from mymethod" + nl
```

41.3 Trace control flow between functions

The next example demonstrates the Trace library usage to trace the control flow between functions.

```
Trace(:Functions)

test1()

func test1
    see :test1 + nl
    test2()

func test2
    see :test2 + nl
    see test3() + nl

func test3
    see :test3 + nl
    return "test 3 output"
```

41.4 Pass Error

The next example demonstrates the Trace library usage to pass an error!

```
Trace(:PassError)

test1()

func test1
    x = 10
    see :test1 + nl
    test2() # Runtime Error!
    see "We can continue!"
```

41.5 Interactive Debugger

The next example demonstrates the Trace library usage to use the Interactive Debugger

```
Trace(:Debugger)

test1()
see "good bye!" + nl

func test1
    x = 10
    see :test1 + nl
    t = 12
    test2() # Runtime Error!
    see "After Error!" +nl
    see "t = " see t see nl
    see "x = " see x see nl
```

41.6 Execute Program Line by Line

The next example demonstrates the Trace library usage to execute the program line by line!

```
Trace(:LineByLine)

test1()

func test1
    x = 10
    see :test1 + nl
    t = 12
    test2()
    see "After Error!" +nl
    see "t = " + t + nl
```

41.7 BreakPoint

The next example demonstrates the Trace library usage to stop at a breakpoint!

```
test1()

func test1
    x = 10
    see :test1 + nl
    t = 12
    BreakPoint()
    see "After breakpoint!" +nl
    see "t = " + t + nl
    see "End of program!" + nl
```

41.8 Disable BreakPoints

The next example demonstrates the Trace library usage and how to disable the Breakpoints!

```
NoBreakPoints()

test1()

func test1
    x = 10
    see :test1 + nl
    t = 12
    BreakPoint()
    see "After breakpoint!" +nl
    see "t = " + t + nl
    see "End of program!" + nl
```

41.9 Using the Interactive Debugger

The next example uses a Breakpoint to open the Interactive Debugger!

```
load "tracelib.ring"

test1()

func test1
    x = 10
    see :test1 + nl
    t = 12
    BreakPoint()
    see "After breakpoint!" +nl
    see "t = " + t + nl
    see "End of program!" + nl
```

Screen Shots:

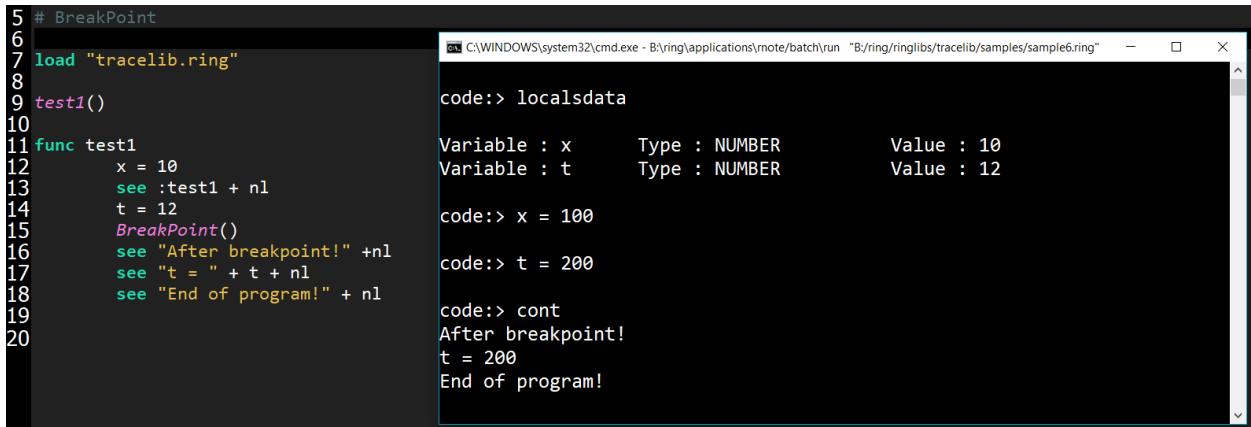
We have the Interactive Debugger at the Breakpoint!

```
5 # BreakPoint
6
7 load "tracelib.ring"
8
9 test1()
10
11 func test1
12     x = 10
13     see :test1 + nl
14     t = 12
15     BreakPoint()
16     see "After breakpoint!" +nl
17     see "t = " + t + nl
18     see "End of program!" + nl
19
20
```

We can print the variables values

```
6
7 load "tracelib.ring"
8
9 test1()
10
11 func test1
12     x = 10
13     see :test1 + nl
14     t = 12
15     BreakPoint()
16     see "After breakpoint!" +nl
17     see "t = " + t + nl
18     see "End of program!" + nl
19
20
```

We can change the variables values then continue execution



The screenshot shows the Ring Notepad interface. On the left, the code for `sample6.ring` is displayed:

```

5 # BreakPoint
6
7 load "tracelib.ring"
8
9 test1()
10
11 func test1
12     x = 10
13     see :test1 + nl
14     t = 12
15     BreakPoint()
16     see "After breakpoint!" +nl
17     see "t = " + t + nl
18     see "End of program!" + nl
19
20

```

To the right, the Ring Interactive Debugger window shows the state of variables and the execution flow:

```

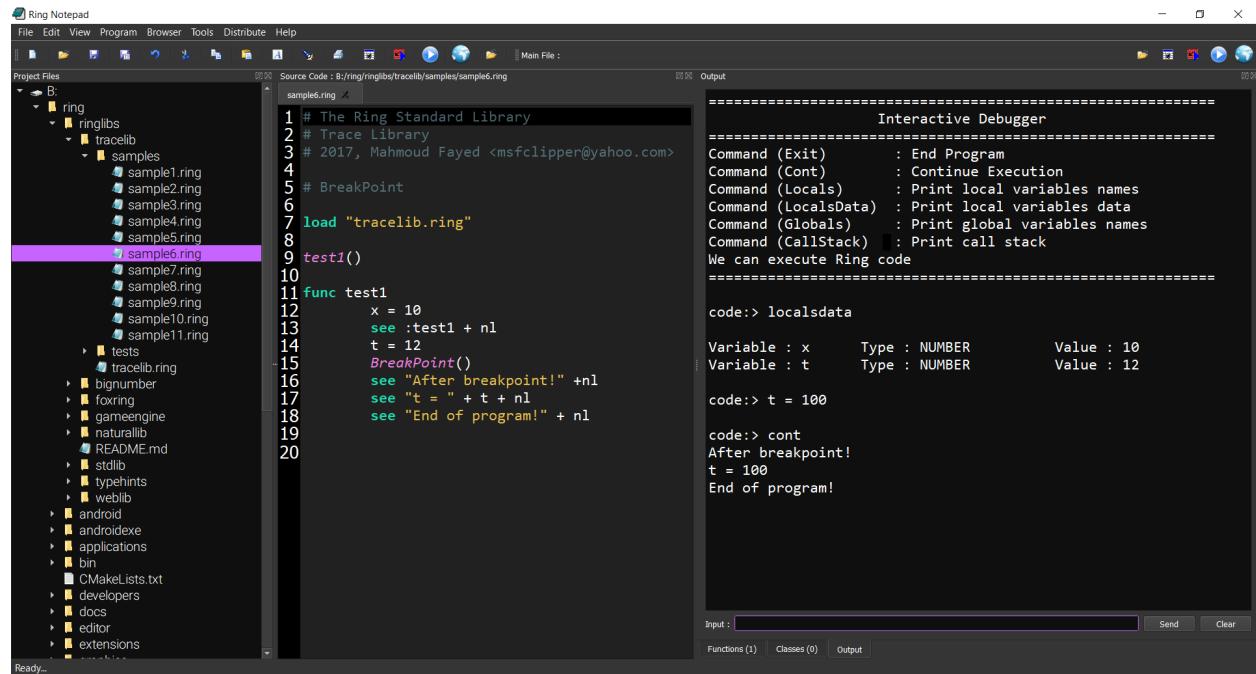
code:> localsdata

Variable : x      Type : NUMBER      Value : 10
Variable : t      Type : NUMBER      Value : 12

code:> x = 100
code:> t = 200
code:> cont
After breakpoint!
t = 200
End of program!

```

We can run the Interactive Debugger in the Output Window



CHAPTER
FORTYTWO

EMBEDDING RING IN RING

In this chapter we will learn about embedding Ring in Ring programs and applications.

42.1 Embedding Ring in Ring without sharing the State

From Ring 1.0 we already have functions for embedding Ring in the C language. Also we can execute Ring code inside Ring programs using the eval() function. In this release we provide functions for embedding Ring in Ring programs without sharing the state.

Advantages:

- (1) Quick integration for Ring programs and applications together without conflicts.
- (2) Execute and run Ring code in safe environments that we can trace.

Example:

```
pState = ring_state_init()
ring_state_runcode(pState, "See 'Hello, World!'+nl")
ring_state_runcode(pState, "x = 10")

pState2 = ring_state_init()
ring_state_runcode(pState2, "See 'Hello, World!'+nl")
ring_state_runcode(pState2, "x = 20")

ring_state_runcode(pState, "see x +nl")
ring_state_runcode(pState2, "see x +nl")

v1 = ring_state_findvar(pState, "x")
v2 = ring_state_findvar(pState2, "x")

see v1[3] + nl
see V2[3] + nl

ring_state_delete(pState)
ring_state_delete(pState2)
```

Output:

```
Hello, World!
Hello, World!
10
20
```

(continues on next page)

(continued from previous page)

10
20

42.2 Serial Execution of Programs

We can execute application after another application using ring_state_main()

Example:

```
chdir(exefolder()+"../applications/formdesigner")
ring_state_main('formdesigner.ring')
chdir(exefolder()+"../applications/cards")
ring_state_main('cards.ring')
```

42.3 ring_state_setvar()

Using ring_state_setvar() we can set variables value

The value could be (String, Number, List or C Pointer)

We need this function to quickly pass lists and C pointers to the Sub Ring Environment

Syntax:

```
ring_state_setvar(oState,cVariableName,Value)
```

Example:

```
load "guilib.ring"

myapp    = null
win      = null

func main
    myapp = new qApp {
        win = new QWidget() {
            setWindowTitle("Advanced Example on using ring_state_setvar()
←")
            move(100,100)
            resize(600,400)
            new QPushButton(win) {
                setText("Test")
                setClickEvent("Test()")
            }
            # We need this because using load 'guilib.ring' in
            # the sub environment
            # Will create timers by Qt and closing the window
            # will not be enough to close the application
            oFilter = new qAllEvents(win)
            oFilter.setCloseEvent("myapp.quit()")
            win.installeventfilter(oFilter)
            show()
        }
    }
```

(continues on next page)

(continued from previous page)

```

        exec()
    }

func test
    pState = ring_state_init()
    ring_state_runcode(pState, "load 'guilib.ring'")
    ring_state_runcode(pState, "x = NULL")
    # Pass String
        ring_state_setvar(pState, "x", "hello")
        ring_state_runcode(pState, "? x")
    # Pass Number
        ring_state_setvar(pState, "x", 100)
        ring_state_runcode(pState, "? x")
    # Pass List
        ring_state_setvar(pState, "x", ["one", "two", "three"])
        ring_state_runcode(pState, "? x")
    # Pass Object
    # We can't pass the Ring Object (win)
    # Because Objects store pointers to the Class Information
    # And the class is related to the Parent Ring Environment
    # And the sub Ring environment can't access it
    # But we can pass C pointers like win.pObject
        ring_state_setvar(pState, "x", win.pObject)
    # Now we create the object again but using the same C pointer
    # So we have access to the Same window in the parent Ring environment
        ring_state_runcode(pState, "
            new QWidget {
                pObject = x
                setWindowTitle('Message from the Sub Ring Environment
        ↵')
            }
        ")
    ring_state_delete(pState)

```

42.4 ring_state_new() and ring_state_mainfile()

Using `ring_state_new()` and `ring_state_mainfile()` we can run Ring programs from Ring programs

But unlike `ring_state_main()`, Here we can control when to delete the Ring state!

This is important when we run GUI programs from GUI programs

Because they will share the GUI Library (RingQt), And In this case the caller will call

`qApp.Exec()`

So the sub program, will not stop and will return to the Main program

Here deleting the State of the sub programs will lead to a problem when we run the sub program events

So keeping the state is important for sub GUI programs hosted in GUI programs.

Example:

```

load "guilib.ring"

func main

```

(continues on next page)

(continued from previous page)

```

new qApp {
    win = new QWidget() {
        setWindowTitle("Test ring_state_mainfile()")
        resize(400,400) move(100,100)
        btn = new QPushButton(Win) {
            settext("test")
            setclickevent("mytest()")
        }
        show()
    }
    exec()
}

func mytest
    pState = ring_state_new()
    ring_state_mainfile(pState, "runprogram.ring")
    # Here we don't delete the state if we will run GUI application
    # So we can run the GUI application events
    // ring_state_delete(pState)

```

If you will use this feature, remember to update the previous example based on your application needs

So you can call `ring_state_delete()` at some point to avoid the memory leak!

42.5 Runtime Errors when Embedding Ring in Ring

Starting from Ring 1.8

When embedding Ring in Ring, the error in the hosted environment will not close the host

Example:

```

? "Start the test!"

pState = ring_state_init()

ring_state_runcode(pState, " ? 'Let us try having an error' ? x")

ring_state_delete(pState)

? ""
? "End of test!"

```

Output:

```

Start the test!
Let us try having an error

Line 1 Error (R24) : Using uninitialized variable : x
in file Ring_EMBEDDEDCode
End of test!

```

42.6 ring_state_filetokens() function

Starting from Ring 1.12 we have the `ring_state_filetokens()` function

Using this function we can get all the tokens in the ring source code file.

```
C_FILENAME      = "test_tokens.ring"
C_WIDTH        = 12

# write the file
write(C_FILENAME, '
    see "Hello, World!"
    ? 3*2+3
    Name = "Ring"
    ? Name
')

# Token Type
C_KEYWORD      = 0
C_OPERATOR     = 1
C_LITERAL      = 2
C_NUMBER       = 3
C_IDENTIFIER   = 4
C_ENDLINE      = 5

# Keywords List
aKeywords = ["IF", "TO", "OR", "AND", "NOT", "FOR", "NEW", "FUNC",
"FROM", "NEXT", "LOAD", "ELSE", "SEE", "WHILE", "OK", "CLASS", "RETURN", "BUT",
"END", "GIVE", "BYE", "EXIT", "TRY", "CATCH", "DONE", "SWITCH", "ON", "OTHER", "OFF",
"IN", "LOOP", "PACKAGE", "IMPORT", "PRIVATE", "STEP", "DO", "AGAIN", "CALL", "ELSEIF",
"PUT", "GET", "CASE", "DEF", "ENDFUNC", "ENDCLASS", "ENDPACKAGE",
"CHANGERINGKEYWORD", "CHANGERINGOPERATOR", "LOADSYNTAX"]

pState = ring_state_new()
aList = ring_state_filetokens(pState, C_FILENAME)
PrintTokens(aList)
ring_state_delete(pState)

func PrintTokens aList
    for aToken in aList
        switch aToken[1]
        on C_KEYWORD
            ? Width("Keyword",C_WIDTH) + ":" + aKeywords[0+aToken[2]]
        on C_OPERATOR
            ? Width("Operator",C_WIDTH) + ":" + aToken[2]
        on C_LITERAL
            ? Width("Literal",C_WIDTH) + ":" + aToken[2]
        on C_NUMBER
            ? Width("Number",C_WIDTH) + ":" + aToken[2]
        on C_IDENTIFIER
            ? Width("Identifier",C_WIDTH) + ":" + aToken[2]
        on C_ENDLINE
            ? "EndLine"
        off
    next

func Width cText,nWidth
    return cText+copy(" ",nWidth-len(cText))
```

Output:

```
EndLine
Keyword      : SEE
Literal       : Hello, World!
EndLine
Operator     : ?
Number       : 3
Operator     : *
Number       : 2
Operator     : +
Number       : 3
EndLine
Identifier   : name
Operator     : =
Literal       : Ring
EndLine
Operator     : ?
Identifier   : name
EndLine
```

CHAPTER
FORTYTHREE

STDLIB FUNCTIONS

In this chapter we are going to learn about functions in the stdlib.ring

Before using the functions in the library, We must load the library first

```
load "stdlib.ring"
```

Instead of using stdlib.ring we can use stdlibcore.ring

Using stdlibcore.ring we can use the StdLib functions (Without Classes)

This is useful when developing standalone console applications

Because using stdlib.ring (functions & classes) will load libraries like RingLibCurl, RingOpenSSL, etc.

43.1 Puts() function

print the value then print new line (nl)

Syntax:

```
puts(expr)
```

Example:

```
Load "stdlib.ring"
```

```
Puts("Hello, World!")
```

43.2 Print() function

print string - support \n,\t and \r

Also we can use #{variable_name} to insert variables values.

Syntax:

```
print(string) ---> String
```

Example:

```
print("\nHello, World\n\nHow are you? \t\t I'm fine!\n")
x=10 y=20
print("\nx value = #{x} , y value = #{y} \n")
```

43.3 Print2Str() Function

Syntax:

```
print2Str(string) ---> String
```

Example:

```
world = "World!"
mystring = print2str("Hello, #{world} \nIn Year \n#{2000+17} \n")

see mystring + nl
```

Output:

```
Hello, World!
In Year
2017
```

43.4 GetString() function

Get input from the keyboard - return value as string

```
getstring() ---> string
```

43.5 GetNumber() function

Get input from the keyboard - return value as number

```
getnumber() ---> number
```

43.6 AppPath() function

Get the path of the application folder

Syntax:

```
AppPath() ---> The path as String
```

Example:

```
Load "stdlib.ring"

# Application Path
Puts("Test AppPath() ")
See AppPath() + nl
```

43.7 JustFilePath() function

Get the path of the file, remove the file name.

Syntax:

```
JustFilePath(cFile) ---> The path as String
```

Example:

```
load "stdlib.ring"

see justfilePath("b:\ring\applications\rnote\rnote.ring")
```

Output:

```
b:\ring\applications\rnote\
```

43.8 JustFileName() function

Get the file, remove the file path.

Syntax:

```
JustFileName(cFile) ---> The file name as String
```

Example:

```
load "stdlib.ring"

see justfileName("b:\ring\applications\rnote\rnote.ring")
```

Output:

```
rnote.ring
```

43.9 Value() function

create a copy from a list or object

Syntax:

```
value(List) ---> new list
```

Example:

```
Load "stdlib.ring"

aList = 1:10
del(value(aList),1) # delete first item
see aList           # print numbers from 1 to 10
```

43.10 Times() function

Execute a Function nCount times

Syntax:

```
Times(nCount,function)
```

Example:

```
Load "stdlib.ring"

Puts("Test Times()")
Times( 3 , func { see "Hello, World!" + nl } )
```

43.11 Map() function

Execute a Function on each list item

Syntax:

```
Map(alist,function) ---> List
```

Example:

```
Load "stdlib.ring"

Puts("Test Map()")
See Map( 1:10, func x { return x*x } )
```

43.12 Filter() function

Execute a Function on each list item to filter items

Syntax:

```
Filter(alist,function) ---> List
```

Example:

```
Load "stdlib.ring"

Puts("Test Filter()")
See Filter( 1:10 , func x { if x <= 5 return true else return false } )
```

43.13 Split() function

Convert string words to list items

Syntax:

```
Split(cstring,delimiter) ---> List
```

Example:

```
Load "stdlib.ring"

Puts("Test Split()")
See Split("one two three four five"," ")
```

43.14 SplitMany() function

Convert string words to list items. Allow many delimiters.

Syntax:

```
SplitMany(cstring,delimiters as string or list) ---> List
```

Example:

```
Load "stdlib.ring"

Puts("Test SplitMany()")
See SplitMany("one,two,three,four and five","","")
```

43.15 Capitalized() function

Return a copy of a string with the first letter capitalized

Syntax:

```
Capitalized(string) ---> string
```

Example:

```
Load "stdlib.ring"

Puts("Test Capitalized()")
See capitalized("welcome to the Ring Programming Language")
```

43.16 IsSpecial() function

Check whether a character is special or not

Syntax:

```
IsSpecial(char) ---> True/False
```

Example:

```
Load "stdlib.ring"

Puts("Test Isspecial()")
See "Isspecial = " + isSpecial("%") + nl
```

43.17 IsVowel() function

Check whether a character is vowel or not

Syntax:

```
IsVowel(char) ---> True/False
```

Example:

```
Load "stdlib.ring"

Puts("Test Isvowel()")
See "Isvowel = " + isVowel("c") + nl
```

43.18 LineCount() function

Return the lines count in a text file.

Syntax:

```
LineCount(cFileName) ---> Lines Count as number
```

Example:

```
Load "stdlib.ring"

Puts("Test Linecount()")
See "the number of lines = " + lineCount("test.ring")
```

43.19 Factorial() function

Return the factorial of a number

Syntax:

```
Factorial(number) ---> number
```

Example:

```
Load "stdlib.ring"

Puts("Test Factorial()")
see "6 factorial is : " + Factorial(6)
```

43.20 Fibonacci() function

Return the fibonacci number

Syntax:

```
Fibonacci(number) ---> number
```

Example:

```
Load "stdlib.ring"

Puts("Test Fibonacci()")
see "6 Fibonacci is : " + Fibonacci(6)
```

43.21 IsPrime() function

Check whether a number is prime or not

Syntax:

```
isprime(number) ---> Number
```

Example:

```
Load "stdlib.ring"

Puts("Test Isprime()")
if isPrime(16) see "16 is a prime number"
else see "16 is not a prime number" ok
```

43.22 Sign() function

Returns an integer value indicating the sign of a number.

Syntax:

```
Sign(number) ---> number (-1 = negative, 0, 1 (positive))
```

Example:

```
Load "stdlib.ring"

Puts("Test Sign()")
see "sign of 12 is = " + sign(12) + nl
```

43.23 List2File() function

Write list items to text file (each item in new line).

Syntax:

```
List2File(aList,cFileName)
```

Example:

```
Load "stdlib.ring"

# Test List2File
Puts("Test List2File()")
list2file(1:100,"myfile.txt")
```

43.24 File2List() function

Read text file and convert lines to list items

Syntax:

```
File2List(cFileName) ---> List
```

Example:

```
Load "stdlib.ring"

# Test File2List
Puts("Test File2List()")
see len(file2list("myfile.txt"))
```

43.25 StartsWith() function

Returns true if the given string starts with the specified substring.

Leading white spaces are ignored.

Syntax:

```
StartsWith(string, substring) ---> True/False
```

Example:

```
Load "stdlib.ring"

Puts("Test Startswith()")
see Startswith("CalmoSoft", "Calmo") + nl
```

43.26 EndsWith() function

Returns true if the given string ends with the specified substring.

Trailing white spaces are ignored.

Syntax:

```
EndsWith(string, substring) ---> True/False
```

Example:

```
Load "stdlib.ring"

Puts("Test Endswith()")
see endsWith("CalmoSoft", "Soft") + nl
```

43.27 GCD() function

Finding of the greatest common divisor of two integers.

Syntax:

```
Gcd(number, number) ---> number
```

Example:

```
Load "stdlib.ring"
Puts("Test Gcd()")
see gcd(24, 32) + nl
```

43.28 LCM() function

Compute the least common multiple of two integers.

Syntax:

```
lcm(number, number) ---> number
```

Example:

```
Load "stdlib.ring"
Puts("Test Lcm()")
see Lcm(24, 36) + nl
```

43.29 SumList() function

Compute the sum of a list of integers.

Syntax:

```
sumlist(list) ---> number
```

Example:

```
Load "stdlib.ring"
Puts("Test Sumlist()")
aList = [1, 2, 3, 4, 5]
see Sumlist(aList) + nl
```

43.30 ProdList() function

Compute the product of a list of integers.

Syntax:

```
prodlist(list) ---> number
```

Example:

```
Load "stdlib.ring"

Puts("Test Prodlist()")
aList = [1,2,3,4,5]
see Prodlist(aList) + nl
```

43.31 EvenOrOdd() function

Test whether an integer is even or odd.

Result of test (1=odd 2=even).

Syntax:

```
evenorodd(number) ---> 1 (odd) or 2 (even)
```

Example:

```
Load "stdlib.ring"

Puts("Test Evenorodd()")
nr = 17
see Evenorodd(nr) + nl
```

43.32 Factors() function

Compute the factors of a positive integer.

Syntax:

```
factors(number) ---> list
```

Example:

```
Load "stdlib.ring"

Puts("Test Factors()")
n = 45
aList = factors(n)
see "Factors of " + n + " = "
for i = 1 to len(aList)
    see "" + aList[i] + " "
next
```

43.33 IsPalindrome() function

Check if a sequence of characters is a palindrome or not.

Syntax:

```
IsPalindrome(String) ---> True/False
```

Example:

```
Load "stdlib.ring"

Puts("Test IsPalindrome()")
cString = "radar"
see IsPalindrome(cString)
```

43.34 IsLeapYear() function

Check whether a given year is a leap year in the Gregorian calendar.

Syntax:

```
Isleapyear(number) ---> True/False
```

Example:

```
Load "stdlib.ring"

Puts("Test Isleapyear()")
year = 2016
if Isleapyear(year) see "" + year + " is a leap year."
else see "" + year + " is not a leap year." ok
```

43.35 BinaryDigits() function

Compute the sequence of binary digits for a given non-negative integer.

Syntax:

```
binarydigits(number) ---> string
```

Example:

```
Load "stdlib.ring"

Puts("Test Binarydigits()")
b = 35
see "Binary digits of " + b + " = " + Binarydigits(b)
```

43.36 MatrixMulti() function

Multiply two matrices together.

Syntax:

```
Matrixmulti(List, List) ---> List
```

Example:

```
Load "stdlib.ring"

# Multiply two matrices together.
Puts("Test Matrixmulti()")
A = [[1,2,3], [4,5,6], [7,8,9]]
B = [[1,0,0], [0,1,0], [0,0,1]]
see Matrixmulti(A, B)
```

43.37 MatrixTrans() function

Transpose an arbitrarily sized rectangular Matrix.

Syntax:

```
Matrixtrans(List) ---> List
```

Example:

```
Load "stdlib.ring"

# Transpose an arbitrarily sized rectangular Matrix.
Puts("Test Matrixtrans()")
matrix = [[78,19,30,12,36], [49,10,65,42,50], [30,93,24,78,10], [39,68,27,64,29]]
see Matrixtrans(matrix)
```

43.38 DayOfWeek() function

Return the day of the week of given date. (yyyy-mm-dd)

Syntax:

```
dayofweek(string) ---> string
```

Example:

```
Load "stdlib.ring"

# Return the day of the week of given date.
Puts("Test Dayofweek()")
date = "2016-04-24"
see "Data : " + date + " - Day : " + Dayofweek(date) + nl
```

43.39 Permutation() function

Generates all permutations of n different numerals.

Syntax:

```
permutation(list)
```

Example:

```
Load "stdlib.ring"

# Generates all permutations of n different numerals
Puts("Test Permutation()")
list = [1, 2, 3, 4]
for perm = 1 to 24
    for i = 1 to len(list)
        see list[i] + " "
    next
    see nl
    Permutation(list)
next
```

43.40 ReadLine() function

Read line from file

Syntax:

```
readline(fp) ---> string
```

Example:

```
Load "stdlib.ring"

# Read a file line by line.
Puts("Test Readline()")
fp = fopen("test.ring", "r")
while not feof(fp)
See Readline(fp) end
fclose(fp)
```

43.41 SubString() function

Return a position of a substring starting from a given position in a string.

Syntax:

```
Substring(str, substr, npos) ---> string
```

Example:

```
Load "stdlib.ring"

# Return a position of a substring starting from a given position in a string.
Puts("Test Substring()")
a = "abcdefghijklmnopqrstuvwxyz"
b = "abc"
i = 4
see substring(a,b,i)
```

43.42 ChangeString() function

Change substring from given position to a given position with another substring.

Syntax:

```
Changestring(cString, nPos1, nPos2, cSubstr) ---> cString
```

Example:

```
Load "stdlib.ring"

# Change substring from given position for given position with a substring.
Puts("Test Changestring()")
see Changestring("Rmasdg",2,5,"in")      # Ring
```

43.43 Sleep() function

Sleep for the given amount of time.

Syntax:

```
sleep(nSeconds)
```

Example:

```
Load "stdlib.ring"

Puts("Test Sleep()")
see "Wait 3 Seconds!"
Sleep(3)
see nl
```

43.44 IsMainSourceFile() function

Check if the current file is the main source file

Syntax:

```
IsMainSourceFile() ---> True/False
```

Example:

```
Load "stdlib.ring"

if ismainsourcefile()
    # code
ok
```

43.45 DirExists() function

Check if directory exists

Syntax:

```
DirExists(String) ---> True/False
```

Example:

```
Load "stdlib.ring"

see "Check dir : b:\ring"
puts( DirExists("b:\ring") )
see "Check dir : C:\ring"
Puts( DirExists("C:\ring") )
```

43.46 MakeDir() function

Make Directory

Syntax:

```
MakeDir(String)
```

Example:

```
Load "stdlib.ring"

# Create Directory
puts("create Directory : myfolder")
makedir("myfolder")
```

43.47 Fsize() function

The function return the file size in bytes.

Syntax:

```
FSize(File Handle) ---> Number (File Size in Bytes)
```

43.48 TrimAll() function

Remove all spaces and tabs characters from a string

Syntax:

```
TrimAll(cString) ---> cString # Without Spaces and Tabs
```

43.49 TrimLeft() function

Remove all spaces and tabs characters from the left side of a string

Syntax:

```
TrimLeft(cString) ---> cString # Without Spaces and Tabs from the left side
```

43.50 TrimRight() function

Remove all spaces and tabs characters from the right side of a string

Syntax:

```
TrimRight(cString) ---> cString # Without Spaces and Tabs from the right side
```

43.51 EpochTime() function

Return the Epoch Time

Syntax:

```
EpochTime(cDate, cTime) ---> nEpochTime
```

Example:

```
see EpochTime( Date(), Time() )
```

43.52 SystemCmd() Function

We can execute system commands using the SystemCmd() function that outputs to a variable

Syntax:

```
SystemCmd(cCommand)
```

Example:

```
cYou = SystemCmd("whoami")      # User Name logged in is output to a variable
cThem = SystemCmd("dir c:\Users") # Directory List is output to a variable
```

43.53 ListAllFiles() Function

Using this function we can quickly do a process on a group of files in a folder and it's sub folders.

Syntax:

```
ListAllFiles(cFolder,cExtension) ---> List of Files
```

Example:

```
aList = ListAllFiles("c:/ring/ringlibs","ring") # *.ring only
aList = sort(aList)
see aList
```

Example:

```
see listallfiles("b:/ring/libraries/weplib","","") # All Files
```

43.54 SystemSilent() Function

We can execute system commands using the SystemSilent() function to avoid displaying the output!

Syntax:

```
SystemSilent (cCommand)
```

43.55 OSCreateOpenFolder() Function

Create folder then change the current folder to this new folder

Syntax:

```
OSCreateOpenFolder(cCommand)
```

43.56 OSCopyFolder() Function

Copy folder to the current folder

Parameters : The path to the parent folder and the folder name to copy

Syntax:

```
OSCopyFolder(cParentFolder,cFolderName)
```

Example

To copy the folder b:\ring\ringlibs\stdlib to the current folder

```
OSCopyFolder("b:\\ring\\ringlibs\\","stdlib")
```

43.57 OSDeleteFolder() Function

Delete Folder in the current Directory

Syntax:

```
OSDeleteFolder(cFolderName)
```

43.58 OSCopyFile() Function

Copy File to the current directory

Syntax:

```
OSCopyFile(cFileName)
```

43.59 OSDeleteFile() Function

Delete File

Syntax:

```
OSDeleteFile(cFileName)
```

43.60 OSRenameFile() Function

Rename File

Syntax:

```
OSRenameFile(cOldFileName,cNewFileName)
```

43.61 List2Code() Function

This function convert a Ring list during the runtime to Ring source code that we can save to source files.

The list may contains strings, numbers or sub lists.

Example:

```
load "stdlibcore.ring"
aList = 1:10
? list2Code(aList)
```

Output:

```
[  
    1, 2, 3, 4, 5, 6, 7, 8, 9, 10  
]
```

43.62 Str2ASCIIList()

Convert a string of bytes to a list of numbers where each item represent the ASCII code of one byte in the string.

Syntax:

```
Str2ASCIIList(String) ---> List of numbers
```

43.63 ASCIIList2Str()

Convert a list of numbers where each item represent the ASCII code of one byte to a string of bytes.

Syntax:

```
ASCIIList2Str(List of numbers) ---> String
```

Example:

```
load "stdlibcore.ring"

cStr = "MmMm"

aList = Str2ASCIIList(cStr)
? aList

cStr2 = ASCIIList2Str(aList)
? cStr2
? len(cStr2)
```

Output:

```
77
109
77
109
```

(continues on next page)

(continued from previous page)

```
MmMm
4
```

43.64 IsListContainsItems()

Syntax:

```
IsListContainsItems(aParent,aChild) ----> True/False
```

Example:

```
load "stdlibcore.ring"
aList1 = "a":"z"
aList2 = [:h,:l,:p,:u]
? IsListContainsItems(aList1,aList2)
```

43.65 IsBetween()

Syntax:

```
IsBetween(nNumber,nMin,nMax) ----> True/False
```

Example:

```
load "stdlibcore.ring"
? isBetween(1,3,4)
? isBetween(1,-3,4)
? isBetween(4,1,6)
? isBetween(4,3,4)
```

43.66 TimeInfo()

Syntax:

```
TimeInfo(cInformation) ----> String
```

The cInformation value could be

```
:hour_24
:hour_12
:minutes
:seconds
:time
:day_short
:day_long
:month_short
:month_long
:date_time
```

(continues on next page)

(continued from previous page)

```
:day
:day_year
:month_year
:am_pm
:week_year
:day_week
:date
:year_century
:year
:time_zone
:percent_sign
```

Example:

```
load "stdlibcore.ring"
? timeInfo(:date)
? timeInfo(:time)
? timeInfo(:hour_12)
```

CHAPTER
FORTYFOUR

STDLIB CLASSES

In this chapter we are going to learn about the classes in the stdlib.ring

- StdBase Class
- String Class
- List Class
- Stack Class
- Queue Class
- HashTable Class
- Tree Class
- Math Class
- DateTime Class
- File Class
- System Class
- Debug Class
- DataType Class
- Conversion Class
- ODBC CClass
- MySQL Class
- SQLite Class
- PostgreSQL Class
- Security Class
- Internet Class

44.1 StdBase Class

Attributes:

- vValue : Object Value

Methods:

Method	Description/Output
Init(x)	Set vValue Attribute to x value
Print()	Print vValue
PrintLn()	Print vValue then New Line
Size()	return number represent the size of vValue
Value()	return vValue
Set(x)	Call Init(x)

44.2 String Class

Parent Class : StdBase Class

Methods:

Method	Description/Output
Init(String Number List)	
Lower()	New String - Lower case characters
Upper()	New String - Upper case characters
Left(x)	New String - contains x characters from the left
Right(x)	New String - contains x characters from the right
Lines()	Number - Lines count
Trim()	New String - Remove Spaces
Copy(x)	New String - repeat string x times
strcmp(cString)	Compare string with cString
tolist()	List (String Lines to String Items)
tofile(cFileName)	Write string to file
mid(nPos1,nPos2)	New String - from nPos1 to nPos2
getfrom(nPos1)	New String - from nPos1 to the end of the string
replace(cStr1,cStr2,lCase)	New String - Replace cStr1 with cStr2 , lCase (True=Match Case)
split()	List - Each Word as list item
startswith(substring)	Return true if the start starts with a substring
endswith(substring)	Return true if the start ends with a substring

Example:

```

Load "stdlib.ring"

See "Testing the String Class" + nl
oString = new string("Hello, World!")
oString.println()
oString.upper().println()
oString.lower().println()
oString.left(5).println()

```

(continues on next page)

(continued from previous page)

```

oString.right(6).println()
oString = new string("Hi" + nl + "Hello" )
See oString.lines() + nl
oString = new string("      Welcome      ")
oString.println()
oString.trim().println()
oString = new string("Hello! ")
oString.copy(3).println()
see oString.strptime("Hello! ") + nl
see oString.strptime("Hello ") + nl
see oString.strptime("Hello!! ") + nl
oString = new string(["one", "two", "three"])
oString.print()
see oString.lines() + nl
oString = new String(1234)
oString.println()
oString = new String("one"+nl+"two"+nl+"three")
aList = oString.tolist()
see "List Items" + nl See aList
oString = new String( "Welcome to the Ring programming language")
See "the - position : " + oString.pos("the") + nl
oString = oString.getfrom(oString.pos("Ring"))
oString.println()
oString.mid(1,4).println()
oString = oString.replace("Ring", "***Ring***", true)
oString.println()
oString = oString.replace("ring", "***Ring***", false)
oString.println()
oString1 = new string("First")
oString2 = new string("Second")
oString = oString1 + oString2
oString.println()
oString = oString1 * 3
oString.println()
for t in ostring see t next
oString.tofile("test.txt")
oString = new string("one two three")
see nl
see ostring.split()
oString {
    set("Hello") println()
    set("How are you?") println()
}

```

Output:

```

Testing the String Class
Hello, World!
HELLO, WORLD!
hello, world!
Hello
World!
2
      Welcome
Welcome
Hello! Hello! Hello!
0

```

(continues on next page)

(continued from previous page)

```

1
-1
one
two
three
4
1234
List Items
one
two
three
the - position : 12
Ring programming language
Ring
***Ring*** programming language
*****Ring***** programming language
FirstSecond
FirstFirstFirst
FirstFirstFirst
one
two
three
Hello
How are you?

```

44.3 List Class

Parent Class : StdBase Class

Methods:

Method	Description/Output
Init(StringList)	
Add(Value)	Add item to the list
Delete(nIndex)	Delete item from the list
Item(nIndex)	Get item from the list
First()	Get the first item in the list
Last()	Get the last item in the list
Set(nIndex,Value)	Set item value
FindInColumn(nCol,Value)	Find item in a column
Sort()	Sort items - return new list
Reverse()	Reverse items - return new list
Insert(nIndex,Value)	Inset Item after nIndex

example:

```

Load "stdlib.ring"

oList = new list ( [1,2,3] )
oList.Add(4)
oList.print()
see oList.item(1) + nl

```

(continues on next page)

(continued from previous page)

```

oList.delete(4)
oList.print()
see oList.first() + nl
see oList.last() + nl
oList { set(1,"one") set(2,"two") set(3,"three") print() }
see oList.find("two") + nl
oList.sort().print()
oList.reverse().print()
oList.insert(2,"nice")
oList.print()
oList = new list ( [ [1,"one"],[2,"two"],[3,"three"] ] )
see copy("*",10) + nl
oList.print()
see "Search two : " + oList.findincolumn(2,"two") + nl
see "Search 1 : " + oList.findincolumn(1,1) + nl
oList = new list ( [ "Egypt" , "USA" , "KSA" ] )
for x in oList
    see x + nl
next
oList = new list ( [1,2,3,4] )
oList + [5,6,7]
oList.print()
oList = new list ( ["one","two"] )
oList2 = new list ( ["three","four"] )
oList + oList2
oList.print()

```

output:

```

1
2
3
4
1
1
2
3
1
3
one
two
three
2
one
three
two
three
two
one
one
two
nice
three
*****
1
one
2

```

(continues on next page)

(continued from previous page)

```

two
3
three
Search two : 2
Search 1 : 1
Egypt
USA
KSA
1
2
3
4
5
6
7
one
two
three
four

```

44.4 Stack Class

Parent Class : List Class

Methods:

Method	Description/Output
Init(String Number List)	
Push(Value)	Push item to the stack
Pop()	Pop item from the stack
Print()	Print the stack items

example:

```

Load "stdlib.ring"

oStack = new Stack
oStack.push(1)
oStack.push(2)
oStack.push(3)
see oStack.pop() + nl
see oStack.pop() + nl
see oStack.pop() + nl
oStack.push(4)
see oStack.pop() + nl
oStack { push("one") push("two") push("three") }
oStack.print()

```

output:

```

3
2
1

```

(continues on next page)

(continued from previous page)

```
4
three
two
one
```

44.5 Queue Class

Parent Class : List Class

Methods:

Method	Description/Output
Init(String Number List)	
Remove()	Remove item from the Queue.

example:

```
Load "stdlib.ring"

oQueue = new Queue
oQueue.add(1)
oQueue.add(2)
oQueue.add(3)
see oQueue.remove() + nl
see oQueue.remove() + nl
see oQueue.remove() + nl
oQueue.add(4)
see oQueue.remove() + nl
oQueue { add("one") add("two") add("three") }
oQueue.print()
```

output:

```
1
2
3
4
one
two
three
```

44.6 HashTable Class

Parent Class : List Class

Methods:

Method	Description/Output
Init(List)	
Add(cKey,Value)	Add item to the HashTable
Set(cKey,Value)	Set item value using the Key
GetValue(cKey)	Get item value using the Key
Contains(cKey)	Check if the HashTable contains item using the Key
Index(cKey)	Get the item index using the Key

example:

```
Load "stdlib.ring"

ohashhtable = new hashtable
See "Test the hashtable Class Methods" + nl
ohashhtable {
    Add("Egypt", "Cairo")
    Add("KSA", "Riyadh")
    see self["Egypt"] + nl
    see self["KSA"] + nl
    see contains("Egypt") + nl
    see contains("USA") + nl
    see index("KSA") + NL
    print()
    delete(index("KSA"))
    see copy("*", 60) + nl
    print()
}
```

output:

```
Test the hashtable Class Methods
Cairo
Riyadh
1
0
2
Egypt
Cairo
KSA
Riyadh
*****
Egypt
Cairo
```

44.7 Tree Class

Data:

Attribute	Description
Data	Node Value
Children	Children List

Methods:

Method	Description/Output
set(value)	Set the node value.
value()	Get the node value.
Add(value)	Add new child.
parent()	Get the parent node.
print()	Print the tree nodes.

example:

```
Load "stdlib.ring"

otree = new tree
See "Test the tree Class Methods" + nl
otree {
    set("The first step")    # set the root node value
    see value() + nl
    Add("one")
    Add("two")
    Add("three") {
        Add("3.1")
        Add("3.2")
        Add("3.3")
        see children
    }
    see children
    oTree.children[2] {
        Add("2.1") Add("2.2") Add("2.3") {
            Add("2.3.1") Add("2.3.2") Add("test")
        }
    }
    oTree.children[2].children[3].children[3].set("2.3.3")
}
see copy("*", 60) + nl
oTree.print()
```

output:

```
Test the tree Class Methods
The first step
data: 3.1
parent: List...
children: List...
data: 3.2
parent: List...
children: List...
data: 3.3
parent: List...
children: List...
data: one
parent: List...
children: List...
data: two
parent: List...
children: List...
data: three
parent: List...
```

(continues on next page)

(continued from previous page)

```
children: List...
*****
one
two
2.1
2.2
2.3
2.3.1
2.3.2
2.3.3
three
3.1
3.2
3.3
```

44.8 Math Class

Methods:

Method	Description
sin(x)	Returns the sine of an angle of x radians
cos(x)	Returns the cosine of an angle of x radians
tan(x)	Returns the tangent of an angle of x radians
asin(x)	Returns the principal value of the arc sine of x, expressed in radians
acos(x)	Returns the principal value of the arc cosine of x, expressed in radians
atan(x)	Returns the principal value of the arc tangent of x, expressed in radians
atan2(y,x)	Returns the principal arc tangent of y/x, in the interval [-pi,+pi] radians
sinh(x)	Returns the hyperbolic sine of x radians
cosh(x)	Returns the hyperbolic cosine of x radians
tanh(x)	Returns the hyperbolic tangent of x radians
exp(x)	Returns the value of e raised to the xth power
log(x)	Returns the natural logarithm of x
log10(x)	Returns the common logarithm (base-10 logarithm) of x
ceil(x)	Returns the smallest integer value greater than or equal to x
floor(x)	Returns the largest integer value less than or equal to x
fabs(x)	Returns the absolute value of x.
pow(x,y)	Returns x raised to the power of y
sqrt(x)	Returns the square root of x
random(x)	Returns a random number in the range [0,x]
unsigned(n,n,c)	Perform operation using unsigned numbers
decimals(n)	Determine the decimals digits after the point in float/double numbers

example:

```
Load "stdlib.ring"
oMath = new Math

See "Test the Math Class Methods" + nl
See "Sin(0) = " + oMath.sin(0) + nl
```

(continues on next page)

(continued from previous page)

```

See "Sin(90) radians = " + oMath.sin(90) + nl
See "Sin(90) degree = " + oMath.sin(90*3.14/180) + nl

See "Cos(0) = " + oMath.cos(0) + nl
See "Cos(90) radians = " + oMath.cos(90) + nl
See "Cos(90) degree = " + oMath.cos(90*3.14/180) + nl

See "Tan(0) = " + oMath.tan(0) + nl
See "Tan(90) radians = " + oMath.tan(90) + nl
See "Tan(90) degree = " + oMath.tan(90*3.14/180) + nl

See "asin(0) = " + oMath.asin(0) + nl
See "acos(0) = " + oMath.acos(0) + nl
See "atan(0) = " + oMath.atan(0) + nl
See "atan2(1,1) = " + oMath.atan2(1,1) + nl

See "sinh(0) = " + oMath.sinh(0) + nl
See "sinh(1) = " + oMath.sinh(1) + nl
See "cosh(0) = " + oMath.cosh(0) + nl
See "cosh(1) = " + oMath.cosh(1) + nl
See "tanh(0) = " + oMath.tanh(0) + nl
See "tanh(1) = " + oMath.tanh(1) + nl

See "exp(0) = " + oMath.exp(0) + nl
See "exp(1) = " + oMath.exp(1) + nl
See "log(1) = " + oMath.log(1) + nl
See "log(2) = " + oMath.log(2) + nl
See "log10(1) = " + oMath.log10(1) + nl
See "log10(2) = " + oMath.log10(2) + nl
See "log10(10) = " + oMath.log10(10) + nl

See "Ceil(1.12) = " + oMath.Ceil(1.12) + nl
See "Ceil(1.72) = " + oMath.Ceil(1.72) + nl

See "Floor(1.12) = " + oMath.floor(1.12) + nl
See "Floor(1.72) = " + oMath.floor(1.72) + nl

See "fabs(1.12) = " + oMath.fabs(1.12) + nl
See "fabs(1.72) = " + oMath.fabs(1.72) + nl

See "pow(2,3) = " + oMath.pow(2,3) + nl

see "sqrt(16) = " + oMath.sqrt(16) + nl

for x = 1 to 20
    see "Random number Max (100) : " + oMath.random(100) + nl
next

x = 1.1234567890123
for d = 0 to 14
    oMath.decimals(d)
    see x + nl
next

cKey = "hello"

h = 0

```

(continues on next page)

(continued from previous page)

```

for x in cKey
    h = oMath.unsigned(h,ascii(x),"+")
    h = oMath.unsigned(h,oMath.unsigned(h,10,"<<"),"+")
    r = oMath.unsigned(h,6,>>")
    h = oMath.unsigned(h, r,"^")
next
h = oMath.unsigned(h,oMath.unsigned(h,3,"<<"),"+")
h = oMath.unsigned(h,oMath.unsigned(h,11,>>"),"+")
h = oMath.unsigned(h,oMath.unsigned(h,15,"<<"),"+")

see "Hash : " + h

```

output:

```

Test the Math Class Methods
Sin(0) = 0
Sin(90) radians = 0.89
Sin(90) degree = 1.00
Cos(0) = 1
Cos(90) radians = -0.45
Cos(90) degree = 0.00
Tan(0) = 0
Tan(90) radians = -2.00
Tan(90) degree = 1255.77
asin(0) = 0
acos(0) = 1.57
atan(0) = 0
atan2(1,1) = 0.79
sinh(0) = 0
sinh(1) = 1.18
cosh(0) = 1
cosh(1) = 1.54
tanh(0) = 0
tanh(1) = 0.76
exp(0) = 1
exp(1) = 2.72
log(1) = 0
log(2) = 0.69
log10(1) = 0
log10(2) = 0.30
log10(10) = 1
Ceil(1.12) = 2
Ceil(1.72) = 2
Floor(1.12) = 1
Floor(1.72) = 1
fabs(1.12) = 1.12
fabs(1.72) = 1.72
pow(2,3) = 8
sqrt(16) = 4
Random number Max (100) : 87
Random number Max (100) : 49
Random number Max (100) : 99
Random number Max (100) : 58
Random number Max (100) : 15
Random number Max (100) : 46
Random number Max (100) : 37
Random number Max (100) : 64

```

(continues on next page)

(continued from previous page)

```

Random number Max (100) : 73
Random number Max (100) : 35
Random number Max (100) : 89
Random number Max (100) : 80
Random number Max (100) : 20
Random number Max (100) : 33
Random number Max (100) : 44
Random number Max (100) : 89
Random number Max (100) : 82
Random number Max (100) : 94
Random number Max (100) : 83
Random number Max (100) : 68
1
1.1
1.12
1.123
1.1235
1.12346
1.123457
1.1234568
1.12345679
1.123456789
1.1234567890
1.12345678901
1.123456789012
1.1234567890123
1.12345678901230
Hash : 3372029979.0000000000000000

```

44.9 DateTime Class

Methods:

Method	Description/Output
clock()	The number of clock ticks from program start.
time()	Get the system time.
date()	Get the date.
timelist()	List contains the date and the time information.
adddays(cDate,nDays)	Return Date from cDate and after nDays
diffdays(cDate1,cDate2)	Return the Number of days (cDate1 - cDate2)

example:

```

Load "stdlib.ring"

oDateTime = new datetime

See "Test the datetime Class Methods" + nl

See "Calculate performance" + nl
t1 = oDateTime.clock()
for x = 1 to 1000000 next

```

(continues on next page)

(continued from previous page)

```

see oDateTime.clock() - t1 + nl

See "Time : " + oDateTime.time() + nl

See "Date : " + oDateTime.date() + nl

See oDateTime.TimeList()

See "Month Name : " + oDateTime.TimeList()[4]

cDate = oDateTime.date()
see cDate + nl
cDate = oDateTime.adddays(cDate, 10)
see cDate + nl

cDate1 = oDateTime.date()
see cDate1 + nl
cDate2 = oDateTime.adddays(cDate1, 10)
see cDate2 + nl
see "DiffDays = " + oDateTime.diffdays(cDate1, cDate2) + nl
see "DiffDays = " + oDateTime.diffdays(cDate2, cDate1) + nl

```

output:

```

Test the datetime Class Methods
Calculate performance
85
Time : 02:53:35
Date : 31/08/2016
Wed
Wednesday
Aug
August
08/31/16 02:53:35
31
02
02
244
08
53
AM
35
35
3
08/31/16
02:53:35
16
2016
Arab Standard Time
%
Month Name : August 31/08/2016
10/09/2016
31/08/2016
10/09/2016
DiffDays = -10
DiffDays = 10

```

44.10 File Class

Methods:

Method	Description/Output
read(cFileName)	Read the file content
write(cFileName,cStr)	Write string to file
dir(cFolderPath)	Get the folder contents (files & sub folders)
rename(cOld,cNew)	Rename files using the Rename() function
remove(cFileName)	Delete a file using the Remove() function
open(cFileName,cMode)	Open a file using the Fopen() function
close()	Close file
flush()	Flushes the output buffer of a stream
reopen(cFileName,cMode)	Open another file using the same file handle
tempfile()	Creates a temp. file (binary).
seek(noffset,n whence)	Set the file position of the stream
tell()	Know the current file position of a stream
rewind()	Set the file position to the beginning of the file
getpos()	Get handle to the current file position
setpos(poshandle)	Set the current file position
clearerr()	Clear the EOF error and the error indicators of a stream
eof()	Test the end-of-file indicator
error()	Test the error indicator
perror(cErrorMessage)	Print error message to the stderr
getc()	Get the next character from the stream
gets(nsize)	Read new line from the stream
putc(cchar)	Write a character to the stream
puts(cStr)	Write a string to the stream
ungetc(cchar)	Push a character to the stream
fread(nsize)	Read data from a stream
fwrite(cString)	Write data to a stream
exists(cFileName)	Check if a file exists

example:

```
Load "stdlib.ring"

ofile = new file

See "Test the file Class Methods" + nl
see ofile.read(filename())

see nl
ofile.open(filename(), "r")
see ofile.gets(100) + nl
ofile.close()
```

44.11 System Class

Methods:

Method	Description/Output
system()	Execute system commands
sysget()	Get environment variables
ismsdos()	Check if the operating system is MSDOS or not
iswindows()	Check if the operating system is Windows or not
iswindows64()	Check if the operating system is Windows 64bit or not
isunix()	Check if the operating system is Unix or not
ismacosx()	Check if the operating system is macOS or not
islinux()	Check if the operating system is Linux or not
isfreebsd()	Check if the operating system is FreeBSD or not
isandroid()	Check if the operating system is Android or not
windowsnl()	Get the windows new line string
sysargv()	Get the command line arguments passed to the ring script
filename()	Get the active source file

example:

```
Load "stdlib.ring"

oSystem = new System

See "Test the System Class Methods" + nl

oSystem.system("dir")
see oSystem.sysget("path") + nl
see oSystem.ismsdos() + nl
see oSystem.iswindows() + nl
see oSystem.iswindows64() + nl
see oSystem.isunix() + nl
see oSystem.ismacosx() + nl
see oSystem.islinux() + nl
see oSystem.isfreebsd() + nl
see oSystem.isandroid() + nl
see oSystem.windowsnl() + nl
see oSystem.sysargv() + nl
see oSystem.filename() + nl
```

44.12 Debug Class

Methods:

Method	Description/Output
eval(cCode)	Execute code during the runtime from string.
raise(cError)	Raise an exception.
assert(cCondition)	Test condition before executing the code.

example:

```

Load "stdlib.ring"

oDebug = new Debug
See "Test the Debug Class Methods" + nl
oDebug.eval("see 'Hello'+nl")
try
    x = 10
    oDebug.assert(x=11)
catch see "assert" + nl done
raise("Error!")

```

44.13 DataType Class

Methods:

Method	Description/Output
isstring(vValue)	We can know if the value is a string or not.
isnumber(vValue)	We can know if the value is a number or not.
islist(vValue)	We can know if the value is a list or not.
type(vValue)	Know the type of a value
isnull(vValue)	Check the value to know if it's null or not.
isalnum(vValue)	1 if the value is digit/letter or 0 if not
isalpha(vValue)	1 if the value is a letter or 0 if not
iscntrl(vValue)	1 if the value is a control character (no printing position)
isdigit(vValue)	1 if the value is a digit or 0 if not
isgraph(vValue)	1 if the value can be printed (Except space) or 0 if not
islower(vValue)	1 if the value is lowercase letter or 0 if not
isprint(vValue)	1 if the value occupies a printing position or 0 if not
ispunct(vValue)	1 if the value is a punctuation character or 0 if not
isspace(vValue)	1 if the value is a white-space or 0 if not
isupper(vValue)	1 if the value is an uppercase alphabetic letter or 0 if not
isxdigit(vValue)	1 if the value is a hexdecimal digit character or 0 if not

example:

```

Load "stdlib.ring"

oDataType = new DataType
See "Test the DataType Class Methods" + nl
see oDataType.isstring("test") + nl
see oDataType.isnumber(1) + nl
see oDataType.islist(1:3) + nl
see oDataType.type("test") + nl
see oDataType.isnull(null) + nl
see oDataType.isalnum("Hello") + nl +      # print 1
oDataType.isalnum("123456") + nl +      # print 1
oDataType.isalnum("ABCabc123") + nl + # print 1
oDataType.isalnum("How are you") + nl      # print 0 because of spaces
see oDataType.isalpha("Hello") + nl +      # print 1
oDataType.isalpha("123456") + nl +      # print 0
oDataType.isalpha("ABCabc123") + nl + # print 0
oDataType.isalpha("How are you") + nl      # print 0

```

(continues on next page)

(continued from previous page)

```
See oDataType.iscntrl("hello") + nl +      # print 0
oDataType.iscntrl(nl)                      # print 1
see oDataType.isdigit("0123456789") + nl +      # print 1
oDataType.isdigit("0123a") + nl
see oDataType.isgraph("abcdef") + nl +      # print 1
oDataType.isgraph("abc def") + nl           # print 0
see oDataType.islower("ABCDEF") + nl +      # print 0
oDataType.islower("ghi") + nl               # print 1
see oDataType.isprint("Hello") + nl +        # print 1
oDataType.isprint("Nice to see you") + nl +  # print 1
oDataType.isprint(nl) + nl                  # print 0
see oDataType.isprint("Hello") + nl          # print 1
see oDataType.isupper("welcome") + nl +     # print 0
oDataType.isupper("WELCOME") + nl           # print 1
see oDataType.isxdigit("0123456789abcdef") + nl + # print 1
oDataType.isxdigit("123z")                 # print 0
```

Output:

```
Test the DataType Class Methods
1
1
1
1
STRING
1
1
1
1
0
1
0
0
0
0
0
11
0
1
0
0
1
1
1
0
1
0
1
1
0
1
1
0
```

44.14 Conversion Class

Methods:

Method	Description/Output
number(vValue)	Convert strings to numbers.
string(vValue)	Convert numbers to strings.
ascii(vValue)	Get the ASCII code for a letter.
char(vValue)	Convert the ASCII code to character.
hex(vValue)	Convert decimal to hexadecimal.
dec(vValue)	Convert hexadecimal to decimal.
str2hex(vValue)	Convert string characters to hexadecimal characters.
hex2str(vValue)	Convert hexadecimal characters to string.

example:

```
Load "stdlib.ring"

oConversion = new conversion
See "Test the conversion Class Methods" + nl
See oConversion.number("3") + 5 + nl
See oConversion.string(3) + "5" + nl
See oConversion.Ascii("m") + nl
See oConversion.char(77) + nl
see oConversion.hex(162) + nl
see oConversion.dec("a2") + nl
cHex = oConversion.str2hex("Hello")
see cHex + nl
see oConversion.hex2str(cHex) + nl
```

Output:

```
Test the conversion Class Methods
8
35
109
M
a2
162
48656c6c6f
Hello
```

44.15 ODBC Class

Methods:

Method	Description/Output
drivers()	Get a list of ODBC drivers.
datasources()	Get a list of ODBC data sources.
close()	Free resources.
connect(cConString)	Connect to the database.
disconnect()	Close the connection.
execute(cSQL)	Execute SQL Statements
colcount()	Get columns count in the query result
fetch()	Fetch a row from the query result
getdata(nCol)	Get column value from the fetched row
tables()	Get a list of tables inside the database
columns(cTableName)	Get a list of columns inside the table
autocommit(lStatus)	Enable or disable the auto commit feature
commit()	Commit updates to the database
rollback()	Rollback updates to the database

example:

```
Load "stdlib.ring"

oodbc = new odbc
See "Test the odbc Class Methods" + nl
oODBC {
    see drivers()
    see datasources()
    See "Connect to database" + nl
    see connect("DBQ=test.mdb;Driver={Microsoft Access Driver (*.mdb)}") + nl
    See "Select data" + nl
    see execute("select * from person") + nl
    nMax = colcount()
    See "Columns Count : " + nMax + nl
    while fetch()
        See "Row data:" + nl
        for x = 1 to nMax
            see getdata(x) + " - "
        next
    end
    See "Close database..." + nl
    disconnect()
    close()
}
```

44.16 MySQL Class

Methods:

Method	Description/Output
info()	Return string contains the MySQL Client version.
error()	Get the error message from the MySQL Client.
connect(cServer,cUser,cPass,cDatabase)	Connect to the MySQL database server.
close()	Close the connection to the MySQL database.
query(cQuery)	Execute SQL queries.
insert_id()	Get the inserted row id.
result()	Get the query result (data without column names).
next_result()	Move to the next query result.
columns()	Get a list of columns names.
result2()	Get all of the column names then the query result in one list.
escape_string(cStr)	Before storing binary data and special characters in the database.
autocommit(lStatus)	Enable or disable the auto commit feature.
commit()	Commit updates to the database.
rollback()	Rollback updates to the database.

example:

```
Load "stdlib.ring"

omysql = new mysql
See "Test the MySQL Class Methods" + nl
omysql {
    see info() + nl
    connect("localhost", "root", "root", "mahdb")
    see "Execute Query" + nl
    query("SELECT * FROM Employee")
    see "Print Result" + nl
    see result2()
    see "Close database" + nl
    close()
}
```

Output:

```
Test the MySQL Class Methods
5.5.30
Execute Query
Print Result
Id
Name
Salary
1
Mahmoud
15000
2
Samir
16000
3
Fayed
```

(continues on next page)

(continued from previous page)

```
17000
Close database
```

44.17 SQLite Class

Methods:

Method	Description/Output
open(cDatabase)	Open Database.
close()	Close Database.
errormessage()	Get Error Message.
execute(cSQL)	Execute Query.

example:

```
Load "stdlib.ring"

osqlite = new sqlite
See "Test the sqlite Class Methods" + nl
osqlite {
    open("test.db")
    sql = "CREATE TABLE COMPANY (" +
        "ID INT PRIMARY KEY      NOT NULL," +
        "NAME      TEXT      NOT NULL," +
        "AGE       INT       NOT NULL," +
        "ADDRESS   CHAR(50) , " +
        "SALARY     REAL ) ;"

    execute(sql)

    sql = "INSERT INTO COMPANY (ID,NAME,AGE,ADDRESS,SALARY) " +
        "VALUES (1, 'Mahmoud', 29, 'Jeddah', 20000.00 ); " +
        "INSERT INTO COMPANY (ID,NAME,AGE,ADDRESS,SALARY) " +
        "VALUES (2, 'Ahmed', 27, 'Jeddah', 15000.00 ); " +
        "INSERT INTO COMPANY (ID,NAME,AGE,ADDRESS,SALARY) " +
        "VALUES (3, 'Mohammed', 31, 'Egypt', 20000.00 );" +
        "INSERT INTO COMPANY (ID,NAME,AGE,ADDRESS,SALARY) " +
        "VALUES (4, 'Ibrahim', 24, 'Egypt ', 65000.00 );"

    execute(sql)

    aResult = execute("select * from COMPANY")
    for x in aResult
        for t in x
            see t[2] + nl
        next
    next
    see copy("*",50) + nl
    for x in aResult
        see x["name"] + nl
    next
    close()
}
```

Output:

```
Test the sqlite Class Methods
1
Mahmoud
29
Jeddah
20000.0
2
Ahmed
27
Jeddah
15000.0
3
Mohammed
31
Egypt
20000.0
4
Ibrahim
24
Egypt
65000.0
*****
Mahmoud
Ahmed
Mohammed
Ibrahim
```

44.18 PostgreSQL Class

Methods:

Method	Description/Output
init(cConString)	Open Database.
close()	Close Database.
execute(cSQL)	Execute Query.

example:

```
load "stdlib.ring"

oPostgreSQL = new PostgreSQL("user=postgres password=sa dbname = mahdb")

See "Test the PostgreSQL Class Methods" + nl

oPostgreSQL {

    sql = "CREATE TABLE COMPANY_TEST(" + 
        "ID INT PRIMARY KEY      NOT NULL," +
        "NAME      TEXT      NOT NULL," +
        "AGE       INT      NOT NULL," +
        "ADDRESS   CHAR(50), " +
        "SALARY    REAL );"
```

(continues on next page)

(continued from previous page)

```

execute(sql)

sql = "INSERT INTO COMPANY_TEST (ID,NAME,AGE,ADDRESS,SALARY) " +
      "VALUES (1, 'Mahmoud', 29, 'Jeddah', 20000.00 ); " +
      "INSERT INTO COMPANY_TEST (ID,NAME,AGE,ADDRESS,SALARY) " +
      "VALUES (2, 'Ahmed', 27, 'Jeddah', 15000.00 ); " +
      "INSERT INTO COMPANY_TEST (ID,NAME,AGE,ADDRESS,SALARY) " +
      "VALUES (3, 'Mohammed', 31, 'Egypt', 20000.00 ); " +
      "INSERT INTO COMPANY_TEST (ID,NAME,AGE,ADDRESS,SALARY) " +
      "VALUES (4, 'Ibrahim', 24, 'Egypt ', 65000.00 );"

execute(sql)

? execute("select * from COMPANY_TEST")

? copy("*",50)

close()
}

```

Output:

```

Test the PostgreSQL Class Methods
id
name
age
address
salary
1
Mahmoud
29
Jeddah
20000
2
Ahmed
27
Jeddah
15000
3
Mohammed
31
Egypt
20000
4
Ibrahim
24
Egypt
65000
*****

```

44.19 Security Class

Methods:

Method	Description/Output
md5(cString)	Calculate the MD5 hash.
sha1(cString)	Calculate the SHA1 hash.
sha256(cString)	Calculate the SHA256 hash.
sha512(cString)	Calculate the SHA512 hash.
sha384(cString)	Calculate the SHA384 hash.
sha224(cString)	Calculate the SHA224 hash.
encrypt(cString,cKey,cIV)	Encrypts the data using the Blowfish algorithm.
decrypt(cString,cKey,cIV)	Decrypt the data encrypted using the Encrypt() method.
randbytes(nSize)	Generate a string of pseudo-random bytes.

example:

```
Load "stdlib.ring"

oSecurity = new security
See "Test the security Class Methods" + nl
oSecurity {
    see md5("hello") + nl +
    sha1("hello") + nl + sha256("hello") + nl +
    sha512("hello") + nl + sha384("hello") + nl +
    sha256("hello") + nl
    list = 0:15 cKey="" for x in list cKey += char(x) next
    list = 1:8   cIV = ""   for x in list cIV += char(x) next
    cCipher = encrypt("hello",cKey,cIV)
    see cCipher + nl + decrypt(cCipher,cKey,cIV) + nl
}
```

44.20 Internet Class

Methods:

- download(cURL)
- sendemail(cSMTPServer,cEmail,cPassword,cSender,cReceiver,cCC,cTitle,cContent)

example:

```
Load "stdlib.ring"

ointernet = new internet
See "Test the internet Class Methods" + nl
ointernet {
    see download("www.ring-lang.sf.net")
}
```

DESKTOP, WEBASSEMBLY AND MOBILE DEVELOPMENT USING RINGQT

In this chapter we will learn how to use the Qt framework classes in our Ring applications to create Desktop, WebAssembly and Mobile Applications.

45.1 The First GUI Application

In this example we will create an application to ask the user about his/her name. When the user type the name in the textbox then click on “Say Hello” button, the textbox value will be updated by adding “Hello ” to the name.

```
load "guilib.ring"

oApp = new qApp {

    win1 = new QWidget() {

        setWindowTitle("Hello World")
        setGeometry(100,100,370,250)

        label1 = new QLabel(win1) {
            setText("What is your name ?")
            setGeometry(10,20,350,30)
            setAlignment(Qt.AlignHCenter)
        }

        btn1 = new QPushButton(win1) {
            setGeometry(10,200,100,30)
            setText("Say Hello")
            setclickevent("pHello()")
        }

        btn1 = new QPushButton(win1) {
            setGeometry(150,200,100,30)
            setText("Close")
            setclickevent("pClose()")
        }

        lineedit1 = new QLineEdit(win1) {
            setGeometry(10,100,350,30)
        }

        show()
    }
}
```

(continues on next page)

(continued from previous page)

```
        }

        exec()

}

Func pHello
    lineedit1.settext( "Hello " + lineedit1.text())

Func pClose
    oApp.quit()
```

Program Output:

At first we type the name in the textbox



Then we click on the say hello button



45.2 The Events Loop

Qt uses Event-Driven and the events loop get the control when we call the exec() method from the qApp class.

Once we call exec(), The events loop starts, and the Widgets starts responding to the different events (Mouse, Keyboard, Timers, etc).

You get the control back again when an event is fired and your callback function is called.

Once the execution of your callback function is done, the control go back again to the events loop.

Useful things to remember

- (1) We can do most of the work using normal events (Events provided directly by each widget).
- (2) We can add more events to any widget using the Events Filter.
- (3) Using Timers we can easily get the control back and check for more things to do.

Also when our callback function is busy with doing time consuming operations, we can call the ProcessEvents() method from the qApp class to avoid stoping the GUI.

```
oApp.processevents()
```

We can avoid calling the exec() method, and create our main loop

It's not recommended to do that, It's just an option.

```
# Instead of calling the exec() method
while true
    oApp.processevents()      # Respond to GUI Events
    # More Thing to do, We have the control!
    # ....
end
```

45.3 Using Layout

The next example is just an upgrade to the previous application to use the vertical layout.

```
Load "guilib.ring"

MyApp = New qApp {
    win1 = new QWidget() {
        setWindowTitle("Hello World")
        setGeometry(100,100,400,130)
        label1 = new QLabel(win1) {
            setText("What is your name ?")
            setGeometry(10,20,350,30)
            setAlignment(Qt.AlignHCenter)
        }
        btn1 = new QPushButton(win1) {
            setGeometry(10,200,100,30)
            setText("Say Hello")
            setClickEvent("pHello()")
        }
        btn2 = new QPushButton(win1) {
```

(continues on next page)

(continued from previous page)

```

        setGeometry(150,200,100,30)
        settext("Close")
        setclickevent("pClose()")
    }
    lineedit1 = new QLineEdit(win1) {
        setGeometry(10,100,350,30)
    }
    layout1 = new QVBoxLayout() {
        addWidget(label1)
        addWidget(lineedit1)
        addWidget(btn1)
        addWidget(btn2)
    }
    win1.setLayout(layout1)
    show()
}

exec()
}

Func pHello
    lineedit1.settext("Hello " + lineedit1.text())

Func pClose
    MyApp.quit()

```

The application during the runtime!



45.4 Using the QTextEdit Class

In this example we will use the QTextEdit Class

```

Load "guilib.ring"

New qApp {

    win1 = new QWidget() {

        setWindowTitle("QTextEdit Class")
        setGeometry(100,100,500,500)

```

(continues on next page)

(continued from previous page)

```
new qtextedit(win1) {
    setGeometry(10,10,480,480)

}
show()
}

exec()
}
```

During the runtime we can paste rich text in the qtextedit widget



45.5 Using the QListWidget Class

In this example we will use the QListWidget Class

```

Load "guilib.ring"

New qApp {

    win1 = new QWidget() {
        setGeometry(100,100,400,400)

        list1 = new QListWidget(win1) {
            setGeometry(150,100,200,200)
            alist = ["one","two","three","four","five"]
            for x in alist additem(x) next
            setCurrentRow(3,2)
            win1.setWindowTitle("Items Count : " + count())
        }

        btn1 = new QPushButton(win1) {
            setGeometry(10,200,100,30)
            setText("Selected item")
            setClickEvent("pWork()")
        }

        btn2 = new QPushButton(win1) {
            setGeometry(10,240,100,30)
            setText("Delete item")
            setClickEvent("pWork2()")
        }

        show()
    }

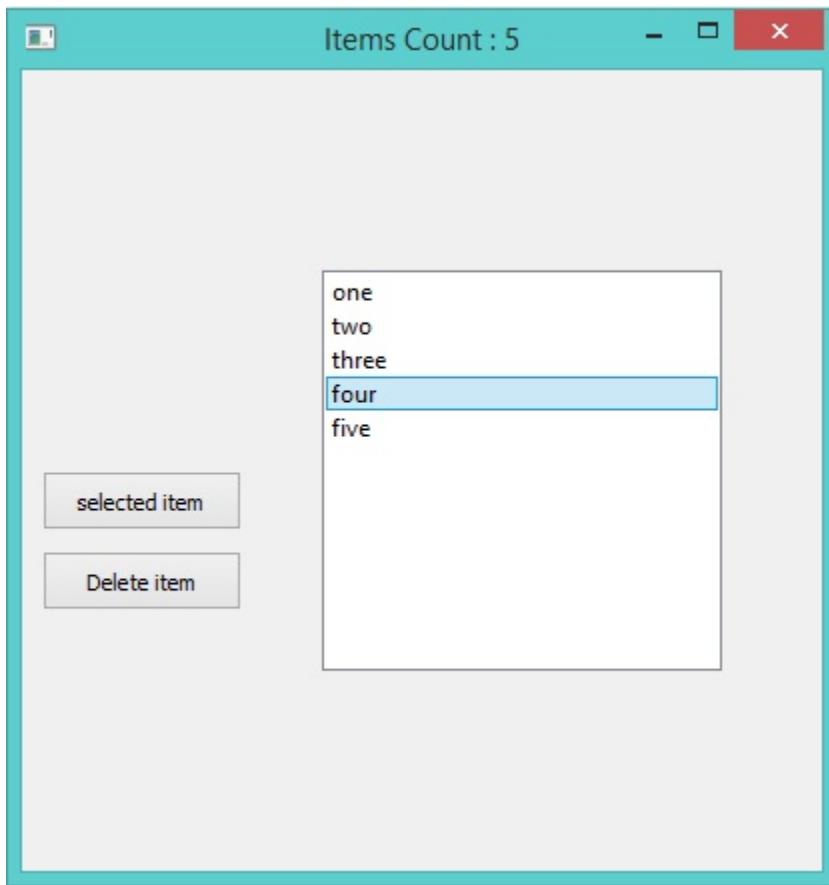
    exec()
}

func pWork
    btn1.setText(string(list1.currentRow()))

func pWork2
    list1 {
        takeItem(currentRow())
    }
}

```

The application during the runtime



Another Example:

```
Load "guilib.ring"

New qApp {
    win1 = new QWidget() {
        setGeometry(100,100,500,400)

        list1 = new QListWidget(win1) {
            setGeometry(150,100,200,200)
            alist = ["one","two","three","four","five"]
            for x in alist additem(x) next

            setCurrentRow(3,2)
            win1.setWindowTitle("Items Count : " + count())
        }

        btn1 = new QPushButton(win1) {
            setGeometry(10,200,100,30)
            setText("selected item")
            setClickEvent("pWork()")
        }

        btn2 = new QPushButton(win1) {
            setGeometry(10,240,100,30)
        }
    }
}
```

(continues on next page)

(continued from previous page)

```

        settext("Delete item")
        setclickevent("pWork2()")
    }

    show()
}

exec()
}

func pWork

nbrOfItems = list1.count()
curItemNbr = list1.currentrow()
curValue   = list1.item(list1.currentrow()).text()

win1.setwindowtitle( "After Select - NbrOfItems: " + nbrOfItems +
                     " CurItemNbr: " + curItemNbr + " CurValue: " + curValue )

btn1.settext( string(list1.currentrow() ) + " --- " +
              list1.item(list1.currentrow()).text() )



func pWork2
list1 {
    takeitem(currentrow())

    nbrOfItems = count()
    curItemNbr = currentrow()
    curValue   = item(currentrow()).text()

    win1.setwindowtitle("After Delete - NbrOfItems: " + nbrOfItems +
                        " CurItemNbr: " + curItemNbr + " CurValue: " + curValue )
}

```

45.6 Using QTreeView and QFileSystemModel

In this example we will learn how to use the QTreeView widget to represent the File System

```

Load "guilib.ring"

New qApp {

    win1 = New QWidget() {

        setWindowTitle("Using QTreeView and QFileSystemModel")
        setGeometry(100,100,500,400)

        New qtreeview(win1) {
            setGeometry(00,00,500,400)
            oDir = new QDir()
            ofile = new QFileSystemModel()
            ofile.setrootpath(oDir.currentpath())

```

(continues on next page)

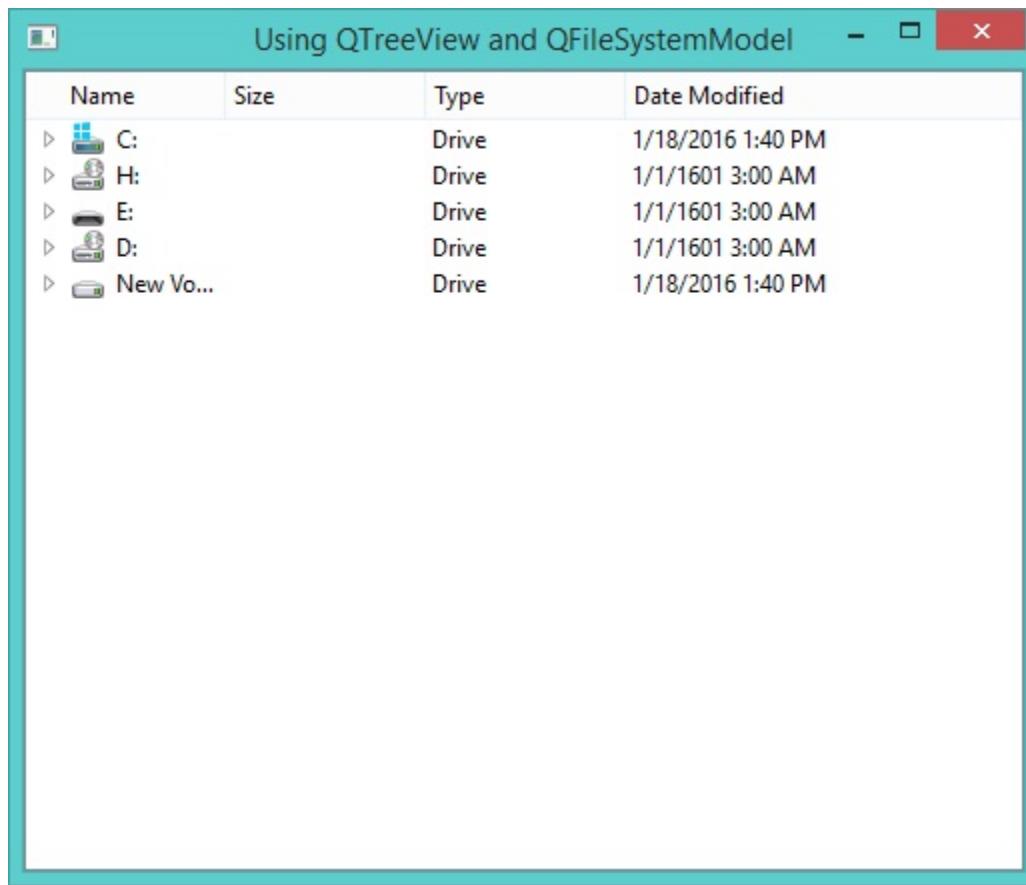
(continued from previous page)

```
    setmodel(ofile)
}
}

show()
}

exec()
}
```

The application during the runtime



45.7 Using QTreeWidget and QTreeWidgetItem

In this example we will learn about using the `QTreeWidget` and `QTreeWidgetItem` classes.

```
Load "guilib.ring"

New qApp {

    win1 = new QWidget() {
        setWindowTitle("TreeWidget")
        setGeometry(100,100,400,400)
```

(continues on next page)

(continued from previous page)

```
layout1 = new QVBoxLayout()

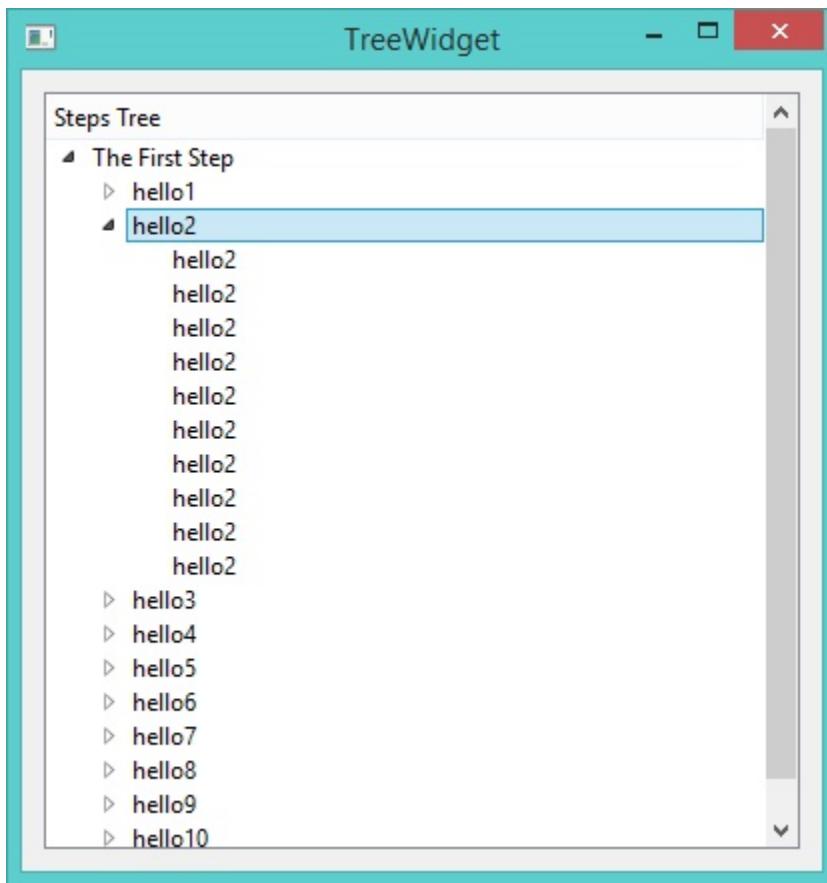
tree1 = new QTreeWidget(win1) {
    setGeometry(00,00,400,400)
    setColumnCount(1)
    myitem = new QTreeWidgetItem()
    myitem.setText(0,"The First Step")
    addTopLevelItem(myitem)
    for x = 1 to 10
        myitem2 = new QTreeWidgetItem()
        myitem2.setText(0,"hello"+x)
        myitem.addChild(myitem2)
        for y = 1 to 10
            myitem3 = new QTreeWidgetItem()
            myitem3.setText(0,"hello"+x)
            myitem2.addChild(myitem3)
    next
}
next
setHeaderLabel("Steps Tree")
}

layout1.addWidget(tree1)
setLayout(layout1)

show()
}

exec()
}
```

The application during the runtime



45.8 Using QComboBox Class

In this example we will learn about using the QComboBox class

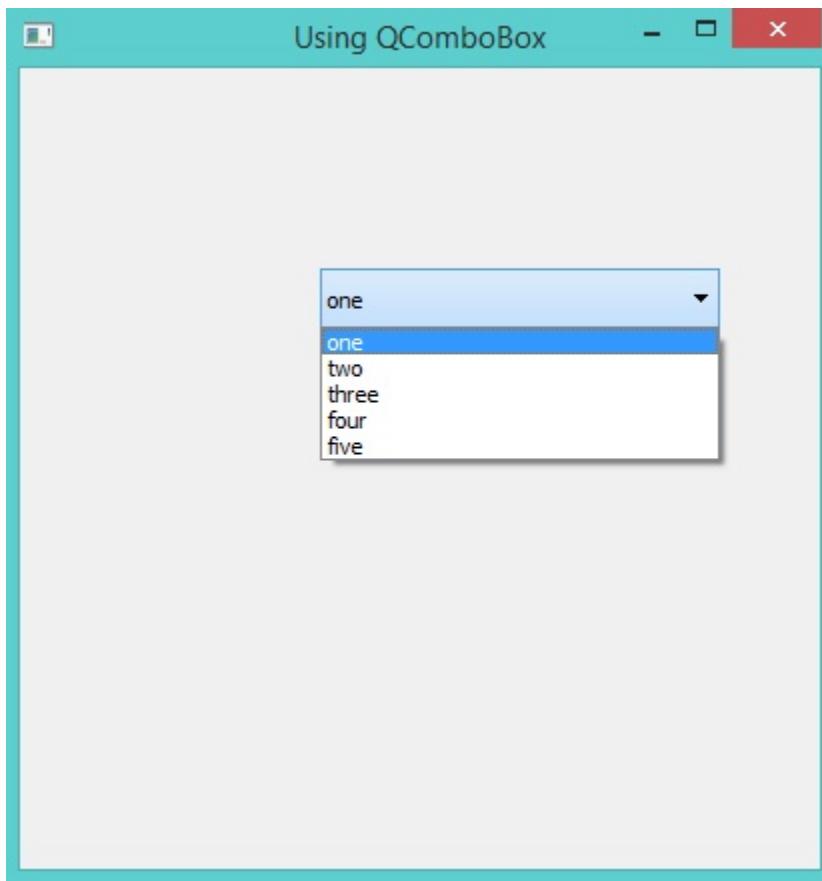
```
Load "guilib.ring"

New qApp {
    win1 = new QWidget() {
        setWindowTitle("Using QComboBox")
        setGeometry(100,100,400,400)

        New QComboBox(win1) {
            setGeometry(150,100,200,30)
            aList = ["one","two","three","four","five"]
            for x in aList additem(x,0) next
        }

        show()
    }
    exec()
}
```

The application during the runtime



45.9 Creating Menubar

In this example we will learn about using the QMenuBar class

```
Load "guilib.ring"

MyApp = New qApp {

    win1 = new QWidget() {

        setWindowTitle("Using QMenubar")
        setGeometry(100,100,400,400)

        menu1 = new QMenuBar(win1) {
            sub1 = addmenu("File")
            sub2 = addmenu("Edit")
            sub3 = addmenu("Help")
            sub1 {
                oAction = new QAction(win1) {
                    setText("New")
                }
                addaction(oAction)
                oAction = new QAction(win1) {
                    setText("Open")
                }
            }
        }
    }
}
```

(continues on next page)

(continued from previous page)

```

        addaction(oAction)
        oAction = new QAction(win1) {
            settext("Save")
        }
        addaction(oAction)
        oAction = new QAction(win1) {
            settext("Save As")
        }
        addaction(oAction)
        addseparator()
        oAction = new QAction(win1) {
            settext("Exit")
            setclickevent("myapp.quit()")
        }
        addaction(oAction)
    }
    sub2 {
        oAction = new QAction(win1) {
            settext("Cut")
        }
        addaction(oAction)
        oAction = new QAction(win1) {
            settext("Copy")
        }
        addaction(oAction)
        oAction = new QAction(win1) {
            settext("Paste")
        }
        addaction(oAction)
        addseparator()
        oAction = new QAction(win1) {
            settext("Select All")
        }
        addaction(oAction)
    }
    sub3 {
        oAction = new QAction(win1) {
            settext("Reference")
        }
        addaction(oAction)
        sub4 = addmenu("Sub Menu")
        sub4 {
            oAction = new QAction(win1) {
                settext("Website")
            }
            addaction(oAction)
            oAction = new QAction(win1) {
                settext("Forum")
            }
            addaction(oAction)
            oAction = new QAction(win1) {
                settext("Blog")
            }
            addaction(oAction)
        }
        addseparator()
        oAction = new QAction(win1) {

```

(continues on next page)

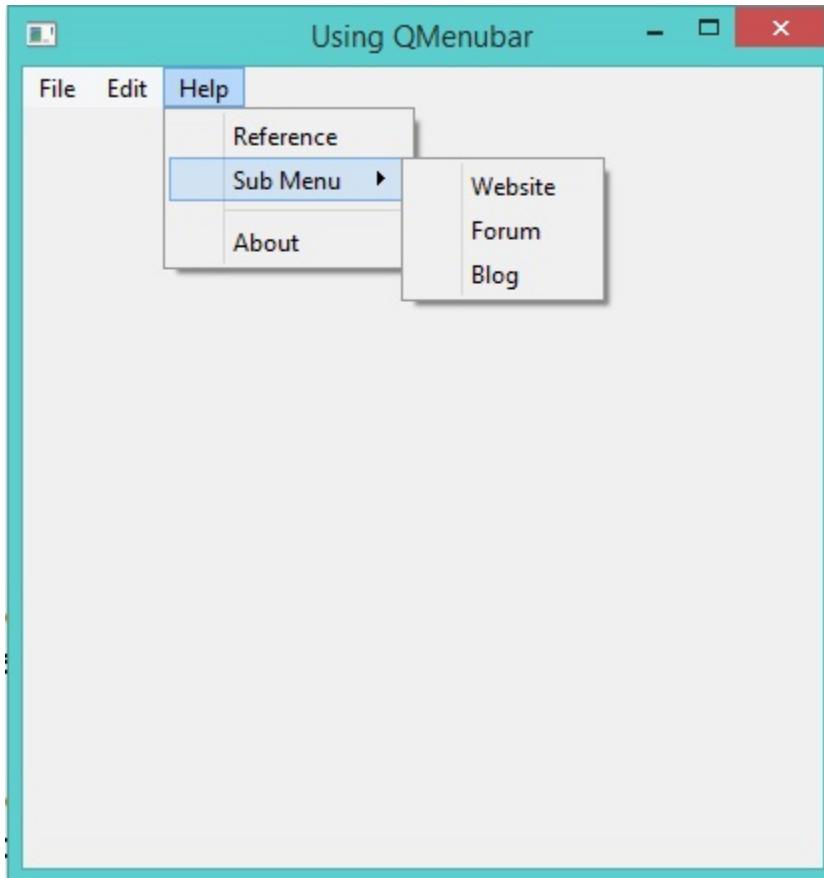
(continued from previous page)

```

        settext ("About")
    }
    addaction(oAction)
}
}
show()
}
exec()
}

```

The application during the runtime



45.10 Context Menu

Example:

```

load "guilib.ring"

new qApp {
    win = new QWidget() {
        setWindowTitle("Context Menu")
        resize(400, 400)
        myfilter = new qAllEvents(win) {
            setContextMenuEvent("mymenu()")
        }
    }
}

```

(continues on next page)

(continued from previous page)

```

        }
        installeventfilter(myfilter)
        show()
    }
    exec()
}

func mymenu

    new qMenu(win) {
        oAction = new qAction(win) {
            settext("new")
            SetCLickevent("See :New")
        }
        addaction(oAction)
        oAction = new qAction(win) {
            settext("open")
            SetCLickevent("See :Open")
        }
        addaction(oAction)
        oAction = new qAction(win) {
            settext("save")
            SetCLickevent("See :Save")
        }
        addaction(oAction)
        oAction = new qAction(win) {
            settext("close")
            SetCLickevent("See :Close")
        }
        addaction(oAction)
        oCursor = new qCursor()
        exec(oCursor.pos())
    }
}

```

45.11 Creating Toolbar

In this example we will learn about using the QToolBar class

```

Load "guilib.ring"

New qApp {

    win1 = new qMainWindow() {

        setWindowTitle("Using QToolBar")
        setGeometry(100,100,600,400)

        abtns = [
            new qpushbutton(win1) { settext("Add") } ,
            new qpushbutton(win1) { settext("Edit") } ,
            new qpushbutton(win1) { settext("Find") } ,
            new qpushbutton(win1) { settext("Delete") } ,
            new qpushbutton(win1) { settext("Exit") }
        ]
    }
}

```

(continues on next page)

(continued from previous page)

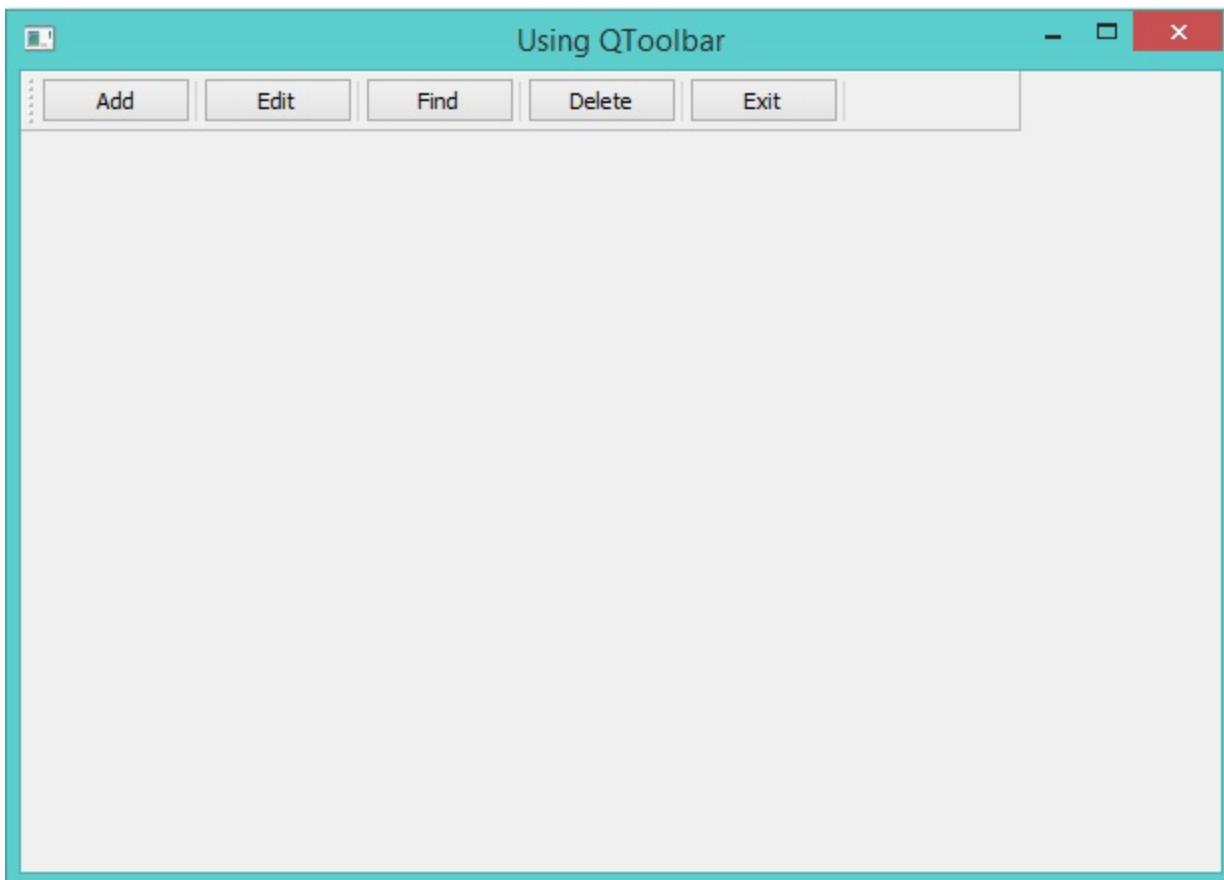
```
        ↵}                                setclickevent("win1.close()") ↵
    ]
```

```
    tool1 = new qtoolbar(win1) {
        for x in abtns addwidget(x) addseparator() next
        setmovable(true)
        setGeometry(0,0,500,30)
        setFloatable(true)
    }

    show()
}

exec()
```

The application during the runtime



45.12 Creating StatusBar

In this example we will learn about using the QStatusBar class

```
Load "guilib.ring"

New qApp {

    win1 = new QMainWindow() {

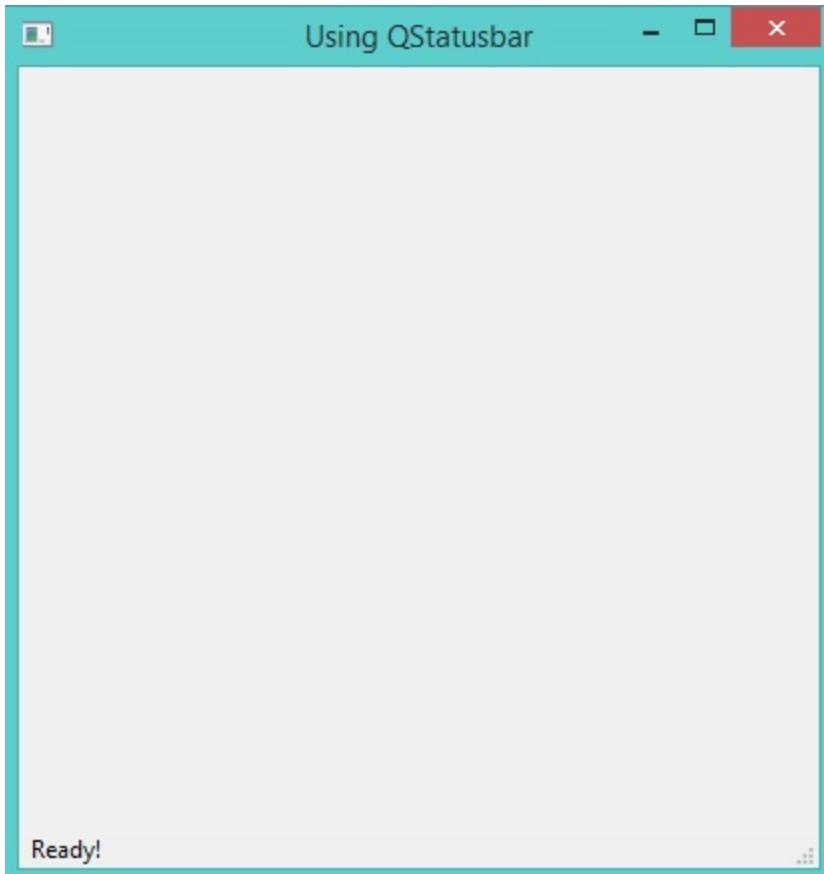
        setWindowTitle("Using QStatusBar")
        setGeometry(100,100,400,400)

        status1 = new QStatusBar(win1) {
            showMessage("Ready!",0)
        }

        setStatusBar(status1)
        show()
    }

    exec()
}
```

The application during the runtime



45.13 Using QDockWidget

In this example we will learn about using the QDockWidget class

```

Load "guilib.ring"

New qApp {
    win1 = new QMainWindow() {
        setWindowTitle("QDockWidget")
        setGeometry(100,100,400,400)

        label1 = new QLabel(win1) {
            setText("Hello")
            setGeometry(300,300,100,100)
        }

        label2 = new QLabel(win1) {
            setText("How are you ?")
            setGeometry(100,100,100,100)
        }

        dock1 = new QDockWidget(win1,0) {
            setWidget(label1)
            SetAllowedAreas(1)
        }

        dock2 = new QDockWidget(win1,0) {
            setWidget(label2)
            SetAllowedAreas(2)
        }

        addDockWidget(Qt_LeftDockWidgetArea,dock1,Qt_Horizontal)
        addDockWidget(Qt_LeftDockWidgetArea,dock2,Qt_Vertical)

        show()
    }
    exec()
}

```

The application during the runtime



45.14 Using QTabWidget

In this example we will learn about using the `QTabWidget` class

```
Load "guilib.ring"

New qApp {
    win1 = new qMainWindow() {
        setWindowTitle("Using QTabWidget")
        setGeometry(100,100,400,400)

        page1 = new QWidget() {
            new QPushButton(page1) {
                setText("The First Page")
            }
        }

        page2 = new QWidget() {
            new QPushButton(page2) {
                setText("The Second Page")
            }
        }
    }
}
```

(continues on next page)

(continued from previous page)

```
page3 = new QWidget() {
    new QPushButton(page3) {
        setText("The Third Page")
    }
}

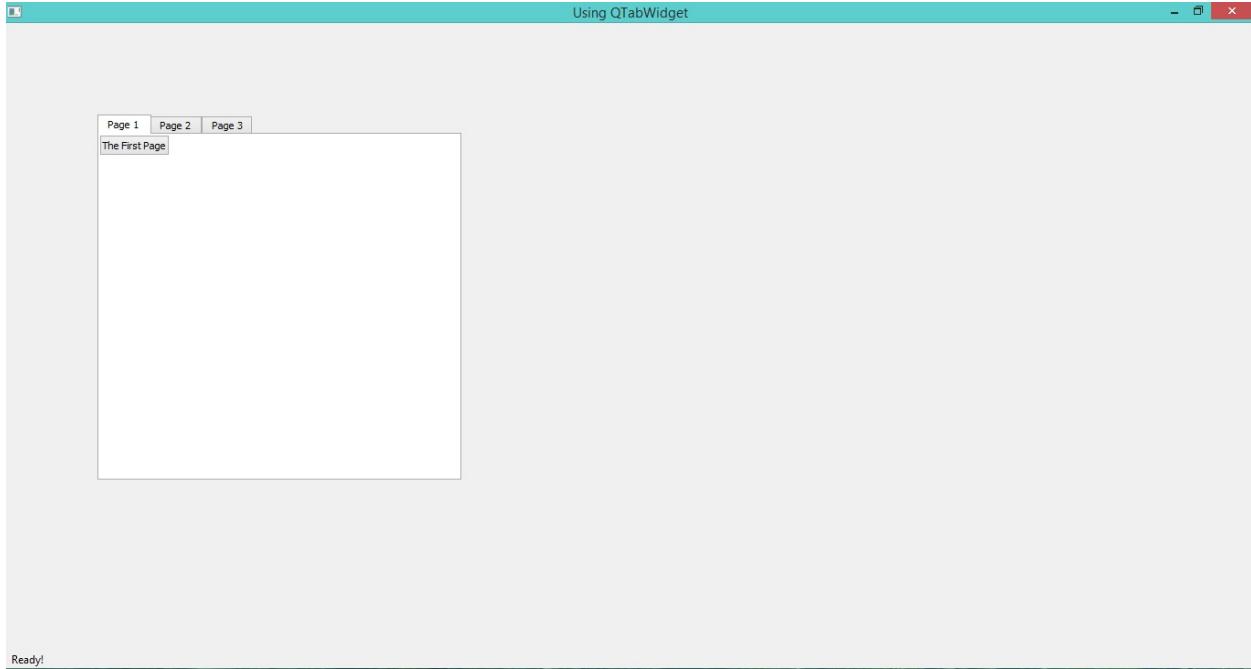
tab1 = new QTabWidget(win1) {
    insertTab(0, page1, "Page 1")
    insertTab(1, page2, "Page 2")
    insertTab(2, page3, "Page 3")
    setGeometry(100, 100, 400, 400)
}

status1 = new QStatusBar(win1) {
    showMessage("Ready!", 0)
}

setStatusBar(status1)
showMaximized()
}

exec()
}
```

The application during the runtime



45.15 Using QTableWidget

In this example we will learn about using the QTableWidget class

```

Load "guilib.ring"

New qApp {
    win1 = new QMainWindow() {
        setGeometry(100,100,1100,370)
        setWindowTitle("Using QTableWidget")

        Table1 = new QTableWidget(win1) {
            setRowCount(10) setColumnCount(10)
            setGeometry(0,0,800,400)
            setSelectionBehavior(QAbstractItemView_SelectRows)

            for x = 1 to 10
                for y = 1 to 10
                    item1 = new QTableWidgetItem("R"+X+"C"+Y)
                    setItem(x-1,y-1,item1)
                next
            next

        }

        setCentralWidget(table1)
        show()
    }

    exec()
}

```

The application during the runtime

	1	2	3	4	5	6	7	8	9	10
1	R1C1	R1C2	R1C3	R1C4	R1C5	R1C6	R1C7	R1C8	R1C9	R1C10
2	R2C1	R2C2	R2C3	R2C4	R2C5	R2C6	R2C7	R2C8	R2C9	R2C10
3	R3C1	R3C2	R3C3	R3C4	R3C5	R3C6	R3C7	R3C8	R3C9	R3C10
4	R4C1	R4C2	R4C3	R4C4	R4C5	R4C6	R4C7	R4C8	R4C9	R4C10
5	R5C1	R5C2	R5C3	R5C4	R5C5	R5C6	R5C7	R5C8	R5C9	R5C10
6	R6C1	R6C2	R6C3	R6C4	R6C5	R6C6	R6C7	R6C8	R6C9	R6C10
7	R7C1	R7C2	R7C3	R7C4	R7C5	R7C6	R7C7	R7C8	R7C9	R7C10
8	R8C1	R8C2	R8C3	R8C4	R8C5	R8C6	R8C7	R8C8	R8C9	R8C10
9	R9C1	R9C2	R9C3	R9C4	R9C5	R9C6	R9C7	R9C8	R9C9	R9C10
10	R10C1	R10C2	R10C3	R10C4	R10C5	R10C6	R10C7	R10C8	R10C9	R10C10

45.16 Using QProgressBar

In this example we will learn about using the QProgressBar class

```
Load "guilib.ring"

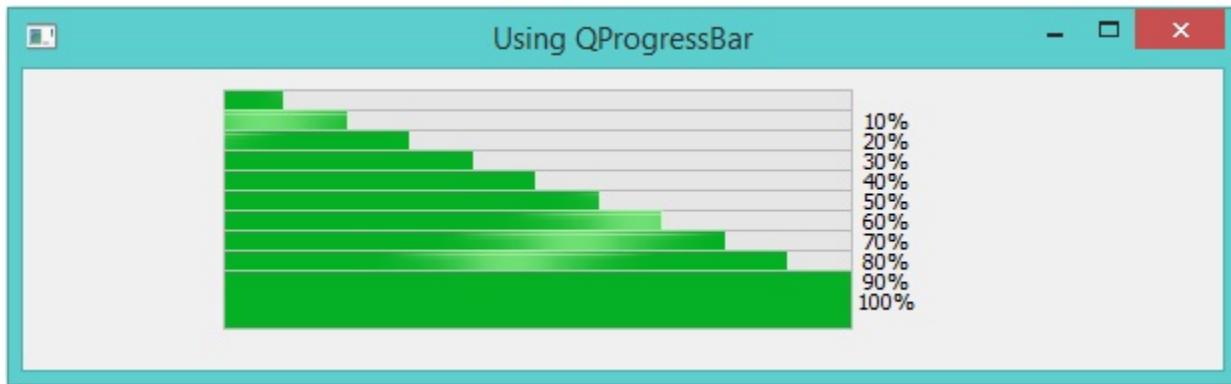
New qApp {
    win1 = new qMainWindow() {

        setGeometry(100,100,600,150)
        setWindowTitle("Using QProgressBar")

        for x = 10 to 100 step 10
            new qprogressbar(win1) {
                setGeometry(100,x,350,30)
                setValue(x)
            }
        next

        show()
    }
    exec()
}
```

The application during the runtime



45.17 Using QSpinBox

In this example we will learn about using the QSpinBox class

```
Load "guilib.ring"

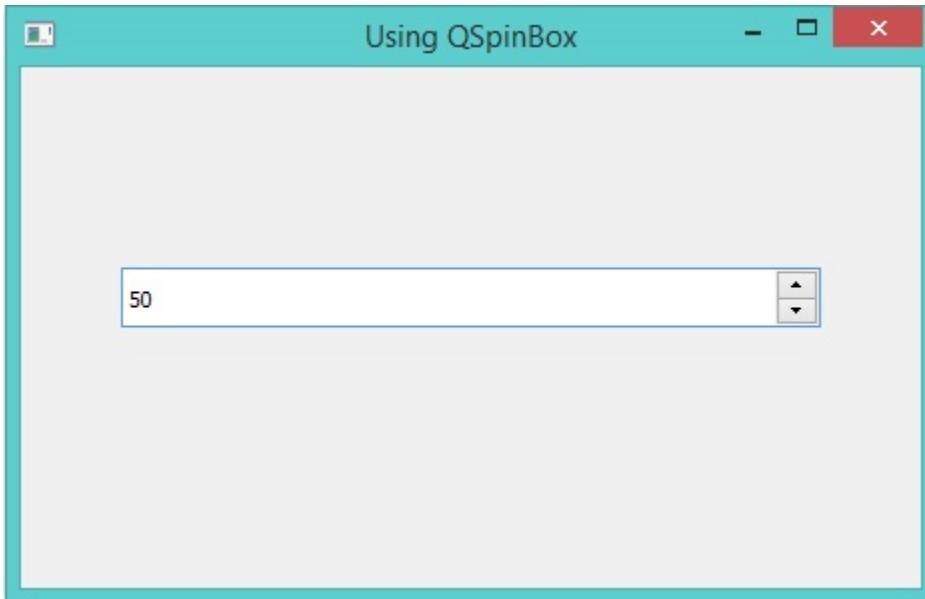
New qApp {
    win1 = new qMainWindow() {
        setGeometry(100,100,450,260)
        setWindowTitle("Using QSpinBox")
        new qspinbox(win1) {
            setGeometry(50,100,350,30)
            setValue(50)
        }
    show()
}
```

(continues on next page)

(continued from previous page)

```
}
```

The application during the runtime



45.18 Using QSlider

In this example we will learn about using the QSlider class.

```
Load "guilib.ring"

New qApp {
    win1 = new qMainWindow() {
        setGeometry(100,100,500,400)
        setWindowTitle("Using QSlider")

        new qslider(win1) {
            setGeometry(100,100,50,130)
            settickinterval(50)
        }

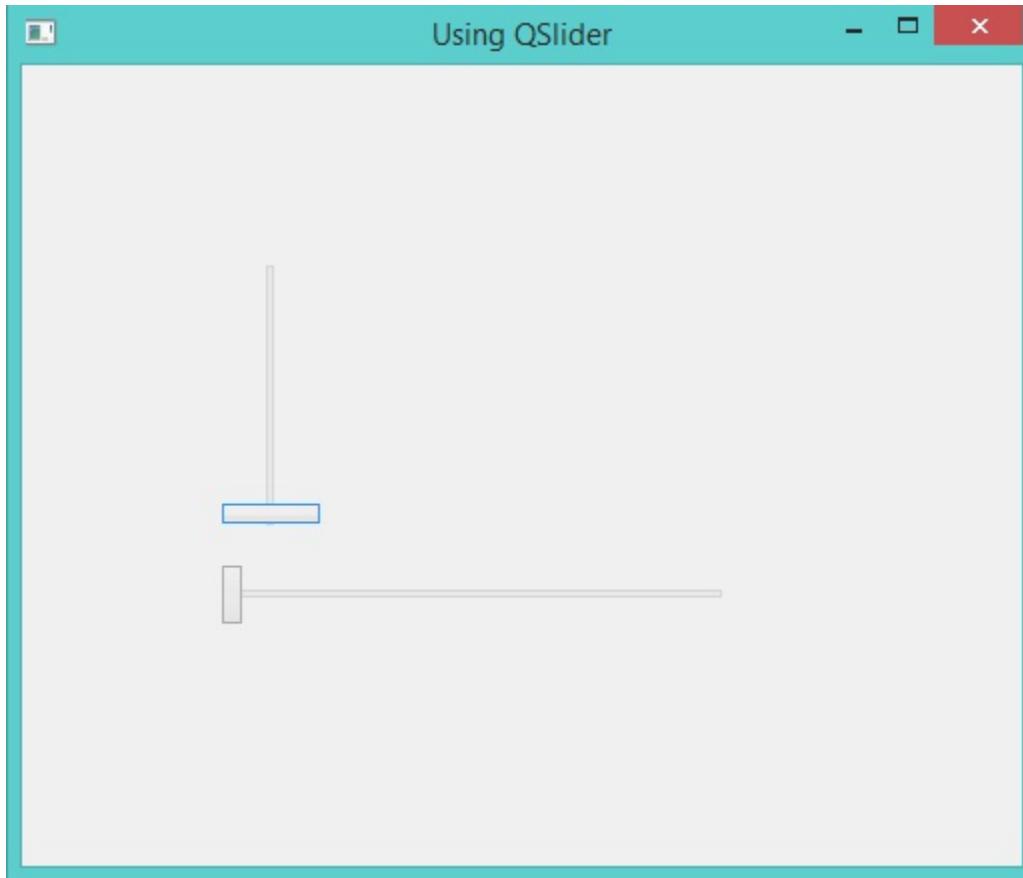
        new qslider(win1) {
            setGeometry(100,250,250,30)
            settickinterval(50)
            setOrientation(Qt_Horizontal)
        }
    }
    show()
}
```

(continues on next page)

(continued from previous page)

```
        exec()
}
```

The application during the runtime



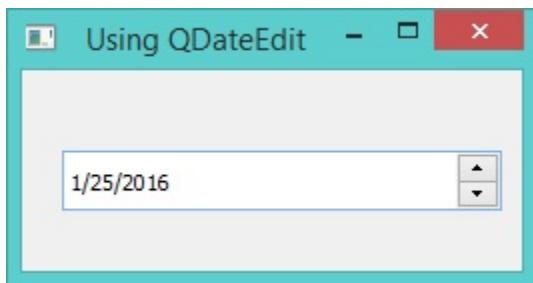
45.19 Using QDateEdit

In this example we will learn about using the QDateEdit class

```
Load "guilib.ring"

New qApp {
    win1 = new QMainWindow() {
        setWindowTitle("Using QDateEdit")
        setGeometry(100,100,250,100)
        new qdateedit(win1) {
            setGeometry(20,40,220,30)
        }
        show()
    }
    exec()
}
```

The application during the runtime



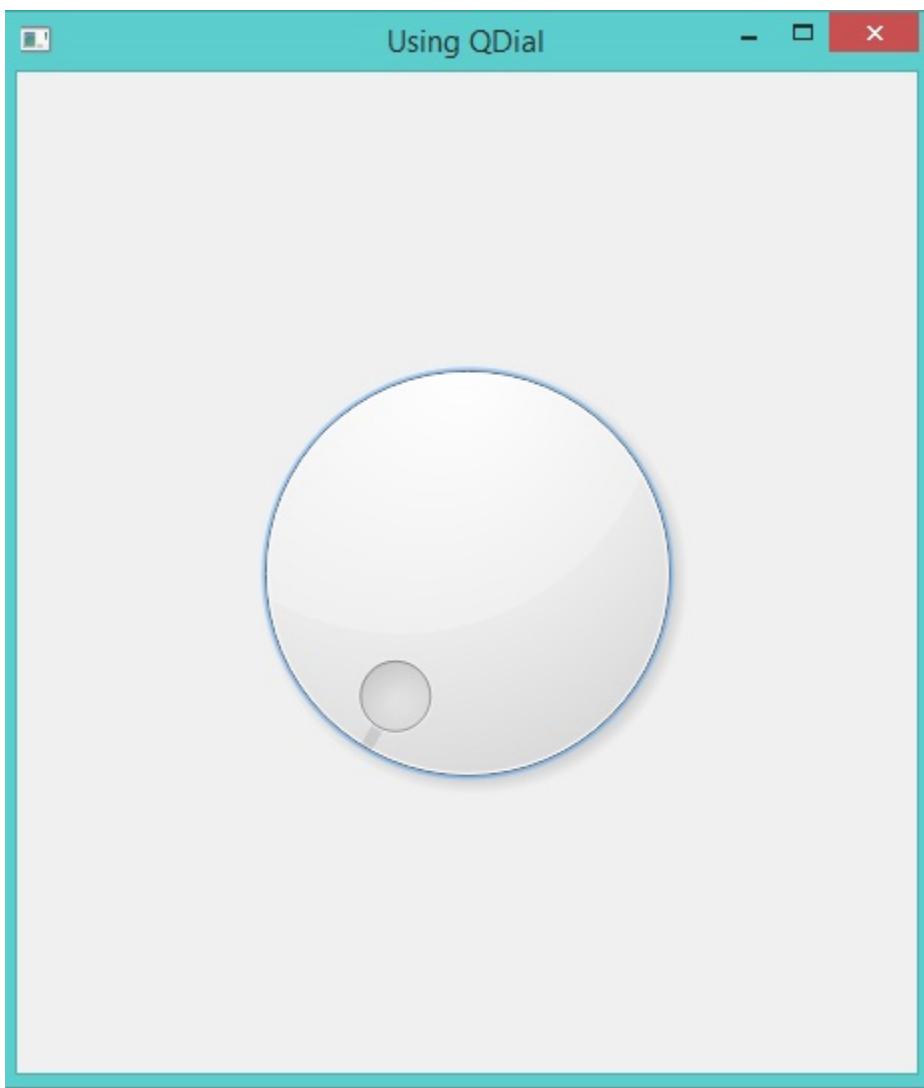
45.20 Using QDial

In this example we will learn about using the QDial class

```
Load "guilib.ring"

New qApp {
    win1 = new qMainWindow() {
        setGeometry(100,100,450,500)
        setWindowTitle("Using QDial")
        new qdial(win1) {
            setGeometry(100,100,250,300)
        }
        show()
    }
    exec()
}
```

The application during the runtime



Another Example

```
Load "guilib.ring"

New qApp {
    win1 = new qMainWindow()
    {
        setGeometry(100,100,450,500)
        setWindowTitle("Using QDial")
        button1 = new QPushButton(win1){
            setGeometry(100,350,100,30)
            setText("Increment")
            setClickEvent("pIncrement()")
        }

        button2 = new QPushButton(win1){
            setGeometry(250,350,100,30)
            setText("Decrement")
            setClickEvent("pDecrement()")
        }
    }
}
```

(continues on next page)

(continued from previous page)

```

        pdial = new qdial(win1) {
            setGeometry(100,50,250,300)
            setNotchesVisible(true)
            setValue(50)
            SetValueChangedEvent ("pDialMove() ")
        }
        lineedit1 = new qlineedit(win1) {
            setGeometry(200,400,50,30)
            setAlignment(Qt.AlignHCenter)
            setText(string(pdial.value()))
            setreturnPressedEvent ("pPress() ")
        }
        show()
    }
    exec()
}

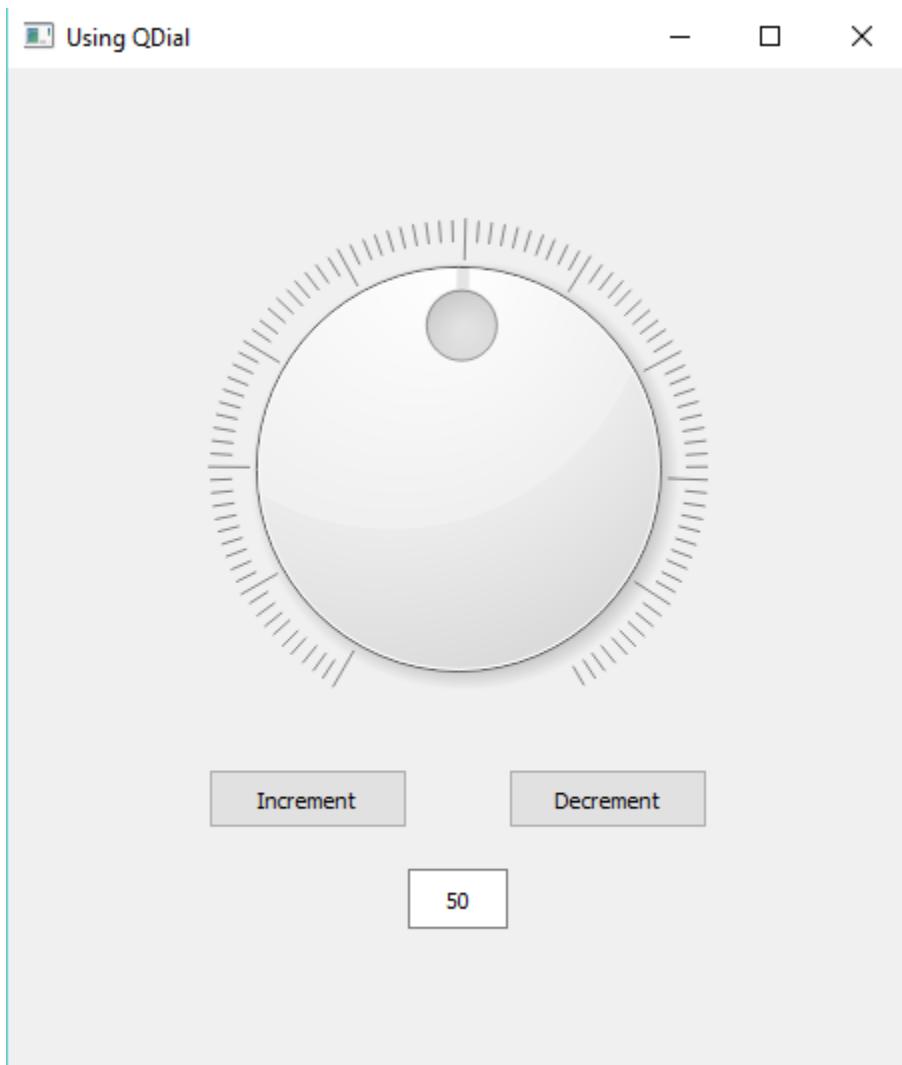
func pIncrement
    pdial{val=value()}
    pdial.setvalue(val+1)
    lineedit1{settext(string(val+1))}

func pDecrement
    pdial{val=value()}
    pdial.setvalue(val-1)
    lineedit1{settext(string(val-1))}

func pPress
    lineedit1{val=text()}
    pdial.setvalue(number(val))

func pDialMove
    lineedit1.settext(""+pdial.value())

```



45.21 Using QWebView

In this example we will learn about using the QWebView class

```
Load "guilib.ring"

New qApp {
    win1 = new qMainWindow() {
        setWindowTitle("QWebView")
        myweb = new qwebView(win1) {
            setGeometry(10,10,600,600)
            loadpage(new qurl("http://google.com"))
        }
        setCentralWidget(myweb)
        showMaximized()
    }
    exec()
}
```

The application during the runtime



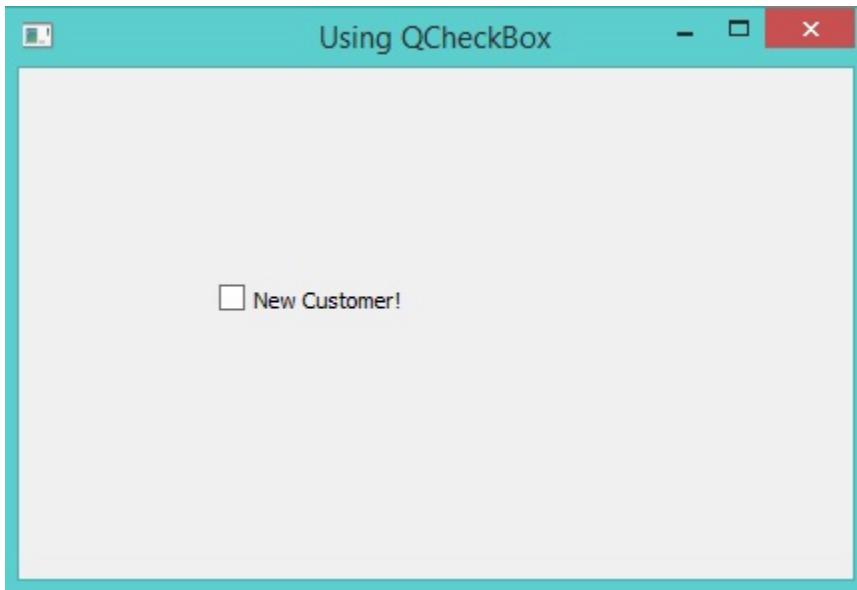
45.22 Using QCheckBox

In this example we will learn about using the QCheckBox class

```
Load "guilib.ring"

New qApp {
    win1 = new QMainWindow() {
        setWindowTitle("Using QCheckBox")
        new qcheckbox(win1) {
            setGeometry(100,100,100,30)
            setText("New Customer!")
        }
        showMaximized()
    }
    exec()
}
```

The application during the runtime



Another Example:

```

Load "guilib.ring"

New qApp {
    win1 = new qMainWindow() {
        setGeometry(100,100,400,300)
        setWindowTitle("Using QCheckBox")

        ## 0-Unchecked 1-Checked

        CheckBox = new qcheckbox(win1) {
            setGeometry(100,100,160,30)
            setText("New Customer!")
            setClickedEvent("HandleClickEvent()")
        }

        show()
    }
    exec()
}

Func HandleClickEvent

if CheckBox.isChecked() = 1
    CheckBox.setText("New Customer. Check 1-ON")
else
    CheckBox.setText("New Customer. Check 0-OFF")
ok

```

45.23 Using QRadioButton and QButtonGroup

In this example we will learn about using the QRadioButton and QButtonGroup classes

```

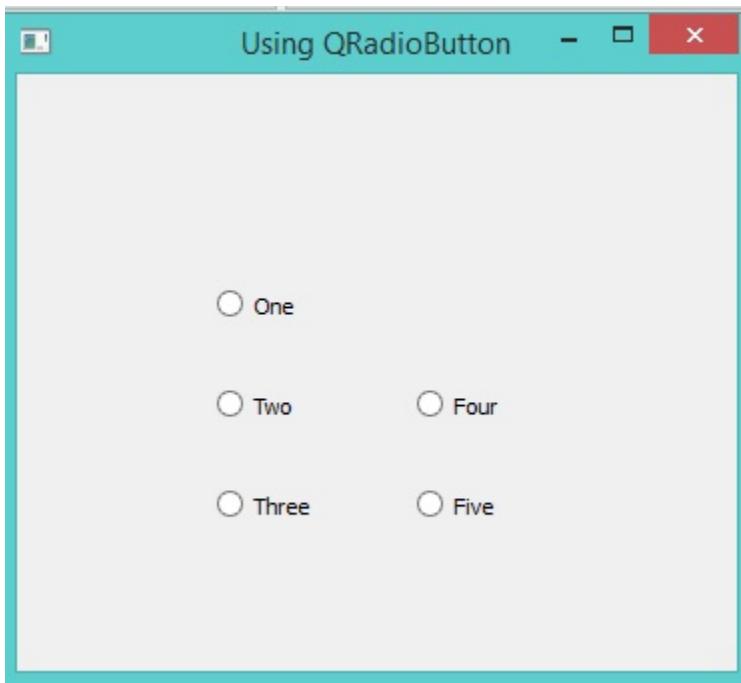
Load "guilib.ring"

New qApp {
    win1 = new QMainWindow() {
        setWindowTitle("Using QRadioButton")
        new qradiobutton(win1) {
            setGeometry(100,100,100,30)
            setText("One")
        }
        new qradiobutton(win1) {
            setGeometry(100,150,100,30)
            setText("Two")
        }
        new qradiobutton(win1) {
            setGeometry(100,200,100,30)
            setText("Three")
        }

        group2 = new qbuttongroup(win1) {
            btn4 = new qradiobutton(win1) {
                setGeometry(200,150,100,30)
                setText("Four")
            }
            btn5 = new qradiobutton(win1) {
                setGeometry(200,200,100,30)
                setText("Five")
            }
            addbutton(btn4, 0)
            addbutton(btn5, 0)
        }
        showMaximized()
    }
    exec()
}

```

The application during the runtime



45.24 Adding Hyperlink to QLabel

In this example we will learn about creating Hyperlink using the QLabel class

```
Load "guilib.ring"

New qApp {
    win1 = new qMainWindow() {
        setWindowTitle("QLabel - Hyperlink")
        new qlabel(win1) {
            setGeometry(100,100,100,30)
            setOpenExternalLinks(true)
            setText('<a href="http://google.com">Google</a>')
        }
        showMaximized()
    }
    exec()
}
```

The application during the runtime



45.25 QVideoWidget and QMediaPlayer

In this example we will learn about using the QVideoWidget and QMediaPlayer classes to play a group of movies from different positions at the same time

```
Load "guilib.ring"

New qApp {
    win1 = new qMainWindow() {
        setWindowTitle("QVideoWidget")
        btn1 = new qpushbutton(win1) {
            setGeometry(0, 0, 100, 30)
            setText("play")
            setclickevent("player.play() player2.play()
                           player3.play() player4.play()")
        }
        videowidget = new qvideowidget(win1) {
            setGeometry(50, 50, 600, 300)
            setstylesheet("background-color: black")
        }
        videowidget2 = new qvideowidget(win1) {
            setGeometry(700, 50, 600, 300)
            setstylesheet("background-color: black")
        }

        videowidget3 = new qvideowidget(win1) {
            setGeometry(50, 370, 600, 300)
            setstylesheet("background-color: black")
        }
    }
}
```

(continues on next page)

(continued from previous page)

```
videowidget4 = new QVideoWidget(win1) {
    setGeometry(700, 370, 600, 300)
    setStyleSheet("background-color: black")
}

player = new QMediaPlayer() {
    setMedia(new QUrl("1.mp4"))
    setVideoOutput(videowidget)
    setPosition(35*60*1000)
}

player2 = new QMediaPlayer() {
    setMedia(new QUrl("2.mp4"))
    setVideoOutput(videowidget2)
    setPosition(23*60*1000)
}

player3 = new QMediaPlayer() {
    setMedia(new QUrl("3.mp4"))
    setVideoOutput(videowidget3)
    setPosition(14.22*60*1000)
}

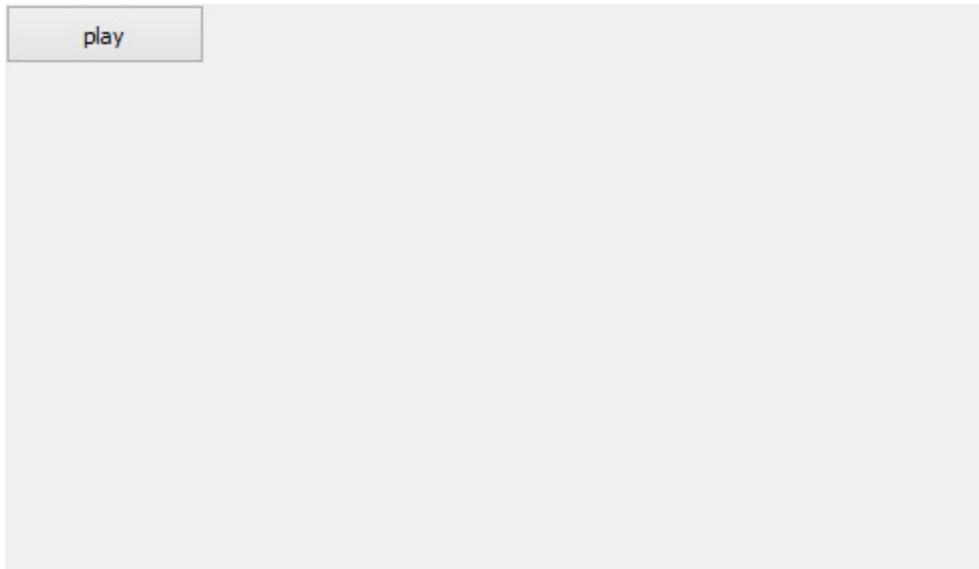
player4 = new QMediaPlayer() {
    setMedia(new QUrl("4.avi"))
    setVideoOutput(videowidget4)
    setPosition(8*60*1000)
}

showFullScreen()

exec()

}
```

The application during the runtime



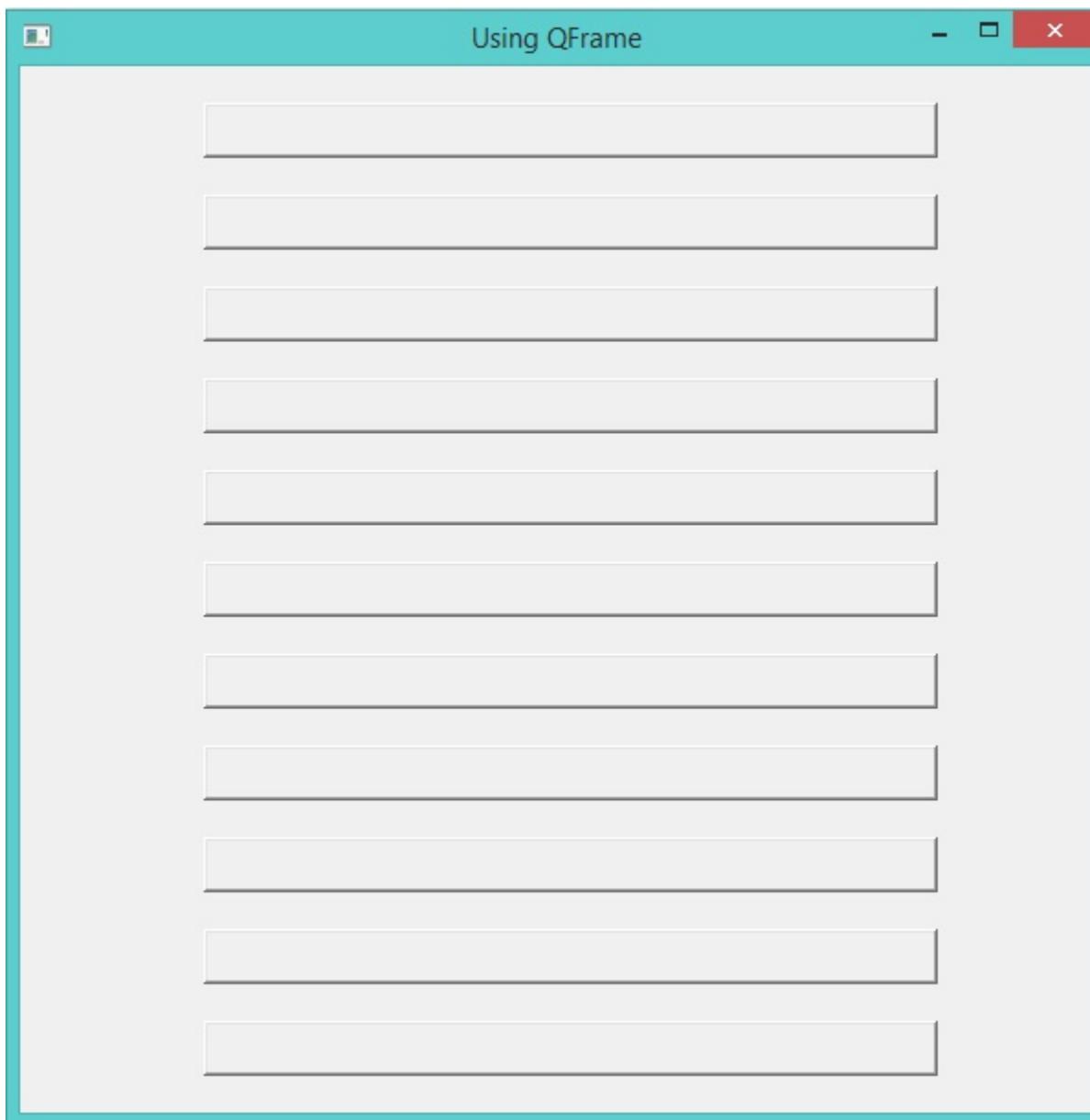
45.26 Using QFrame

In this example we will learn about using the QFrame class

```
Load "guilib.ring"

New qApp {
    win1 = new qMainWindow() {
        setWindowTitle("Using QFrame")
        for x = 0 to 10
            frame1 = new qframe(win1,0) {
                setGeometry(100,20+50*x,400,30)
                setFrameStyle(QFrame_Raised | QFrame_WinPanel)
            }
        next
        showMaximized()
    }
    exec()
}
```

The application during the runtime



45.27 Display Image using QLabel

In this example we will learn about displaying an image using the QLabel widget

```
Load "guilib.ring"

New qApp {
    win1 = new qMainWindow() {
        setWindowTitle("QLabel - Display image")
        new qlabel(win1) {
            image = new qpixmap("b:/mahmoud/photo/advice.jpg")
            setPixmap(image)
            setGeometry(0,0,image.width(),image.height())
        }
    }
}
```

(continues on next page)

(continued from previous page)

```
        }
        showMaximized()
    }
exec()
}
```

The application during the runtime



45.28 Menubar and StyleSheet Example

In this example we will learn about creating menubar and setting the window stylesheet

```

Load "guilib.ring"

New qApp {
    win1 = new QMainWindow() {
        setWindowTitle("Menubar")
        menu1 = new QMenuBar(win1) {
            sub1 = addmenu("File")
            sub1 {
                oAction = new QAction(win1) {
                    setText("New")
                    setEnabled(false)
                }
                addaction(oAction)
                oAction = new QAction(win1) {
                    setText("Open")
                    setCheckable(true)
                    setChecked(true)
                    setStatusTip("open new file")
                }
                addaction(oAction)
                oAction = new QAction(win1) {
                    setText("Save")
                }
                addaction(oAction)
                oAction = new QAction(win1) {
                    setText("Save As")
                }
                addaction(oAction)

                addseparator()
                oAction = new QAction(win1)
                oAction.setText("Exit")
                oAction.setClickEvent("myapp.quit()")
                addaction(oAction)
            }
        }
        status1 = new QStatusBar(win1) {
            showMessage("Ready!", 0)
        }
        setMenuBar(menu1)
        setMouseTracking(true)
        setStatusBar(status1)
        setStyleSheet("color: black; selection-color: black;
selection-background-color:white ;
background: QLinearGradient(x1: 0, y1: 0, x2: 0, y2: 1,
stop: 0 #eef, stop: 1 #ccf);")
        showMaximized()
    }
    exec()
}

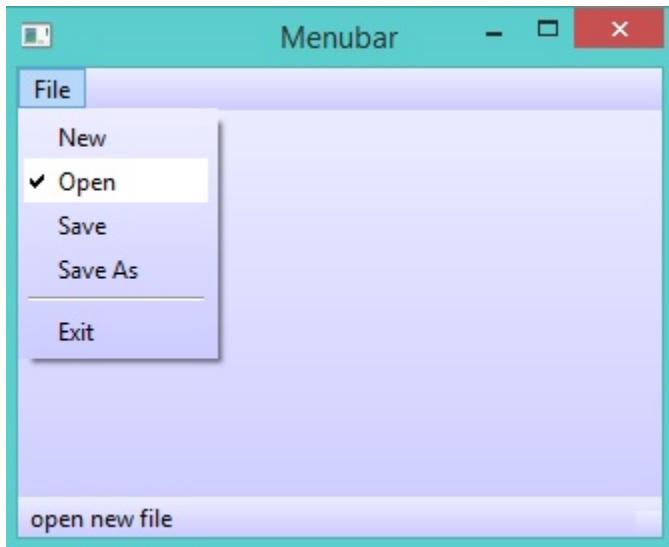
```

(continues on next page)

(continued from previous page)

}

The application during the runtime



45.29 QLineEdit Events and QMessageBox

In this example we will learn about using QLineEdit Events and displaying a Messagebox

```
Load "guilib.ring"

MyApp = New qApp {
    win1 = new QWidget() {
        setWindowTitle("Welcome")
        setGeometry(100,100,400,300)

        label1 = new QLabel(win1) {
            setText("What is your name ?")
            setGeometry(10,20,350,30)
            setAlignment(Qt.AlignHCenter)
        }

        btn1 = new QPushButton(win1) {
            setGeometry(10,200,100,30)
            setText("Say Hello")
            setClickEvent("pHello()")
        }

        btn1 = new QPushButton(win1) {
            setGeometry(150,200,100,30)
            setText("Close")
            setClickEvent("pClose()")
        }
    }
}
```

(continues on next page)

(continued from previous page)

```
lineedit1 = new QLineEdit(win1) {
    setGeometry(10,100,350,30)
    setTextChangedEvent("pChange()")
    setReturnPressedEvent("penter()")
}

show()
}

exec()
}

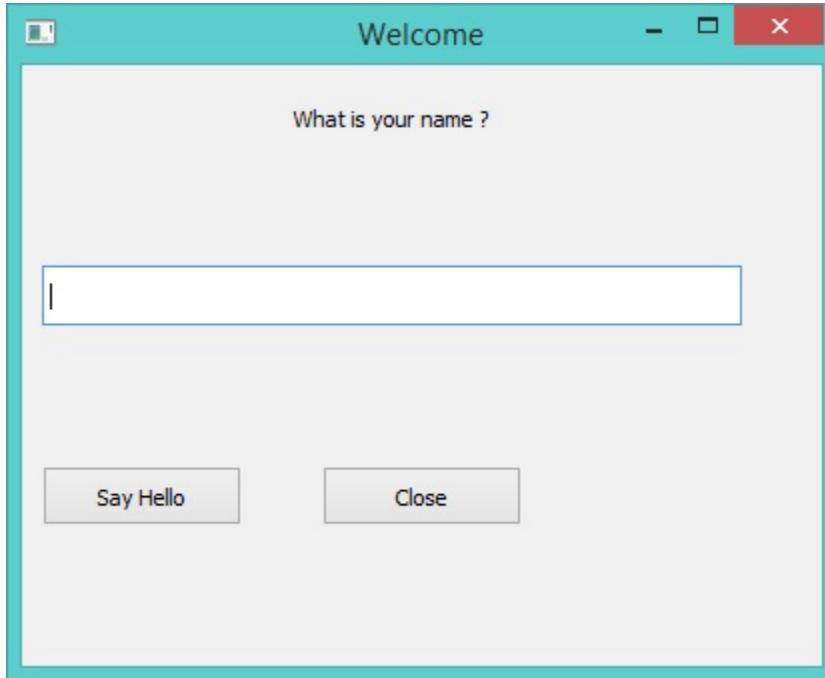
Func pHHello
    lineedit1.setText( "Hello " + lineedit1.text() )

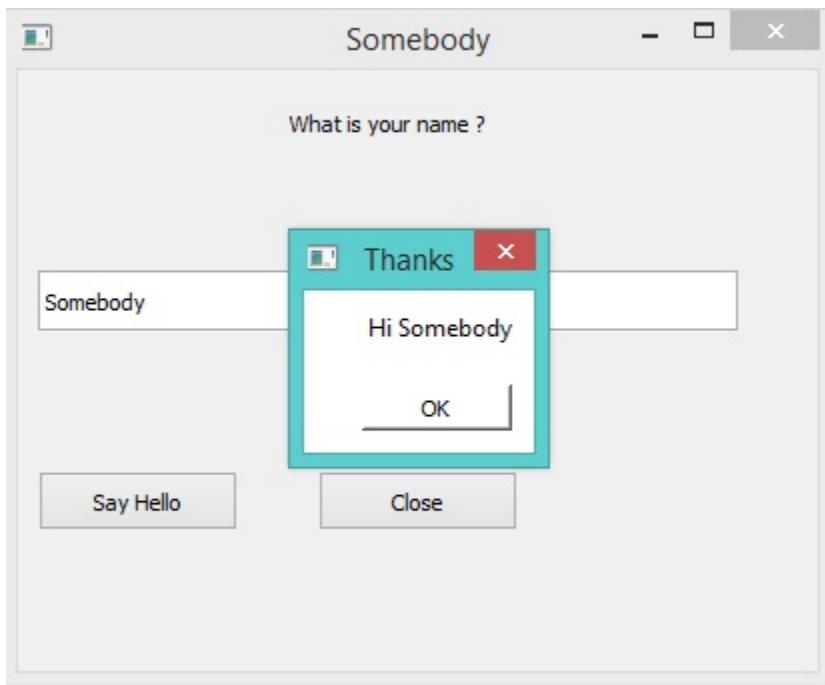
Func pClose
    MyApp.quit()

Func pChange
    win1 { setWindowTitle( lineedit1.text() ) }

Func pEnter
    new QMessageBox(win1) {
        setWindowTitle("Thanks")
        setText("Hi " + lineedit1.text())
        setStyleSheet("background-color : white")
        show()
}
```

The application during the runtime





45.30 Other Widgets Events

Each Qt signal can be used in RingQt, just add Set before the signal name and add event after the signal name to get the method that can be used to determine the event code.

For example the QProgressBar class contains a signal named valueChanged() To use it just use the function setValueChangedEvent()

Example:

```
Load "guilib.ring"

New qApp {
    win1 = new QMainWindow() {
        setWindowTitle("QProgressBar valueChanged Event")

        progress1 = new qprogressbar(win1) {
            setGeometry(100,100,350,30)
            setvalue(10)
            setvaluechangedevent ("pChange()")
        }

        new QPushButton(win1) {
            setGeometry(10,10,100,30)
            setText("increase")
            setclickevent ("pIncrease()")
        }
    }
    showMaximized()
}
```

(continues on next page)

(continued from previous page)

```

        exec()
}

func pIncrease
    progress1 { setvalue(value() +1) }

func pchange
    win1.setWindowTitle("value : " + progress1.value() )

```

The application during the runtime



Another example for the stateChanged event of the QCheckBox class

```

Load "guilib.ring"

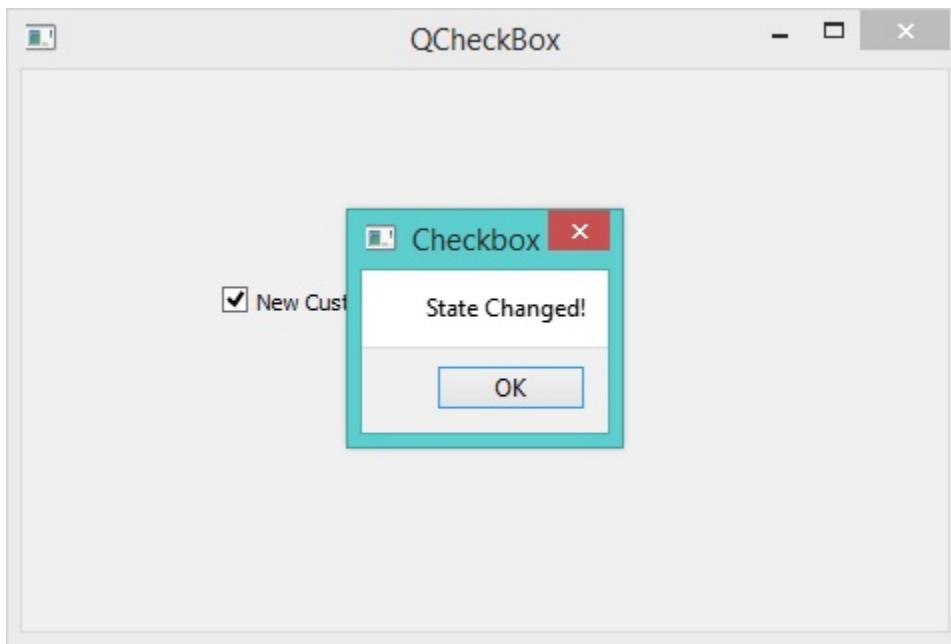
New qApp {
    win1 = new qMainWindow() {
        setWindowTitle("QCheckBox")
        new qcheckbox(win1) {
            setGeometry(100,100,100,30)
            setText("New Customer!")
            setStateChangedEvent ("pchange()")
        }
        showMaximized()
    }
    exec()
}

Func pChange

    new qMessageBox(Win1) {
        setWindowTitle("Checkbox")
        setText("State Changed!")
        show()
    }

```

The application during the runtime



45.31 Using the QTimer Class

In this example we will learn about using the QTimer class

```

Load "guilib.ring"

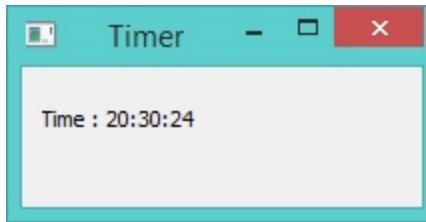
new qApp {
    win1 = new QWidget() {
        setGeometry(100,100,200,70)
        setWindowTitle("Timer")
        label1 = new QLabel(win1) {
            setGeometry(10,10,200,30)
            setText(theTime())
        }
        new QTimer(win1) {
            setInterval(1000)
            setTimerOutEvent("pTime()")
            start()
        }
        show()
    }
    exec()
}

func pTime
    label1.setText(theTime())

Func theTime
    return "Time : " + Time()

```

The application during the runtime



45.32 Using QProgressBar and Timer

In this example we will learn about using the “animated” QProgressBar class and Timer

```
#####
## ProgressBar and Timer Example

Load "guilib.ring"

new qApp
{
    win1 = new QWidget()
    {
        setGeometry(100,100,400,100)
        setWindowTitle("Timer and ProgressBar")

        LabelMan = new QLabel(win1)
        {
            setGeometry(10,10,200,30)
            setText(theTime())           ## ==>> func
        }

        TimerMan = new QTimer(win1)
        {
            setInterval(1000)
            setTimeOutEvent("pTime()")  ## ==>> func
            start()
        }

        BarMan = new QProgressBar(win1)
        {
            setGeometry(100,50,300,10)   ## Position X y, Length, Thickness
            setValue(0)                 ## Percent filled
        }

        show()
    }
    exec()
}

func pTime
    LabelMan.setText(theTime())      ## ==>> func

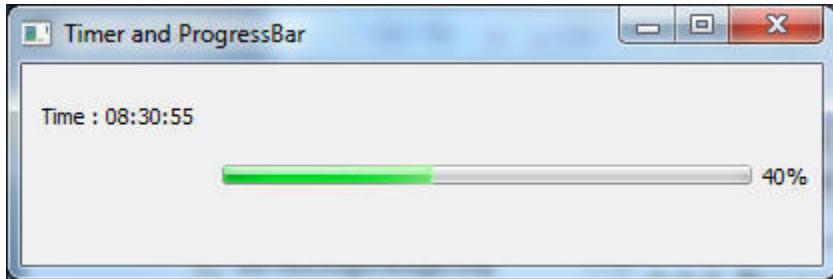
    Increment = 10
    if BarMan.value() >= 100       ## ProgressBar start over.
        BarMan.setValue(0)
    ok
}
```

(continues on next page)

(continued from previous page)

```
BarMan{ setvalue(value() + Increment) }

Func theTime
    return "Time : " + Time()
```



45.33 Display Scaled Image using QLabel

In this example we will learn about displaying and scaling an image so that it looks “animated” using the QLabel widget

```
Load "guilib.ring"

#-----
# REQUIRES: image = "C:\RING\bin\stock.jpg"

# imageStock: start dimensions for growing image

imageW = 200 ; imageH = 200 ; GrowBy = 4

###-----
### Window and Box Size dimensions

WinWidth = 1280 ; WinHeight = 960
BoxWidth = WinWidth -80 ; BoxHeight = WinHeight -80

###-----

New qapp {
    win1 = new qwidget() {

        setgeometry(50,50, WinWidth,WinHeight)
        setwindowtitle("Animated Image - Display Image Scaled and Resized")

        imageStock = new qlabel(win1) {

            image = new qpixmap("C:\RING\bin\stock.jpg")
            AspectRatio = image.width() / image.height()

            imageW = 200
            imageH = imageH / AspectRatio

            ## Size-H, Size-V, Aspect, Transform
            setpixmap(image.scaled(imageW , imageH , 0,0))
        }
    }
}
```

(continues on next page)

(continued from previous page)

```

        PosLeft = (BoxWidth - imageW) / 2
        PosTop = (BoxHeight - imageH) / 2
        setGeometry(PosLeft, PosTop, imageW, imageH)

    }

    TimerMan = new QTimer(win1) {
        setInterval(100)           ##### interval 100 millisecs.
        setTimerOutEvent("pTime()") ##### ==> func
        start()
    }

    show()
}
exec()
}

#####
### Function TimerMan: calling interval 100 milliseconds

func pTime

    ##### Stop Timer when image is size of Window area
    if imageW > BoxWidth
        TimerMan.stop()
        imageStock.clear()      ##### Will clear the image
    ok

    ##### Grow image
    imageW += GrowBy
    imageH = imageW / AspectRatio

    ##### Scaled Image: Size-H, Size-V, Aspect, Transform
    imageStock.setPixmap(image.scaled(imageW, imageH, 0, 0))

    ##### Center the image
    PosLeft = (WinWidth - imageW) / 2
    PosTop = (WinHeight - imageH) / 2
    imageStock.setGeometry(PosLeft, PosTop, imageW, imageH)

```

45.34 Using the QFileDialog Class

Example

```

Load "guilib.ring"

New qapp {
    win1 = new QWidget() {
        setWindowTitle("open file")
        setGeometry(100, 100, 400, 400)
        new QPushButton(win1) {
            setGeometry(10, 10, 200, 30)

```

(continues on next page)

(continued from previous page)

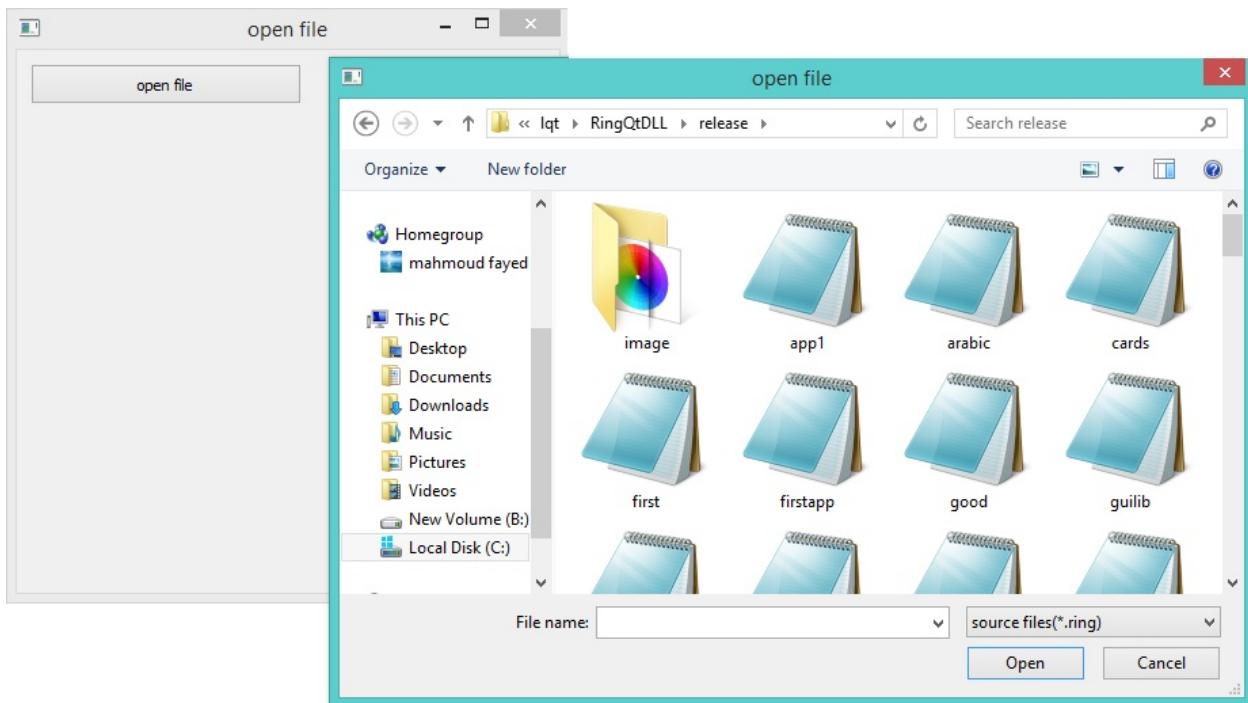
```

        settext("open file")
        setclickevent("pOpen()")
    }
    show()
}
exec()
}

Func pOpen
    new qfiledialog(win1) {
        cName = getopenfilename(win1,"open file","c:\\","source files (*.ring)")
        win1.setwindowtitle(cName)
    }
}

```

The application during the runtime



45.35 Drawing using QPainter

In this example we will learn about drawing using the QPainter class

```

Load "guilib.ring"
New qapp {
    win1 = new qwidget() {
        setwindowtitle("Drawing using QPainter")
        setgeometry(100,100,500,500)
        label1 = new qlabel(win1) {
            setgeometry(10,10,400,400)
            settext("")
        }
        new qpushbutton(win1) {

```

(continues on next page)

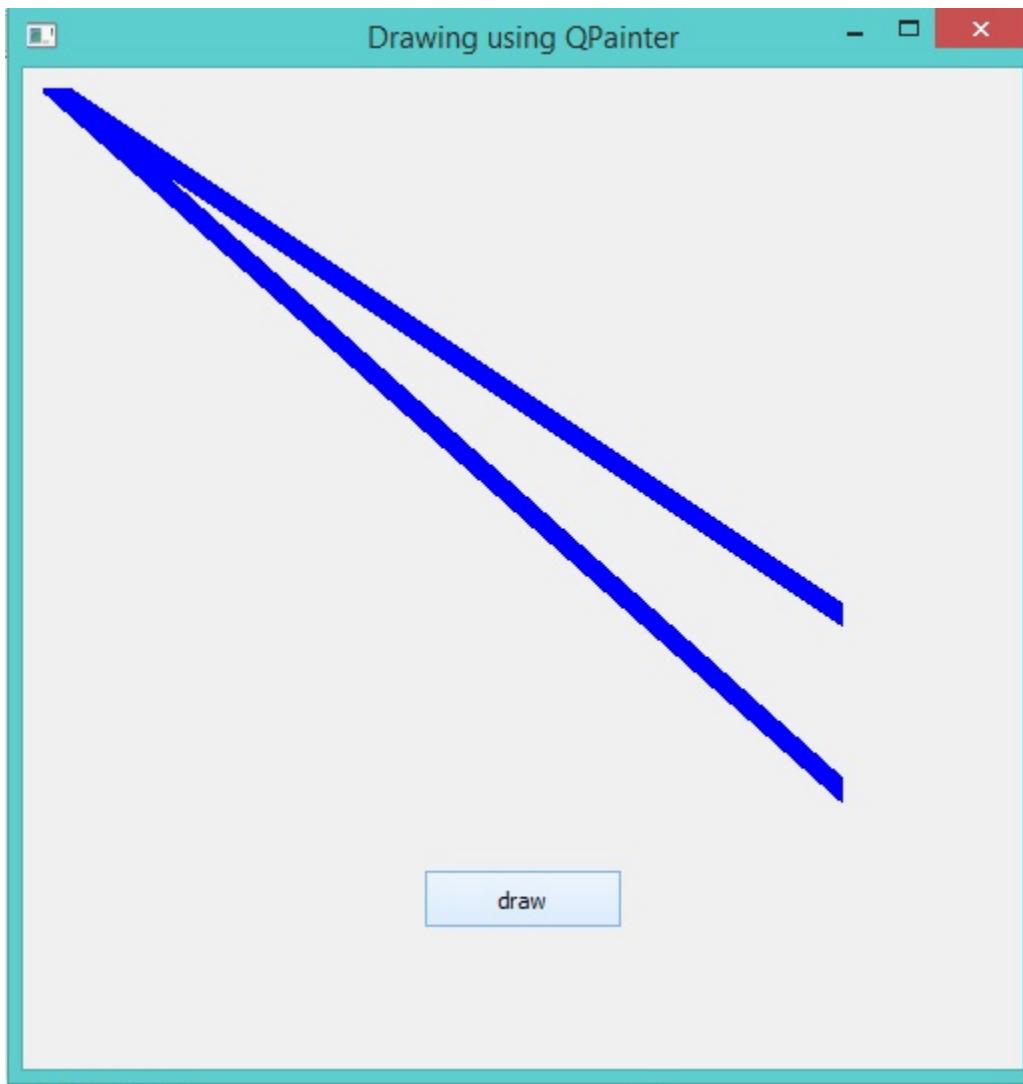
(continued from previous page)

```
        setgeometry(200,400,100,30)
        settext("draw")
        setclickevent("draw()")
    }

    show()
}
exec()
}

Func draw
p1 = new qpicture()
color = new qcolor() {
    setrgb(0,0,255,255)
}
pen = new qpen() {
    setcolor(color)
    setwidth(10)
}
new qpainter() {
    begin(p1)
    setpen(pen)
    drawline(500,150,950,450)
    drawline(950,550,500,150)
    endpaint()
}
label1 { setpicture(p1) show() }
```

The application during the runtime



45.36 Printing using QPrinter

In this example we will learn how to print to PDF file using QPrinter

```
Load "guilib.ring"
new qApp {
    win1 = new QWidget() {
        setWindowTitle("Printer")
        setGeometry(100,100,500,500)
        myweb = new QWebView(win1) {
            setGeometry(100,100,1000,500)
            loadPage(new QUrl("http://google.com"))
        }
        new QPushButton(win1) {
            setGeometry(20,20,100,30)
            setText("Print")
            setClickEvent("print()")
        }
    }
}
```

(continues on next page)

(continued from previous page)

```

        showmaximized()
    }
    exec()
}

func print
    printer1 = new qPrinter(0) {
        setoutputformat(1)      # 1 = pdf
        setoutputfilename("test.pdf")
        painter = new qpainter() {
            begin(printer1)
            myfont = new qfont("Times",50,-1,0)
            setfont(myfont)
            drawtext(100,100,"test")
            printer1.newpage()
            drawtext(100,100,"test2")
            endpaint()
        }
    }

    printer1 = new qPrinter(0) {
        setoutputformat(1)
        setoutputfilename("test2.pdf")
        myweb.print(printer1)
        myweb.show()
    }

    system ("test.pdf")
    system ("test2.pdf")

```

45.37 Using QPrintPreviewDialog

In this example we will learn how to use the QPrintPreviewDialog class.

Example:

```

load "guilib.ring"

new qApp {
    win1 = new qwidget() {
        setwindowtitle("Printer Preview Dialog")
        setgeometry(100,100,800,880)
        printer1 = new qPrinter(0)
        show()
        oPreview = new qPrintPreviewDialog(printer1) {
            setParent(win1)
            move(10,10)
            setPaintrequestedevent("printPreview()")
            exec()
        }
    }
    exec()
}

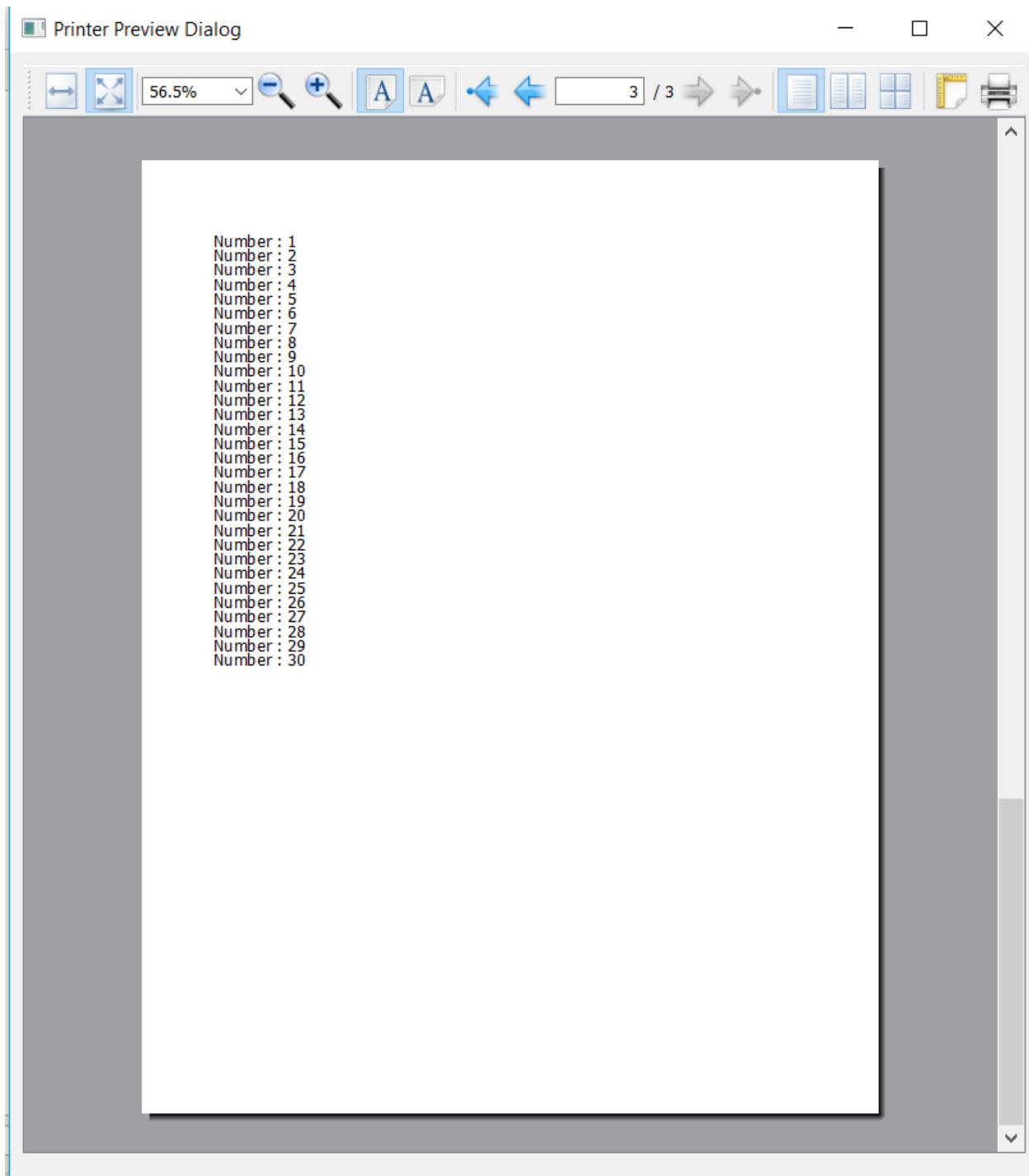
```

(continues on next page)

(continued from previous page)

```
func printPreview
    printer1  {
        painter = new QPainter() {
            begin(printer1)
            myfont = new QFont("Times", 50, -1, 0)
            setFont(myfont)
            drawText(100, 100, "Test - Page (1)")
            printer1.newpage()
            drawText(100, 100, "Test - Page (2)")
            printer1.newpage()
            myfont2 = new QFont("Times", 14, -1, 0)
            setFont(myfont2)
            for x = 1 to 30
                drawText(100, 100+(20*x), "Number : " + x)
            next
            endPaint()
        }
    }
```

Screen Shot:



45.38 Creating More than one Window

The next example demonstrates how to create more than one window

```

Load "guilib.ring"
app1 = new qapp {
    win1 = new qwidget() {
        setwindowtitle("First")
        setgeometry(100,100,500,500)

        new qpushbutton(win1) {
            setgeometry(100,100,100,30)
            settext("close")
            setclickevent("app1.quit()")
        }

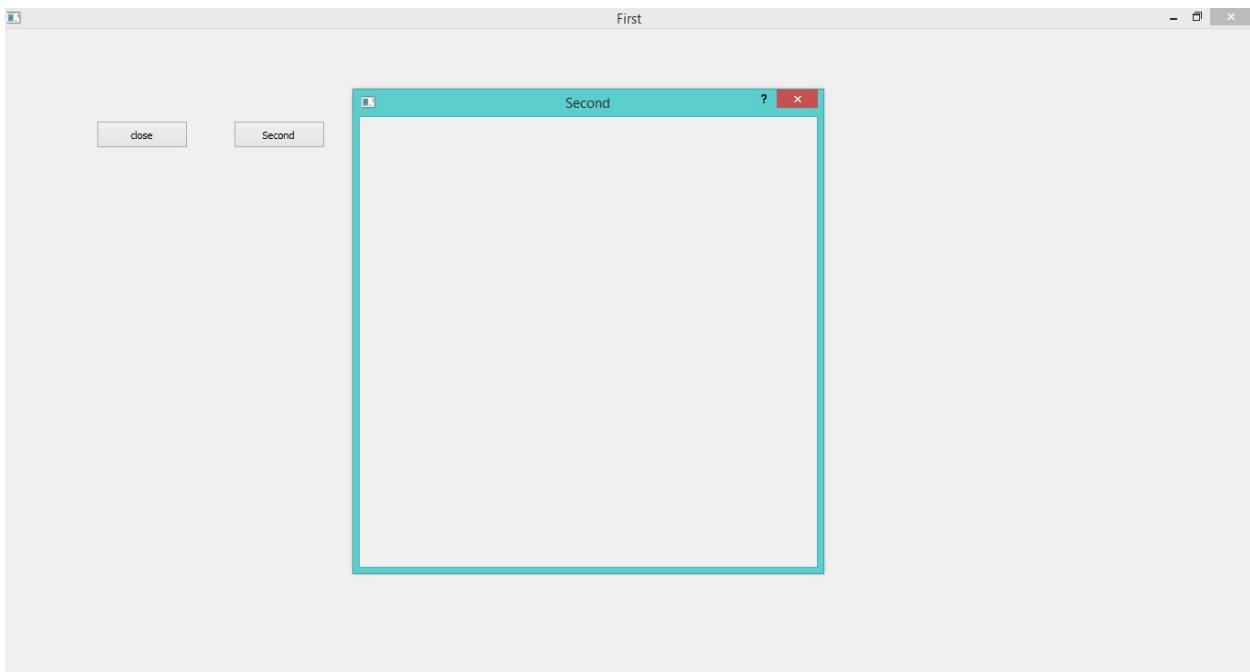
        new qpushbutton(win1) {
            setgeometry(250,100,100,30)
            settext("Second")
            setclickevent("second()")
        }

        showmaximized()
    }
    exec()
}

func second
    win2 = new qwidget() {
        setwindowtitle("Second")
        setgeometry(100,100,500,500)
        setwindowflags(Qt_dialog)
        show()
    }

```

The application during the runtime



45.39 Playing Sound

Example:

```
Load "guilib.ring"
new qapp {
    win1 = new qwidget() {
        setwindowtitle("play sound!") show()
    }
    new qmediaplayer() {
        setmedia(new qurl("footstep.wav"))
        setvolume(50) play()
    }
    exec()
}
```

45.40 Using the QColorDialog Class

Example:

```
Load "guilib.ring"

oApp = new myapp { start() }

Class MyApp

    oColor  win1

Func start
```

(continues on next page)

(continued from previous page)

```

myapp = new qapp

win1 = new qMainWindow() {
    setWindowTitle("Color Dialog")
    setGeometry(100,100,400,400)
}

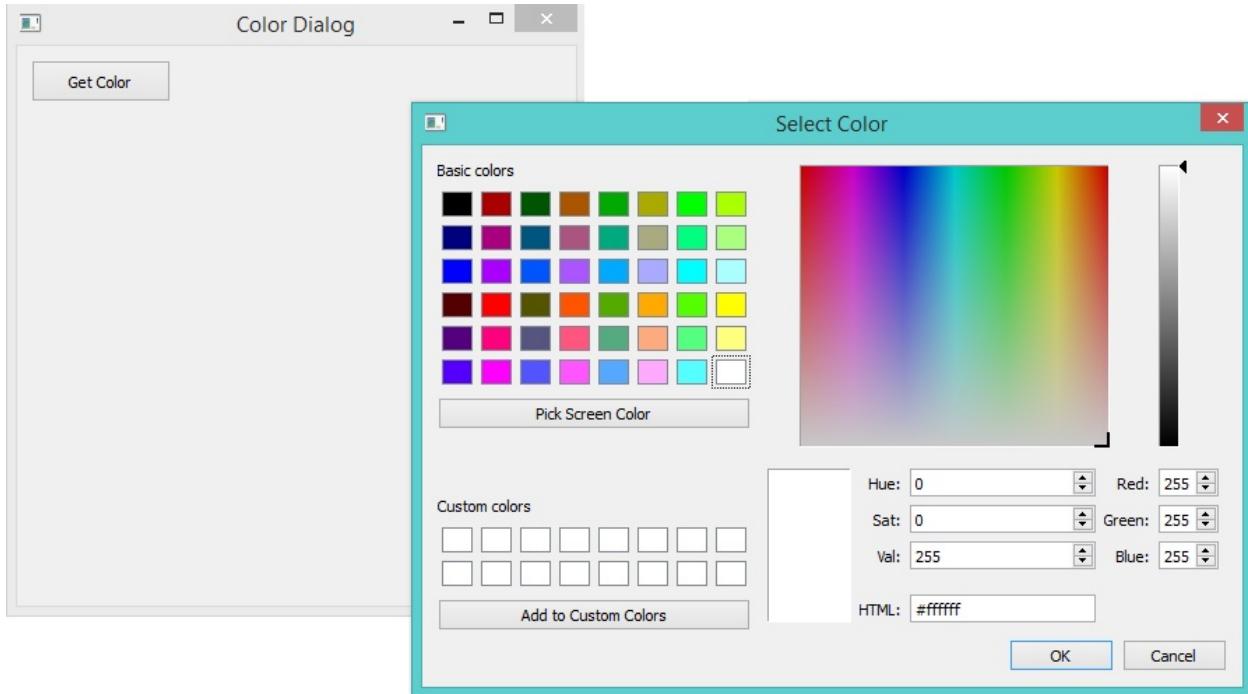
new QPushButton(win1) {
    setGeometry(10,10,100,30)
    setText("Get Color")
    setClickEvent("oApp.pColor()")
}

win1.show()
myapp.exec()

Func pColor
myobj = new QColorDialog()
aColor = myobj.GetColor()
r=aColor[1] g=aColor[2] b=aColor[3]
win1.setStyleSheet("background-color: rgb("+r+", " + g+ ", " + b + ")")

```

The application during the runtime



45.41 Using qLCDNumber Class

In this example we will learn about using the qLCDNumber class

```
Load "guilib.ring"

New qApp
{
    win1 = new QWidget()
    {
        setWindowTitle("LCD Number")
        setGeometry(100,100,250,120)

        new qLCDNumber(win1)
        {
            setGeometry(10,10,100,40)
            display(100)

        }

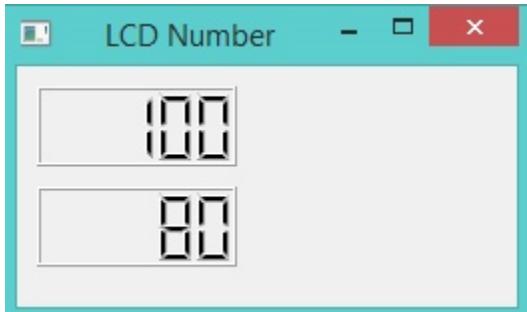
        new qLCDNumber(win1)
        {
            setGeometry(10,60,100,40)
            display(80)

        }
    }

    show()
}

exec()
```

The application during the runtime



45.42 Movable Label Example

```

Load "guilib.ring"

new qApp {
    win1 = new QWidget()
    {

        label1 = new QLabel(win1)
        {
            setText("Welcome")
            setGeometry(10,10,200,50)
            setStyleSheet("color: purple ; font-size: 30pt;")
        }

        new QTimer(win1)
        {
            setInterval(10)
            setTimeOutEvent("pMove()")
            start()
        }

        setWindowTitle("Movable Label")
        setGeometry(100,100,600,80)
        setStyleSheet("background-color: white;")
        show()
    }

    exec()
}

Func pMove
    label1
    {
        move(x() + 1, y())
        if x() > 600
            move(10, y())
        ok
    }
}

```

The application during the runtime



45.43 QMessageBox Example

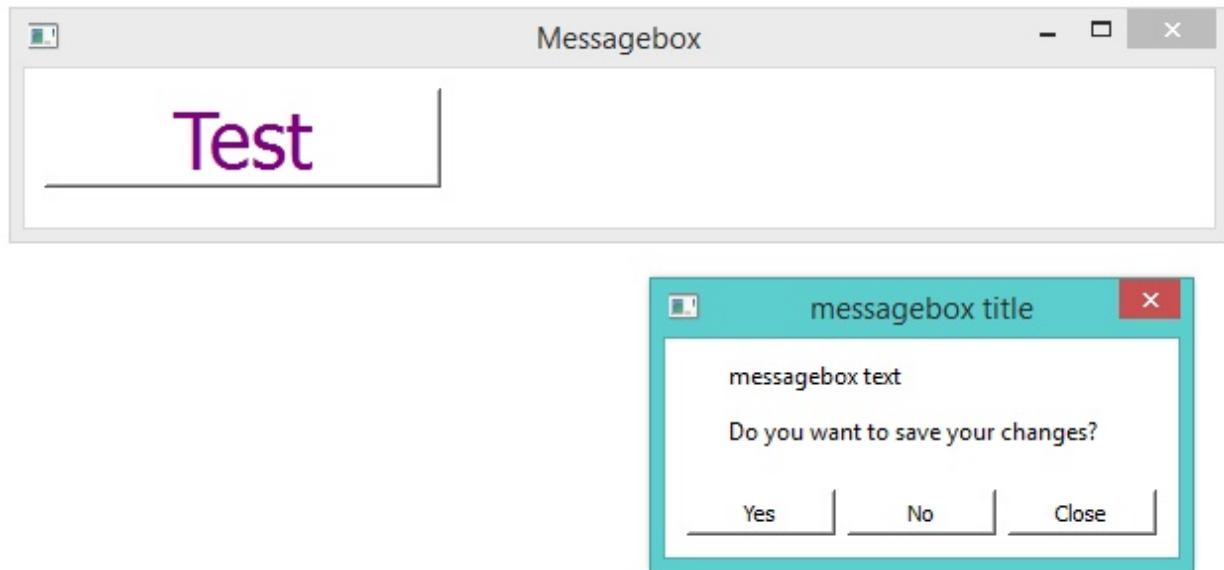
In this section we will learn how to check the output of the Message box

```
Load "guilib.ring"

new qApp {
    win1 = new QWidget()
    {
        label1 = new QPushButton(win1)
        {
            setText("Test")
            setGeometry(10,10,200,50)
            setStyleSheet("color: purple ; font-size: 30pt;")
            setClickEvent("pWork()")
        }
        setWindowTitle("Messagebox")
        setGeometry(100,100,600,80)
        setStyleSheet("background-color: white;")
        show()
    }
    exec()
}

func pWork
{
    new QMessageBox(win1)
    {
        setWindowTitle("messagebox title")
        setText("messagebox text")
        setInformativeText("Do you want to save your changes?")
        setStandardButtons(QMessageBox_Yes | QMessageBox_No | QMessageBox_Close)
        result = exec()
        win1 {
            if result = QMessageBox_Yes
                setWindowTitle("Yes")
            but result = QMessageBox_No
                setWindowTitle("No")
            but result = QMessageBox_Close
                setWindowTitle("Close")
            ok
        }
    }
}
```

The application during the runtime



45.44 Using QInputDialog Class

In the next example we will learn about using the QInputDialog class

```

Load "guilib.ring"

New QApplication {
    Win1 = New QWidget () {
        SetGeometry(100,100,400,400)
        SetWindowTitle("Input Dialog")

        New QPushButton(win1)
        {
            SetText ("Input Dialog")
            SetGeometry(100,100,100,30)
            SetClickEvent("pWork()")
        }

        Show()
    }

    exec()
}

Func pWork
    oInput = New QInputDialog(win1)
    {
        setWindowTitle("What is your name?")
        setGeometry(100,100,400,50)
        setLabelText("User Name")
        setTextValue("Mahmoud")
    }
}

```

(continues on next page)

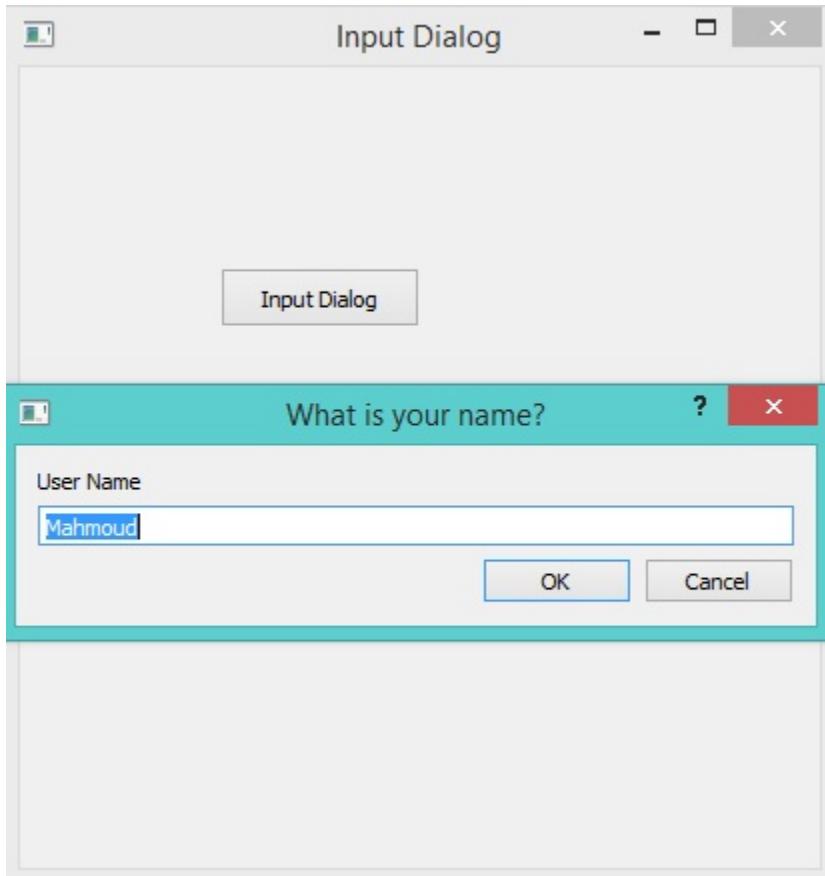
(continued from previous page)

```

lcheck = exec()
if lCheck win1.setwindowtitle(oInput.textvalue()) ok
}

```

The application during the runtime



45.45 Dialog Functions

We have the next functions

```

SetDialogIcon(cIconFile)
MsgInfo(cTitle, cMessage)
ConfirmMsg(cTitle, cMessage) --> lResult
InputBox(cTitle, cMessage) --> cValue
InputBoxInt(cTitle, cMessage) --> nValue
InputBoxNum(cTitle, cMessage) --> nValue
InputBoxPass(cTitle, cMessage) --> cValue

```

Example

```

load "guilib.ring"

new qApp
{

```

(continues on next page)

(continued from previous page)

```

SetDialogIcon("notepad.png")
msginfo(:Ring,:Welcome)
 confirmMsg(:Ring,"Are you sure?") + nl
 InputBoxNum(:Ring,"Enter Number(double) :") + nl
 InputBox(:Ring,"Enter Value :") + nl
 InputBoxInt(:Ring,"Enter Number(int)") + nl
 InputBoxPass(:Ring,"Enter Password") +nl
}

```

45.46 KeyPress and Mouse Move Events

In this example we will learn how to use the Events Filter to know about KeyPress and Mouse Move Events

```

Load "guilib.ring"

new qApp {

    win1 = new QWidget()
    {
        setWindowTitle("Test using Event Filter!")
        setGeometry(100,100,400,400)
        setMouseTracking(true)
        myfilter = new qallevents(win1)
        myfilter.setKeyPressEvent("pWork()")
        myfilter.setMouseButtonPressEvent("pClick()")
        myfilter.setMouseMoveEvent("pMove()")

        installEventFilter(myfilter)

        show()
    }

    exec()
}

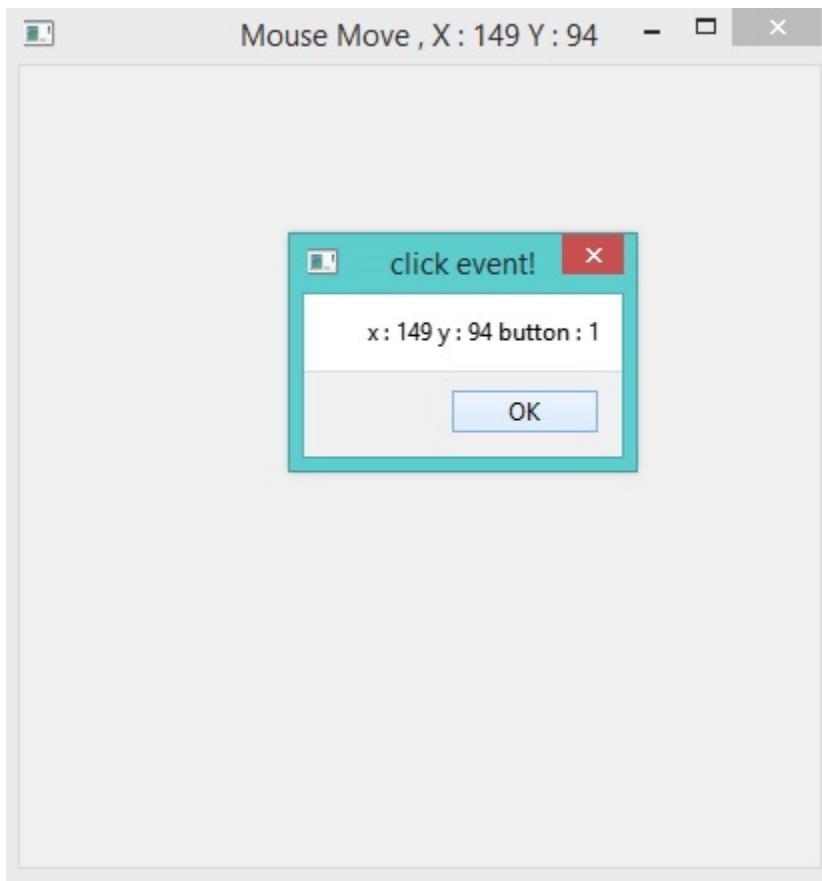
func pWork
    win1.setWindowTitle('KeyPress! : ' + myfilter.getKeyCode())

func pClick
    new QMessageBox(win1) {
        setGeometry(100,100,400,100)
        setWindowTitle("click event!")
        setText("x : " + myfilter.getX() +
               " y : " + myfilter.getY() + " button : " +
               myfilter.getButton())
        show()
    }

func pMove
    win1.setWindowTitle("Mouse Move , X : " + myfilter.getX() +
                       " Y : " + myfilter.getY())

```

The application during the runtime



45.47 Moving Objects using the Mouse

In the next example we will learn how to program movable objects where the user can move a label

```
Load "guilib.ring"

lPress = false
nX = 0
nY = 0

new qApp {

    win1 = new QWidget()
    {

        setWindowTitle("Move this label!")
        setGeometry(100,100,400,400)
        setstylesheet ("background-color:white;")

        Label1 = new QLabel(Win1){
            setGeometry(100,100,200,50)
            setText ("Welcome")
            setstylesheet ("font-size: 30pt")
            myfilter = new qallevents(label1)
            myfilter.setEnterevent ("pEnter()")
    }
}
```

(continues on next page)

(continued from previous page)

```

        myfilter.setLeaveEvent ("pLeave() ")
        myfilter.setMouseEvent ("pPress() ")
        myfilter.setMouseButtonReleaseEvent ("pRelease() ")
        myfilter.setMouseMoveEvent ("pMove() ")
        installEventFilter(myfilter)
    }

    show()
}

exec()
}

Func pEnter
    Label1.setStyleSheet ("background-color: purple; color:white;font-size: 30pt;")

Func pLeave
    Label1.setStyleSheet ("background-color: white; color:black;font-size: 30pt;")

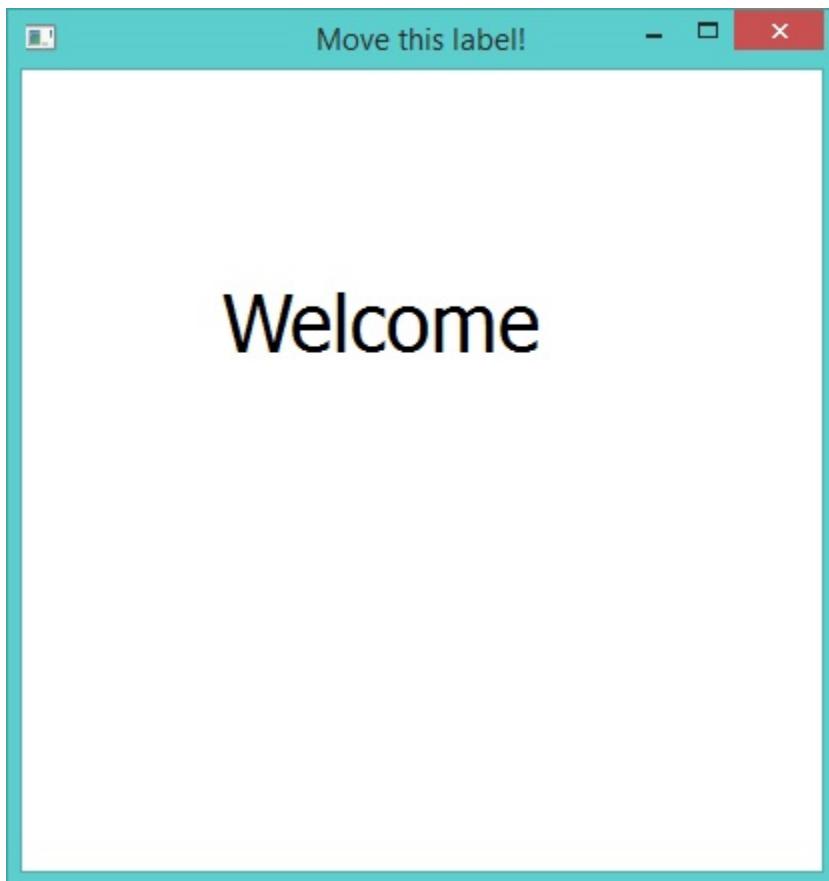
Func pPress
    lPress = True
    nX = myfilter.getGlobalX()
    ny = myfilter.getGlobalY()

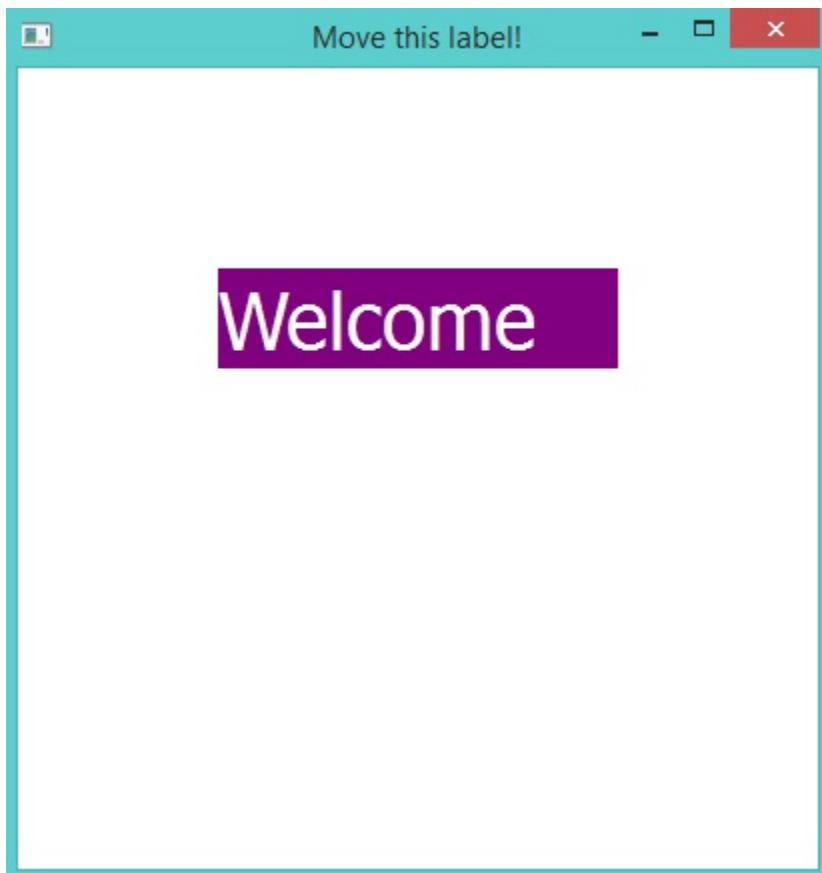
Func pRelease
    lPress = False
    pEnter()

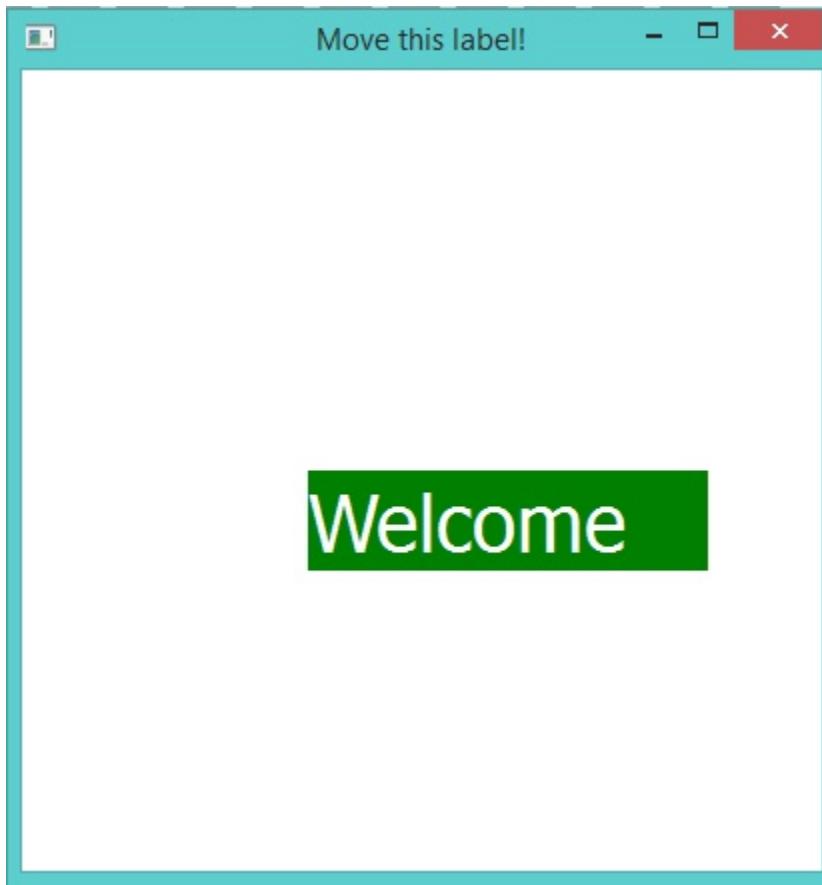
Func pMove
    nX2 = myfilter.getGlobalX()
    ny2 = myfilter.getGlobalY()
    ndiffx = nX2 - nX
    ndiffy = ny2 - ny
    if lPress
        Label1 {
            move(x()+ndiffx,y()+ndiffy)
            setStyleSheet ("background-color: Green;
                           color:white;font-size: 30pt;")
            nX = nX2
            ny = ny2
        }
    ok

```

The application during the runtime







45.48 Inheritance from GUI Classes

Example :

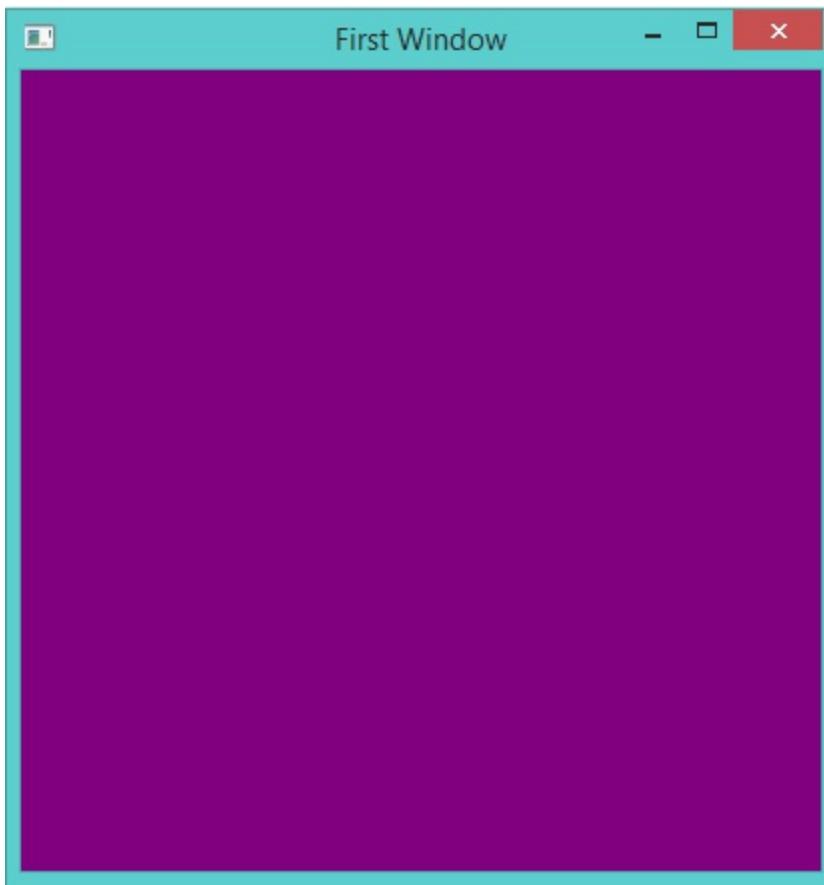
```
Load "guilib.ring"

New MyWindow()

new qApp { exec() }

class mywindow from QWidget
    Func init
        super.init()
        setWindowTitle("First Window")
        setGeometry(100,100,400,400)
        setStyleSheet("background-color: purple;")
        setToolTip("my first window!")
        show()
```

The application during the runtime



45.49 Using QDesktopWidget Class

In the next example we will learn about using the QDesktopWidget class

```
Load "guilib.ring"

New qApp {
    win1 = New QWidget()
    {
        resize(400,400)
        btn1 = new QPushButton(win1)
        {
            setText("Center")
            move(100,100)
            resize(100,30)
            setClickEvent("pCenter()")
        }

        Show()
    }

    exec()
}

Func pCenter
```

(continues on next page)

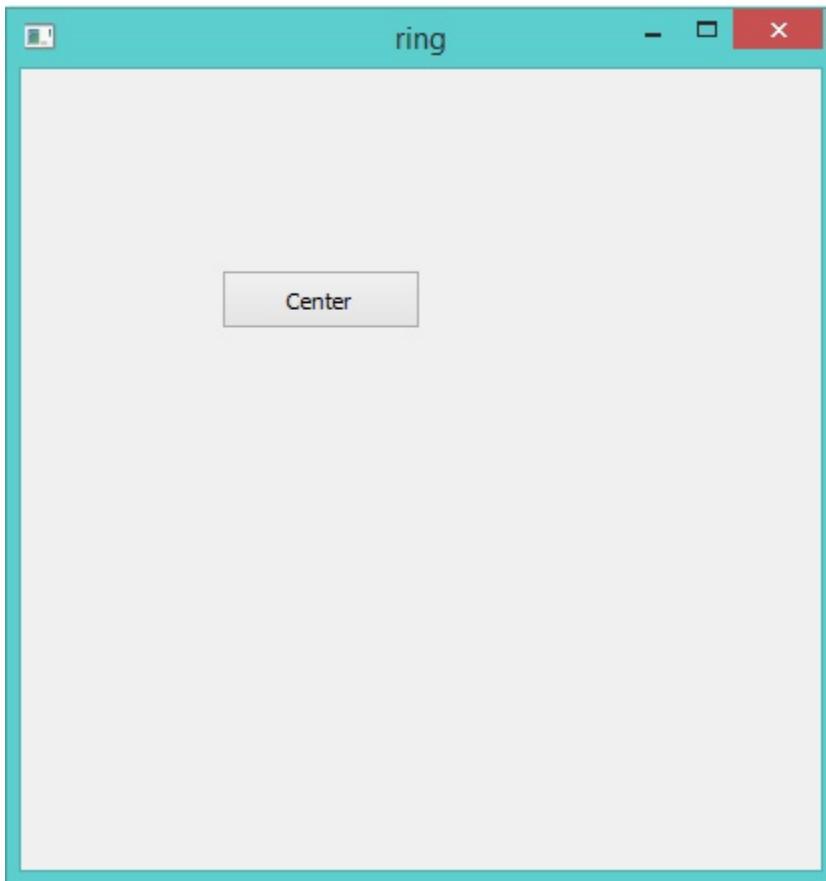
(continued from previous page)

```

oDesktop = new qDesktopWidget()
oRect = oDesktop.screenGeometry( oDesktop.primaryScreen() )
win1.move((oRect.width()-win1.width()) /2 , (oRect.Height()-win1.Height()) /2 )
win1.show()

```

The application during the runtime



45.50 Rotate Text

The next example rotate text using a Timer.

```

Load "guilib.ring"

nAngle = 0

New qapp {
    win1 = new QWidget() {
        setWindowTitle("Rotate Text")
        resize(800,600)
        label1 = new QLabel(win1) {
            setText("")
            myfilter = new QAllevents(win1)
            myfilter.setMouseButtonPressEvent("pClick()")
            installEventFilter(myfilter)

```

(continues on next page)

(continued from previous page)

```

        }
        new QTimer(win1) {
            setInterval(50)
            setTimeOutEvent("pTime()")
            start()
        }
    pDraw()
    L1 = new QVBoxLayout() { AddWidget(Label1) } SetLayout(L1)
    showMaximized()
}
exec()
}

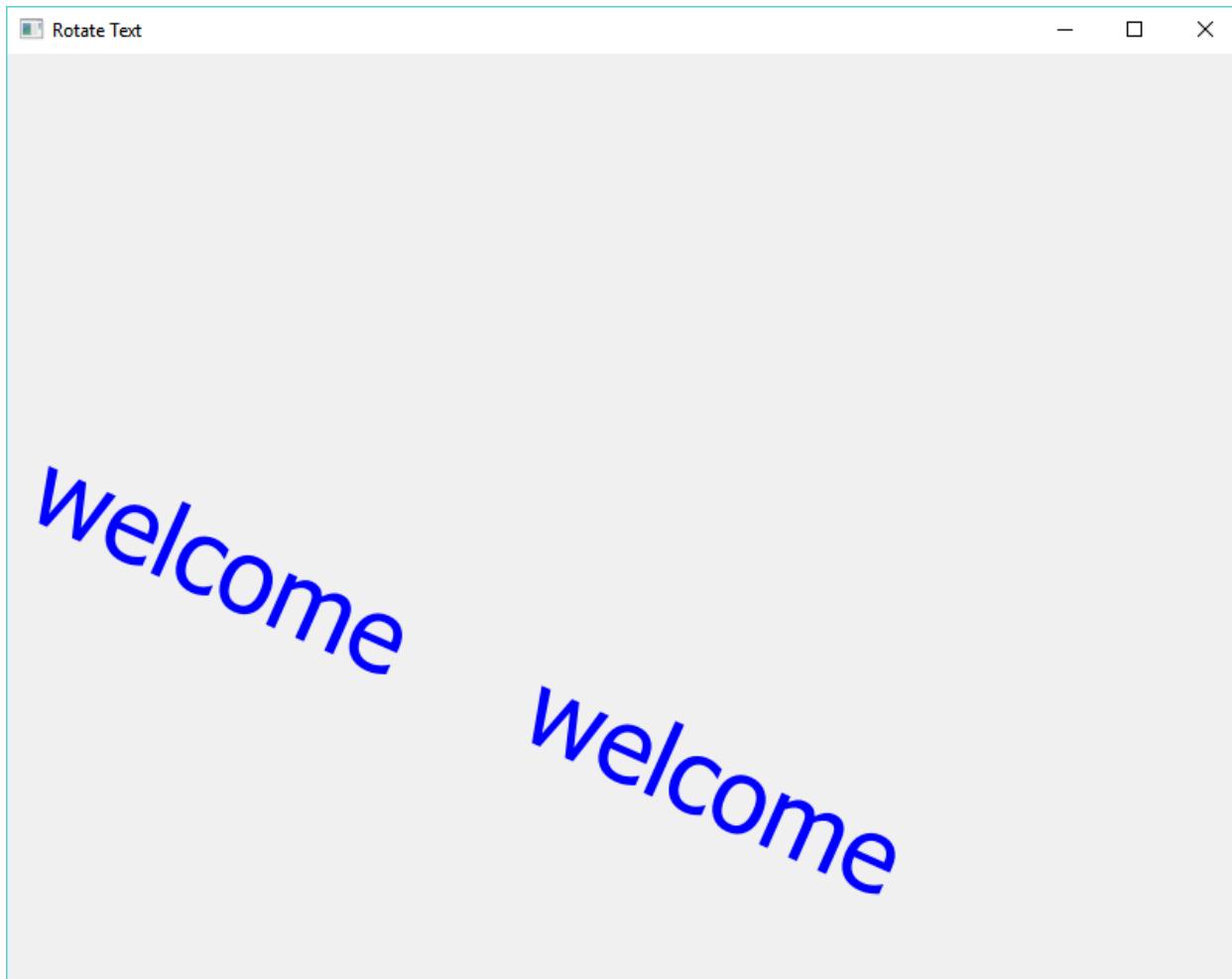
Func pDraw
    p1 = new QPicture()
    color = new QColor() {
        setRGB(0,0,255,255)
    }
    pen = new QPen() {
        setColor(color)
        setWidth(50)
    }
    painter = new QPainter() {
        begin(p1)
            setPen(pen)
            myFont = font()
            myFont.setPointSize(50)
            setFont(myFont)
            rotate(nAngle)
            drawText(350, 0*nAngle, "welcome")
            drawText(0, 0*nAngle, "welcome")
        endPaint()
    }
    label1 {
        setPicture(p1)
        show()
    }

Func pClick
    win1 { setWindowTitle("Click Event") }

Func pTime
    nAngle++
    if nAngle = 90
        nAngle = 10
    ok
    pDraw()
}

```

The application during the runtime



45.51 Change Focus

The next example change the focus using the ENTER key.

```
load "guilib.ring"

new qApp {
    win = new QWidget() {
        resize(600,600)
        SetWindowTitle("Change Focus")
        text1 = new QLineEdit(win)
        text2 = new QLineEdit(win)
        text3 = new QLineEdit(win)
        text4 = new QLineEdit(win)
        layout1 = new QVBoxLayout() {
            AddWidget(text1)
            AddWidget(text2)
            AddWidget(text3)
            AddWidget(text4)
        }
    }
}
```

(continues on next page)

(continued from previous page)

```

        setLayout(Layout1)
        aList = [text1,text2,text3,text4]
        oFilter = new qallevents(win)
        oFilter.setKeyPressEvent("pWork()")
        installeargentfilter(oFilter)
        show()
    }
    exec()
}

func pWork
    nCode = oFilter.getkeycode()
    if nCode = 16777220      # ENTER Key
        for x=1 to len(aList)
            if aList[x].HasFocus()
                t = x+1
                if t > len(aList) t=1 ok
                aList[t].SetFocus(0)
                exit
            ok
        next
    ok

```

45.52 Regular Expressions

The next example uses the Regular Expressions classes.

```

load "guilib.ring"

new qApp
{
    see "Using Regular Expressions" + nl

    exp = new qregularexpression() {
        setPattern("\d\d \w+")
        see pattern() + nl
        match = match("33 one",0,0,0)
        see match.hasmatch() + nl
        match = match("3 one",0,0,0)
        see match.hasmatch() + nl
        match = match("welcome 11 one",0,0,0)
        see match.hasmatch() + nl
        matched = match.captured(0)
        see matched + nl
    }
    exp = new qregularexpression() {
        setPattern("^(\d\d)/(\d\d)/(\d\d\d\d)$")
        see pattern() + nl
        match = match("08/12/1985",0,0,0)
        see match.hasmatch() + nl
        day = match.captured(1)
        month = match.captured(2)
        year = match.captured(3)
        see day + nl + month + nl + year + nl
    }
}

```

(continues on next page)

(continued from previous page)

```

    ↵nl      see  " (" + match.capturedStart(1) + ", " + match.capturedEnd(1) + ") " + ↵
    ↵nl      see  " (" + match.capturedStart(2) + ", " + match.capturedEnd(2) + ") " + ↵
    ↵nl      see  " (" + match.capturedStart(3) + ", " + match.capturedEnd(3) + ") " + ↵
    ↵nl    }
}

}

```

Output

```

Using Regular Expressions
\d\d \w+
1
0
1
11 one
^(\d\d) / (\d\d) / (\d\d\d\d)$
1
08
12
1985
(0,2)
(3,5)
(6,10)

```

45.53 Simple Client and Server Example

In this section we will learn about creating simple Client and Server Application

```

Load "guilib.ring"

new qApp {
    oClient = new Client { client() }
    oServer = new Server { server() }
    exec()
}

Class Client

    win1 lineedit1 cOutput=""
    oTcpSocket

    func client

        win1 = new QWidget()

        new QPushButton(win1) {
            setGeometry(50,50,100,30)
            setText("connect")
            setClickEvent("oClient.Connect()")
        }

```

(continues on next page)

(continued from previous page)

```

lineedit1 = new QTextEdit(win1) {
    setGeometry(150, 50, 200, 300)
}

win1 {
    setWindowTitle("client")
    setGeometry(10, 100, 400, 400)
    show()
}

func connect
    cOutput = "Connect to host 127.0.0.1 port 9999" + nl
    lineedit1.settext(cOutput)
    oTcpSocket = new QTcpSocket(win1) {
        setConnectedEvent("oClient.pConnected()")
        setReadyReadEvent("oClient.pRead()")
        connecttohost("127.0.0.1", 9999, 3, 0)
        waitForConnected(5000)
    }

func pConnected

    cOutput += "Connected!" + nl
    lineedit1.settext(cOutput)

func pRead

    cOutput += "Ready Read!" + nl
    lineedit1.settext(cOutput)
    cOutput += oTcpSocket.readAll().data() + nl
    lineedit1.settext(cOutput)

Class Server

    win1 lineedit1
    oTcpServer oTcpClient
    cOutput = ""

func server

    win1 = new QWidget()

    lineedit1 = new QTextEdit(win1) {
        setGeometry(150, 50, 200, 300)
    }

    win1 {
        setWindowTitle("Server")
        setGeometry(450, 100, 400, 400)
        show()
    }

    oTcpServer = new QTcpServer(win1) {
        setNewConnectionEvent("oServer.pNewConnection()")
        oHostAddress = new QHostAddress()
        oHostAddress.setAddress("127.0.0.1")
        listen(oHostAddress, 9999)
    }

```

(continues on next page)

(continued from previous page)

```

        }
        cOutput = "Server Started" + nl +
                  "listen to port 9999" + nl

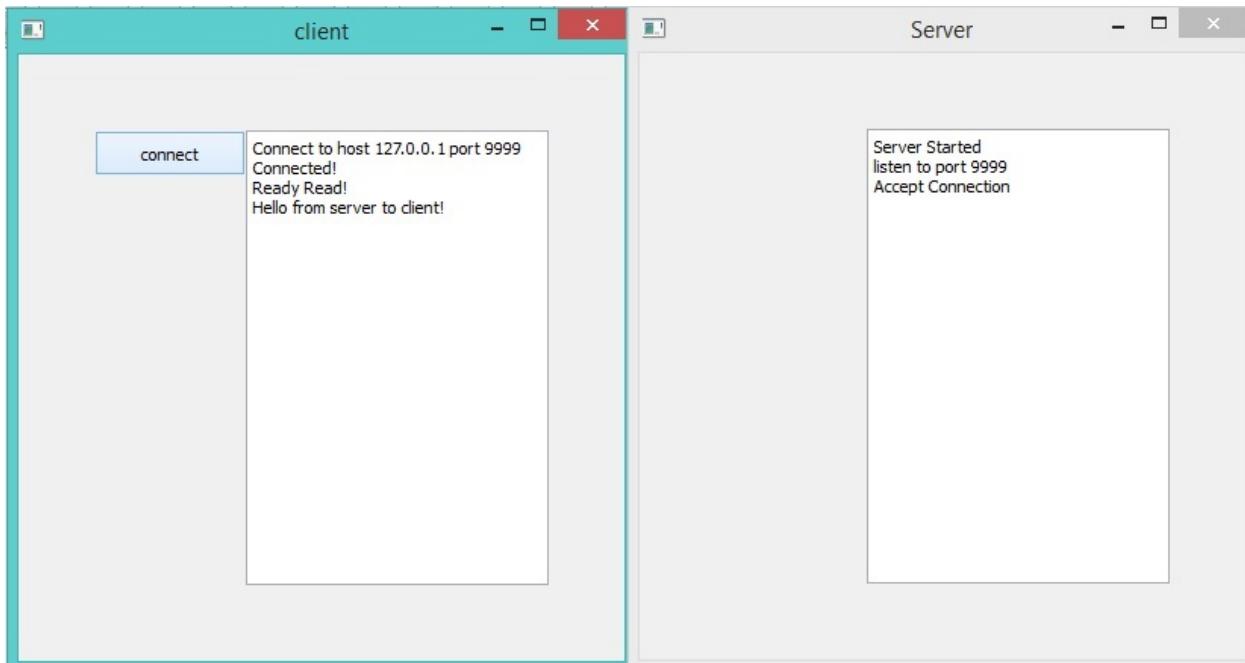
        lineedit1.settext(cOutput)

Func pNewConnection

    oTcpClient = oTcpServer.nextPendingConnection()
    cOutput += "Accept Connection" + nl
    lineedit1.settext(cOutput)
    oTcpClient {
        cStr ="Hello from server to client!"+char(13)+char(10)
        write(cStr,len(cStr))
        flush()
        waitforbyteswritten(300000)
        close()
    }
}

```

The application during the runtime



45.54 Dynamic Objects

We may create objects in the runtime and add them to windows.

Example:

```

load "guilib.ring"

oFormDesigner = new FormDesigner { start("oFormDesigner") }

```

(continues on next page)

(continued from previous page)

Class FormDesigner

```

winToolBox  winForm

aObjects = []

func start cObjectName

oApp = new qApp

winToolBox = new QWidget()
winToolBox.setWindowTitle("ToolBox")
winToolBox.move(10,10)
winToolBox.resize(300,600)

btn = new QPushButton(winToolBox)
btn.resize(300,30)
btn.setText("Create Button")
btn.setClickEvent(cObjectName+".pCreateButton()")
btn.show()

winToolBox.show()

winForm = new QWidget() {
    move(400,50)
    setWindowTitle("Form Designer")
    resize(600,600)
    show()
}

oApp.exec()

```

func pCreateButton

```

nCount = len(aObjects)

aObjects + new MyButton(winForm)
{
    nIndex = nCount + 1
    setText("Button"+ nIndex)
    Move(30*nIndex,30*nIndex)
    resize(100,30)
    show()
}

```

Class MyButton **from** qPushButton
nIndex = 0

45.55 Weight History Application

The next sample help in recording (Date, Time and Weight).

```
Load "guilib.ring"

MyApp = new qApp
{
    $ApplicationObject = "oApp"      # To be used when calling events
    oApp = new App
    exec()
    oApp.CloseDatabase()
}

class App

    cDir = currentdir() + "/"
    oCon
    aIDs = []

    win1 = new QWidget()
    {
        setWindowTitle("Weight History")
        resize(600,600)
        layoutButtons = new qhboxlayout()
        {
            label1 = new QLabel(win1) { setText("Weight") }
            text1 = new QLineEdit(win1)
            btnAdd = new QPushButton(win1) {
                setText("Add")
                setClickEvent($ApplicationObject+".AddWeight()")
            }
            btnDelete = new QPushButton(win1) {
                setText("Delete")
                setClickEvent($ApplicationObject+".DeleteWeight()")
            }
            addWidget(label1)
            addWidget(text1)
            addWidget(btnAdd)
            addWidget(btnDelete)
        }
        layoutData = new qhboxlayout()
        {
            Table1 = new QTableWidget(win1) {
                setRowCount(0)
                setColumnCount(3)
                setSelectionBehavior(QAbstractItemView_SelectRows)
                setHorizontalHeaderItem(0, new QTableWidgetItem("Date"))
                setHorizontalHeaderItem(1, new QTableWidgetItem("Time"))
                setHorizontalHeaderItem(2, new QTableWidgetItem("Weight"))
                setItemChangedEvent($ApplicationObject+".ItemChanged()")
                setAlternatingRowColors(true)
                horizontalHeader().setStyleSheet("color: blue")
                verticalHeader().setStyleSheet("color: red")
            }
            addWidget(Table1)
        }
    }
}
```

(continues on next page)

(continued from previous page)

```

layoutClose = new qhboxlayout()
{
    btnClose = new qpushbutton(win1) {
        setText("Close")
        setClickEvent("MyApp.Quit()")
    }
    addwidget(btnClose)
}
layoutMain = new qvboxlayout()
{
    addlayout(layoutButtons)
    addLayout(LayoutData)
    addLayout(layoutClose)
}
setLayout(layoutMain)
self.OpenDatabase()
self.ShowRecords()
show()
}

Func OpenDatabase
lCreate = False
if not fexists(cDir + "weighthistory.db")
    lCreate = True
ok
new QSqlDatabase() {
    this.oCon = addDatabase("QSQLITE") {
        setDatabaseName("weighthistory.db")
        Open()
    }
}
if lCreate
    new QSqlQuery() {
        exec("create table weighthistory (id integer primary key," +
            " f_date varchar(10), " +
            " f_time varchar(8), f_weight varchar(8) );")
        delete()
    }
ok

Func CloseDatabase
oCon.Close()

Func AddWeight
cWeight = text1.text()
AddRecord(cWeight)

Func DeleteWeight
Table1 {
    nRow = CurrentRow()
    if nRow >= 0
        nID = this.aIDs[nROW+1]
        new QSqlQuery() {
            exec("delete from weighthistory where id = " + nID )
        }
        Del(this.aIDs,nRow+1)
}

```

(continues on next page)

(continued from previous page)

```

        removerow(nRow)
        selectrow(nRow)
    ok
}

Func AddRecord cWeight
    new QSqlQuery( ) {
        cStr = "insert into weighthistory (f_date,f_time,f_weight) values"+
        " ('%f1','%f2','%f3')"
        cDate = Date()
        cTime = Time()
        cStr = substr(cStr,"%f1",cDate)
        cStr = substr(cStr,"%f2",cTime)
        cStr = substr(cStr,"%f3",cWeight)
        exec(cStr)
        delete()
    }
    ShowRecords()
    Table1.selectrow(table1.rowcount()-1)

Func ShowRecords
    table1.setItemChangedEvent("")
    aIDs = []
    query = new QSqlQuery() {
        exec("select * from weighthistory")
        nRows = 0
        this.Table1.setRowCount(0)
        while moveNext()
            this.table1 {
                insertRow(nRows)
                this.aIDs + query.value(0).toString()
                for x = 1 to 3
                    cStr = query.value(x).toString()
                    item = new QTableWidgetItem(cStr)
                    setItem(nRows,x-1,item)
            }
            nRows++
        end
        delete()
    }
    table1.setItemChangedEvent($ApplicationObject+".ItemChanged()")

Func ItemChanged
    nRow = table1.currentRow()
    if nRow >= 0
        myitem = Table1.item(table1.currentRow(),0)
        cDate = myitem.text()
        myitem = Table1.item(table1.currentRow(),1)
        cTime = myitem.text()
        myitem = Table1.item(table1.currentRow(),2)
        cWeight = myitem.text()
        new QSqlQuery( ) {
            cStr = "update weighthistory set f_date ='%f1' , f_time = '%f2' , "+
            "f_weight ='%f3' where id = " + this.aIDs[nRow+1]
        }
    }
}

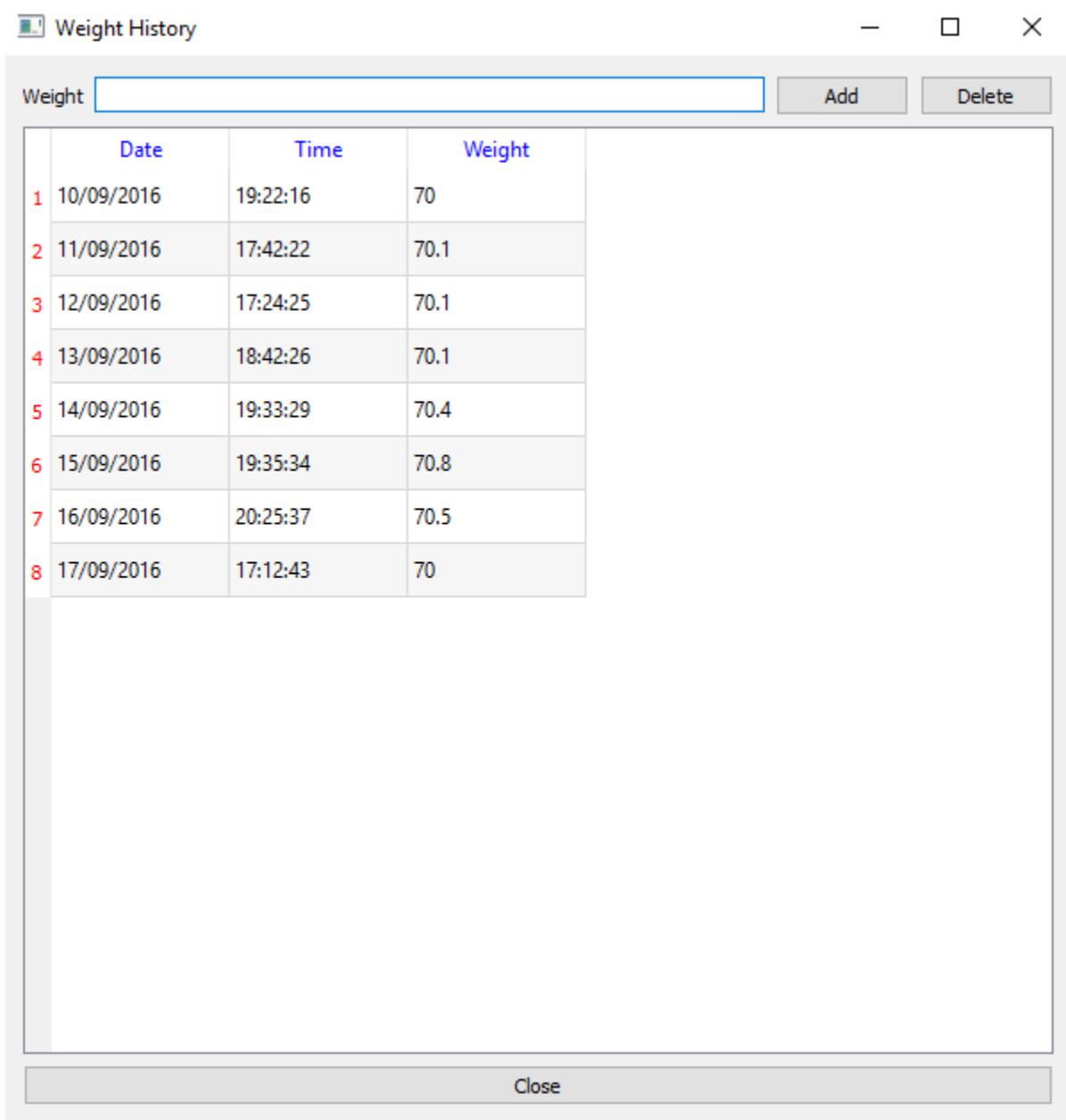
```

(continues on next page)

(continued from previous page)

```
cStr = substr(cStr,"%f1",cDate)
cStr = substr(cStr,"%f2",cTime)
cStr = substr(cStr,"%f3",cWeight)
exec(cStr)
delete()
}
ok
```

The next screen shot for the application during the runtime



45.56 Notepad Application

In the next example we will see simple Notepad developed using the RingQt

```

Load "guilib.ring"

cActiveFileName = ""
aTextColor = [0,0,0]
aBackColor = [255,255,255]
cFont = "MS Shell Dlg 2,14,-1,5,50,0,0,0,0,0"
cWebsite = "http://www.google.com"

oSearch = NULL
oSearchValue = NULL
oSearchCase = NULL
oSearchFilter = NULL
oReplaceValue = NULL

lAskToSave = false

MyApp = New qApp {
    win1 = new qMainWindow() {

        setWindowTitle("Ring Notepad")
        setGeometry(100,100,400,400)
        aBtns = [
            new QPushButton(win1) {
                setBtnImage(self,"image/new.png")
                setClickEvent("pNew()")
                setToolTip("New File")
            },
            new QPushButton(win1) {
                setBtnImage(self,"image/open.png")
                setClickEvent("pOpen()")
                setToolTip("Open File")
            },
            new QPushButton(win1) {
                setBtnImage(self,"image/save.png")
                setClickEvent("pSave()")
                setToolTip("Save")
            },
            new QPushButton(win1) {
                setBtnImage(self,"image/saveas.png")
                setClickEvent("pSaveAs()")
                setToolTip("Save As")
            },
            new QPushButton(win1) {
                setBtnImage(self,"image/cut.png")
                setClickEvent("pCut()")
                setToolTip("Cut")
            },
            new QPushButton(win1) {
                setBtnImage(self,"image/copy.png")
                setClickEvent("pCopy()")
                setToolTip("Copy")
            },
            new QPushButton(win1) {

```

(continues on next page)

(continued from previous page)

```

        setbtnimage(self,"image/paste.png")
        setclickevent("pPaste()")
        settooltip("Paste")
    } ,
    new QPushButton(win1) {
        setbtnimage(self,"image/font.png")
        setclickevent("pFont()")
        settooltip("Font")
    } ,
    new QPushButton(win1) {
        setbtnimage(self,"image/colors.jpg")
        setclickevent("pColor()")
        settooltip("Text Color")
    } ,
    new QPushButton(win1) {
        setbtnimage(self,"image/search.png")
        setclickevent("pFind()")
        settooltip("Find and Replace")
    } ,
    new QPushButton(win1) {
        setbtnimage(self,"image/print.png")
        setclickevent("pPrint()")
        settooltip("Print")
    } ,
    new QPushButton(win1) {
        setbtnimage(self,"image/debug.png")
        setclickevent("pDebug()")
        settooltip("Debug (Run then wait!)")
    } ,
    new QPushButton(win1) {
        setbtnimage(self,"image/run.png")
        setclickevent("pRun()")
        settooltip("Run the program")
    } ,
    new QPushButton(win1) {
        setbtnimage(self,"image/close.png")
        setclickevent("pQuit()")
        settooltip("Quit")
    }
]

tool1 = addtoolbar("files") {
    for x in aBtns addwidget(x) addseparator() next
}

menu1 = new QMenuBar(win1) {
    sub1 = addmenu("File")
    sub2 = addmenu("Edit")
    sub3 = addmenu("View")
    sub4 = addmenu("Help")
    sub1 {
        oAction = new QAction(win1) {
            setShortcut(new QKeySequence("Ctrl+n"))
            setbtnimage(self,"image/new.png")
            setText("New")
            setclickevent("pNew()")
        }
    }
}

```

(continues on next page)

(continued from previous page)

```

addaction(oAction)
oAction = new QAction(win1) {
    setShortcut(new QKeySequence("Ctrl+o"))
    setbtnimage(self, "image/open.png")
    settext("Open")
    setclickevent ("pOpen() ")
}
addaction(oAction)
addseparator()
oAction = new QAction(win1) {
    setShortcut(new QKeySequence("Ctrl+s"))
    setbtnimage(self, "image/save.png")
    settext("Save")
    setclickevent ("pSave() ")
}
addaction(oAction)
addseparator()
oAction = new QAction(win1) {
    setShortcut(new QKeySequence("Ctrl+e"))
    setbtnimage(self, "image/saveas.png")
    settext("Save As")
    setclickevent ("pSaveAs() ")
}
addaction(oAction)
addseparator()
oAction = new QAction(win1) {
    setShortcut(new QKeySequence("Ctrl+p"))
    setbtnimage(self, "image/print.png")
    settext("Print to PDF")
    setclickevent ("pPrint() ")
}
addaction(oAction)
addseparator()
oAction = new QAction(win1) {
    setShortcut(new QKeySequence("Ctrl+d"))
    setbtnimage(self, "image/debug.png")
    settext("Debug (Run then wait!)")
    setclickevent ("pDebug() ")
}
addaction(oAction)
addseparator()
oAction = new QAction(win1) {
    setShortcut(new QKeySequence("Ctrl+r"))
    setbtnimage(self, "image/run.png")
    settext("Run")
    setclickevent ("pRun() ")
}
addaction(oAction)
addseparator()
oAction = new QAction(win1) {
    setShortcut(new QKeySequence("Ctrl+F5"))
    setbtnimage(self, "image/run.png")
    settext("Run GUI Application (No Console)")
    setclickevent ("pRunNoConsole() ")
}
addaction(oAction)
addseparator()

```

(continues on next page)

(continued from previous page)

```

oAction = new QAction(win1) {
    setShortcut(new QKeySequence("Ctrl+q"))
    setBtnImage(self, "image/close.png")
    setText("Exit")
    setStatusTip("Exit")
    setClickEvent("pQuit()")
}
addaction(oAction)
}

sub2 {
    oAction = new QAction(win1) {
        setShortcut(new QKeySequence("Ctrl+x"))
        setBtnImage(self, "image/cut.png")
        setText("Cut")
        setClickEvent("pCut()")
    }
    addaction(oAction)
    oAction = new QAction(win1) {
        setShortcut(new QKeySequence("Ctrl+c"))
        setBtnImage(self, "image/copy.png")
        setText("Copy")
        setClickEvent("pCopy()")
    }
    addaction(oAction)
    oAction = new QAction(win1) {
        setShortcut(new QKeySequence("Ctrl+v"))
        setBtnImage(self, "image/paste.png")
        setText("Paste")
        setClickEvent("pPaste()")
    }
    addaction(oAction)
    addseparator()
    oAction = new QAction(win1) {
        setShortcut(new QKeySequence("Ctrl+i"))
        setBtnImage(self, "image/font.png")
        setText("Font")
        setClickEvent("pFont()")
    }
    addseparator()
    addaction(oAction)
    oAction = new QAction(win1) {
        setShortcut(new QKeySequence("Ctrl+t"))
        setBtnImage(self, "image/colors.jpg")
        setText("Text Color")
        setClickEvent("pColor()")
    }
    addaction(oAction)
    oAction = new QAction(win1) {
        setShortcut(new QKeySequence("Ctrl+b"))
        setBtnImage(self, "image/colors.jpg")
        setText("Back Color")
        setClickEvent("pColor2()")
    }
    addaction(oAction)
    addseparator()
    oAction = new QAction(win1) {
        setShortcut(new QKeySequence("Ctrl+g"))

```

(continues on next page)

(continued from previous page)

```

        settext("Go to line")
        setclickevent("pGoto() ")
    }
    addaction(oAction)
    oAction = new QAction(win1) {
        setShortcut(new QKeySequence("Ctrl+f"))
        setbtnimage(self,"image/search.png")
        settext("Find and Replace")
        setclickevent("pFind() ")
    }
    addaction(oAction)
}
sub3 {
    oAction = new QAction(win1) {
        setShortcut(new QKeySequence("Ctrl+p"))
        setbtnimage(self,"image/project.png")
        settext("Project Files")
        setclickevent("pProject() ")
    }
    addaction(oAction)
    oAction = new QAction(win1) {
        setShortcut(new QKeySequence("Ctrl+u"))
        setbtnimage(self,"image/source.png")
        setclickevent("pSourceCode() ")
        settext("Source Code")
    }
    addaction(oAction)
    oAction = new QAction(win1) {
        setShortcut(new QKeySequence("Ctrl+w"))
        setbtnimage(self,"image/richtext.png")
        setclickevent("pWebBrowser() ")
        settext("Web Browser")
    }
    addaction(oAction)
}
sub4 {
    sub5 = addmenu("Development Tools")
    sub5 {

        oAction = new QAction(win1) {
            settext("Programming Language")
            setclickevent("pLang() ")
        }
        addaction(oAction)
        oAction = new QAction(win1) {
            settext("GUI Library")
            setclickevent("pGUI() ")
        }
        addaction(oAction)
    }
    addseparator()
    oAction = new QAction(win1) {
        settext("About")
        setclickevent("pAbout() ")
    }
    addaction(oAction)
}

```

(continues on next page)

(continued from previous page)

```

}

setmenubar(menu1)

status1 = new qstatusbar(win1) {
    showmessage("Ready!", 0)
}

setstatusbar(status1)

tree1 = new qtreeview(win1) {
    setclickedevent("pChangeFile()")
    setGeometry(00,00,200,400)
    oDir = new QDir()
    ofile = new QFilesystemModel() {
        setrootpath(oDir.currentpath())
        myfiles = new QStringList()
        myfiles.append("*.ring")
        myfiles.append("*.rh")
        setnamefilters(myfiles)
        setNameFilterDisables(false)
    }
    setmodel(ofile)
    myindex = ofile.index(oDir.currentpath(), 0)
    for x = 1 to ofile.columncount()
        hidecolumn(x)
    next
    setcurrentIndex(myindex)
    setexpanded(myindex, true)
    header().hide()
}

oDock1 = new qdockwidget(win1, 0) {
    setGeometry(00,00,200,200)
    setwindowtitle("Project Files")
    setwidget(tree1)
}

textedit1 = new qtextedit(win1) {
    setCursorPositionChangedEvent("pCursorPositionChanged()")
    setLineWrapMode(QTextEdit_NoWrap)
    setAcceptRichText(false)
    setTextChangedEvent("lAskToSave = true")
}

oDock2 = new qdockwidget(win1, 0) {
    setwidget(textedit1)
    setwindowtitle("Source Code")
}

oWebBrowser = new QWidget() {
    setWindowFlags(Qt_SubWindow)
    oWBLLabel = new QLabel(win1) {
        setText("Website: ")
    }
    oWBText = new QLineEdit(win1) {
}

```

(continues on next page)

(continued from previous page)

```

        setText(cWebSite)
        setReturnPressedEvent("pWebGo () ")
    }
oWBGo = new QPushButton(win1) {
    setText("Go")
    setClickEvent("pWebGo () ")
}
oWBBack = new QPushButton(win1) {
    setText("Back")
    setClickEvent("pWebBack () ")
}
oWBLLayout1 = new QHBoxLayout() {
    addWidget(oWBLLabel)
    addWidget(oWBText)
    addWidget(oWBGo)
    addWidget(oWBBack)
}
oWebView = new QWebView(win1) {
    loadpage(new QUrl(cWebSite))
}
oWBLLayout2 = new QVBoxLayout() {
    addLayout(oWBLLayout1)
    addWidget(oWebView)
}
setLayout(oWBLLayout2)
}

oDock3 = new QDockWidget(win1,0) {
    setWidget(oWebBrowser)
    setWindowTitle("Web Browser")
    setFeatures(QDockWidget_DocWidgetClosable)
}

addDockWidget(1,oDock1,1)
addDockWidget(2,oDock2,2)
addDockWidget(2,oDock3,1)

setWindowIcon(self,"image/notepad.png")

showMaximized()
}
RestoreSettings()
exec()
}

func pWebGo
    cWebsite = oWBText.text()
    oWebView.LoadPage( new QUrl( cWebsite ) )

func pWebBack
    oWebView.Back()

func pProject
    oDock1.Show()

func pSourceCode
    oDock2.Show()

```

(continues on next page)

(continued from previous page)

```

func pWebBrowser
    oDock3.Show()

func pChangeFile
    myitem = tree1.currentindex()
    if ofile.isdir(myitem)
        return
    ok
    cActiveFileName = ofile.filepath(myitem)
    textedit1.settext(read(cActiveFileName))
    textedit1.setFocus(0)
    pCursorPositionChanged()
    pSetActiveFileName()

func pSetActiveFileName
    oDock2.setWindowTitle("Source Code : " + cActiveFileName)

func pCursorPositionChanged
    status1.showmessage(" Line : "+(textedit1.textcursor().blocknumber()+1) +
                        " Column : " +(textedit1.textcursor().columnnumber()+1) +
                        " Total Lines : " + textedit1.document().linecount() ,0)

func pGoto
    oInput = New QInputDialog(win1)
    {
        setWindowTitle("Enter the line number?")
        setGeometry(100,100,400,50)
        setLabelText("Line")
        setTextValue("1")
        exec()
        nLine = 0 + oInput.textValue()
        oBlock = textedit1.document().findBlockByLineNumber(nLine-1)
        oCursor = textedit1.textcursor()
        oCursor.setPosition(oBlock.position(),0)
        textedit1.setTextCursor(oCursor)
    }

func pFind
    if isobject(oSearch)
        oSearch.activateWindow()
        return
    ok
    oSearch = new QWidget()
    {
        new QLabel(oSearch)
        {
            setText("Find What : ")
            setGeometry(10,10,50,30)
        }
        oSearchValue = new QLineEdit(oSearch)
        {
            setGeometry(80,10,460,30)
            setReturnPressedEvent("pFindValue()")
        }
        new QLabel(oSearch)
        {
    
```

(continues on next page)

(continued from previous page)

```

        setText("Replace with ")
        setgeometry(10,45,80,30)
    }
    oReplaceValue = new QLineEdit(oSearch)
    {
        setgeometry(80,45,460,30)
    }
    oSearchCase = new QCheckbox(oSearch)
    {
        setText("Case Sensitive")
        setgeometry(80,85,100,30)
    }
    new QPushButton(oSearch)
    {
        setText("Find/Find Next")
        setgeometry(80,120,100,30)
        setclickevent("pFindValue()")
    }
    new QPushButton(oSearch)
    {
        setText("Replace")
        setgeometry(200,120,100,30)
        setclickevent("pReplace()")
    }
    new QPushButton(oSearch)
    {
        setText("Replace All")
        setgeometry(320,120,100,30)
        setclickevent("pReplaceAll()")
    }
    new QPushButton(oSearch)
    {
        setText("Close")
        setgeometry(440,120,100,30)
        setclickevent("pSearchClose()")
    }

    setwinicon(oSearch, "image/notepad.png")
    setWindowTitle("Find/Replace")
    setStyleSheet("background-color:white;")
    setFixedSize(550,160)
    setwindowflags( Qt_CustomizeWindowHint |
                    Qt_WindowTitleHint | Qt_WindowStaysOnTopHint)

    oSearchFilter = new QAllevents(oSearch)
    oSearchFilter.setKeyPressEvent("pSearchKeyPress()")
    installEventFilter(oSearchFilter)

    show()
}

Func pReplace
    oCursor = textedit1.textCursor()
    if oCursor.HasSelection() = false
        new QMessageBox(oSearch)
        {
            SetWindowTitle("Replace")

```

(continues on next page)

(continued from previous page)

```

        SetText("No Selection")
        show()
    }
    return false
ok
cValue = oSearchValue.text()
cSelected = oCursor.SelectedText()
if oSearchCase.checkState() = Qt_Unchecked
    cValue = lower(cValue)
    cSelected = lower(cSelected)
ok
if cSelected != cValue
    new qMessagebox(oSearch)
    {
        SetWindowTitle("Replace")
        SetText("No Match")
        show()
    }
    return false
ok
cValue = oReplaceValue.text()
nStart = oCursor.SelectionStart()
nEnd = oCursor.SelectionEnd()
cStr = textedit1.toPlainText()
cStr = left(cStr,nStart)+cValue+substr(cStr,nEnd+1)
textedit1.setText(cStr)
return pFindValue()

Func pReplaceAll
    cStr = textedit1.toPlainText()
    cOldValue = oSearchValue.text()
    cnewValue = oReplaceValue.text()
    if oSearchCase.checkState() = Qt_Unchecked
        # Not Case Sensitive
        cStr = SubStr(cStr,cOldValue,cnewValue,true)
    else
        # Case Sensitive
        cStr = SubStr(cStr,cOldValue,cnewValue)
    ok
    textedit1.setText(cStr)
    new qMessagebox(oSearch)
    {
        SetWindowTitle("Replace All")
        SetText("Operation Done")
        show()
    }

Func pSearchClose
    oSearch.close()
    oSearch = NULL

func pSearchKeyPress
    if oSearchFilter.getKeyCode() = Qt_Key_Escape
        pSearchClose()
    ok

func pFindValue

```

(continues on next page)

(continued from previous page)

```

oCursor = textedit1.textcursor()
nPosStart = oCursor.Position() + 1
cValue = oSearchValue.text()
cStr = textedit1.toplaintext()
cStr = substr(cStr,nPosStart)
if oSearchCase.checkState() = Qt_Unchecked
    cStr = lower(cStr) cValue = lower(cValue)
ok
nPos = substr(cStr,cValue)
if nPos > 0
    nPos += nPosStart - 2
    oCursor = textedit1.textcursor()
    oCursor.setposition(nPos,0)
    textedit1.settextcursor(oCursor)
    oCursor = textedit1.textcursor()
    oCursor.setposition(nPos+len(cValue),1)
    textedit1.settextcursor(oCursor)
    return true
else
    new QMessageBox(oSearch)
    {
        SetWindowTitle("Search")
        SetText("Cannot find :" + cValue)
        show()
    }
    return false
ok

func pNofileopened
    New QMessageBox(win1) {
        setWindowTitle("Sorry")
        setText("Save the file first!")
        show()
    }

func pDebug
    if cActiveFileName = Null return pNofileopened() ok
    cCode = "start run " + cActiveFileName + nl
    system(cCode)

func pRun
    if cActiveFileName = Null return pNofileopened() ok
    cCode = "start ring " + cActiveFileName + nl
    system(cCode)

func pRunNoConsole
    if cActiveFileName = Null return pNofileopened() ok
    cCode = "start /b ring " + cActiveFileName + nl
    system(cCode)

func pSave
    if cActiveFileName = NULL return pSaveAs() ok
    writefile(cActiveFileName, textedit1.toplaintext())
    status1.showmessage("File : " + cActiveFileName + " saved!",0)
    lAskToSave = false

func pSaveAs

```

(continues on next page)

(continued from previous page)

```

new qfiledialog(win1) {
    cName = getsavefilename(win1,"Save As","","source files(*.ring)")
    if cName != NULL
        cActiveFileName = cName
        writefile(cActiveFileName, textedit1.toplaintext())
        status1.showmessage("File : " + cActiveFileName + " saved!", 0)
        pSetActiveFileName()
        lAskToSave = false
    ok
}

func pPrint
    status1.showmessage("Printing to File : RingDoc.pdf", 0)
    printer1 = new qPrinter(0) {
        setoutputformat(1)          # 1 = pdf
        setoutputfilename("RingDoc.pdf")
        textedit1.print(printer1)
    }
    status1.showmessage("Done!", 0)
    system("RingDoc.pdf")

func pCut
    textedit1.cut()
    status1.showmessage("Cut!", 0)

func pCopy
    textedit1.copy()
    status1.showmessage("Copy!", 0)

func pPaste
    textedit1.paste()
    status1.showmessage("Paste!", 0)

func pFont
    oFontDialog = new qfontdialog() {
        aFont = getfont()
    }
    textedit1.selectall()
    cFont = aFont[1]
    pSetFont()

Func pSetFont
    myfont = new qfont("", 0, 0, 0)
    myfont.fromstring(cFont)
    textedit1.setcurrentfont(myfont)

Func pColor
    new qcolordialog() { aTextColor = GetColor() }
    pSetColors()

Func pColor2
    new qcolordialog() { aBackColor = GetColor() }
    pSetColors()

Func pSetColors
    textedit1.setStyleSheet("color: rgb(" + aTextColor[1] + ", " + aTextColor[2] +
                           ", " + aTextColor[3] + ");" + "background-color: rgb(" +
                           aBackColor[1] + ", " + aBackColor[2] + ", " + aBackColor[3] + ")")

```

→+

(continues on next page)

(continued from previous page)

```

        aBackColor[1] + ", " + aBackColor[2] + ", " +
        aBackColor[3] + ")")

func pOpen
    new qfiledialog(win1) {
        cName = getopenfilename(win1,"open file","c:\\", "source files(*.ring)")
        if cName != NULL
            cActiveFileName = cName
            textedit1.settext(read(cActiveFileName))
        ok
    }

func pNew
    new qfiledialog(win1) {
        cName = getsavefilename(win1,"New file","","source files(*.ring)")
        if cName != NULL
            write(cName,"")
            cActiveFileName = cName
            textedit1.settext(read(cActiveFileName))

        ok
    }

Func WriteFile cFileName,cCode
    aCode = str2list(cCode)
    fp = fopen(cFileName, "wb")
    for cLine in aCode
        fwrite(fp,cLine+char(13)+char(10))
    next
    fclose(fp)

Func MsgBox cTitle,cMessage
    new qMessagebox(win1) {
        setwindowtitle(cTitle)
        setText(cMessage)
        show()
    }

Func pLang
    MsgBox("Programming Language",
           "This application developed using the Ring programming language")

Func pGUI
    MsgBox("GUI Library",
           "This application uses the Qt GUI Library through RingQt")

Func pAbout
    MsgBox("About",
           "2016, Mahmoud Fayed <msfclipper@yahoo.com>")

Func pSaveSettings
    cSettings = "aTextColor = ["+aTextColor[1]+", "+aTextColor[2]+
               ", "+aTextColor[3]+""]" + nl +
    "aBackColor = ["+aBackColor[1]+", "+aBackColor[2]+
               ", "+aBackColor[3]+""]" + nl +
    "cFont = '" + cFont + "'"+ nl +

```

(continues on next page)

(continued from previous page)

```

        "cWebSite = '" + cWebsite + "'" + nl
cSettings = substr(cSettings,nl,char(13)+char(10))
write("ringnotepad.ini",cSettings)
if lAsktoSave
    new qmessagebox(win1)
    {
        setWindowTitle("Save Changes?")
        setText("Some changes are not saved!")
        setInformativeText("Do you want to save your changes?")
        setStandardButtons(QMessageBox_Yes | QMessageBox_No | QMessageBox_Cancel)
        result = exec()
        win1 {
            if result == QMessageBox_Yes
                pSave()
            but result == QMessageBox_Cancel
                return false
            ok
        }
    }
ok
return true

Func pSetWebsite
    oWebView { loadpage(new qurl(cWebSite)) }
    oWBText { setText(cWebSite) }

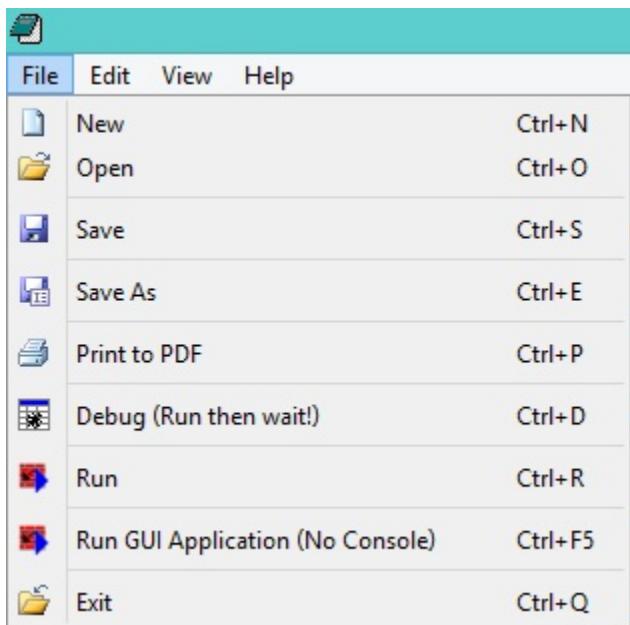
Func RestoreSettings
    eval(read("ringnotepad.ini"))
    pSetColor()
    pSetFont()
    pSetWebsite()

Func pQuit
    if pSaveSettings()
        myapp.quit()
    ok

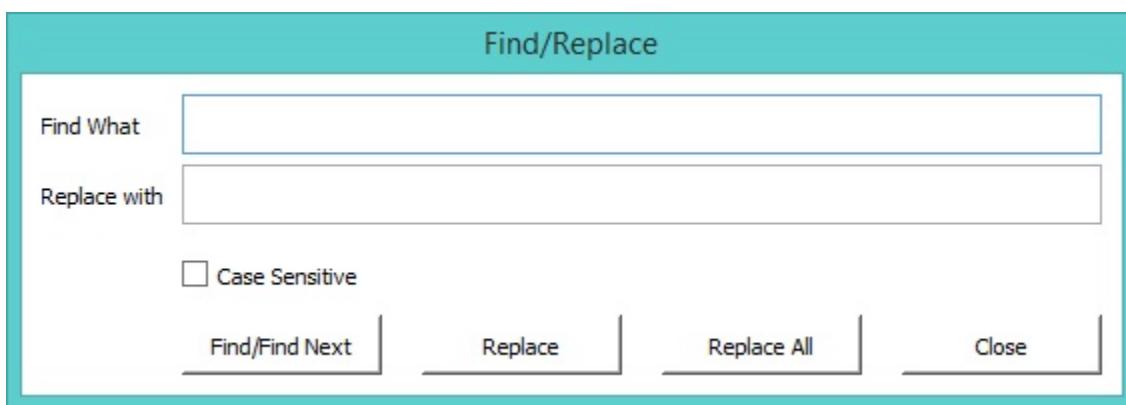
```

The application during the runtime

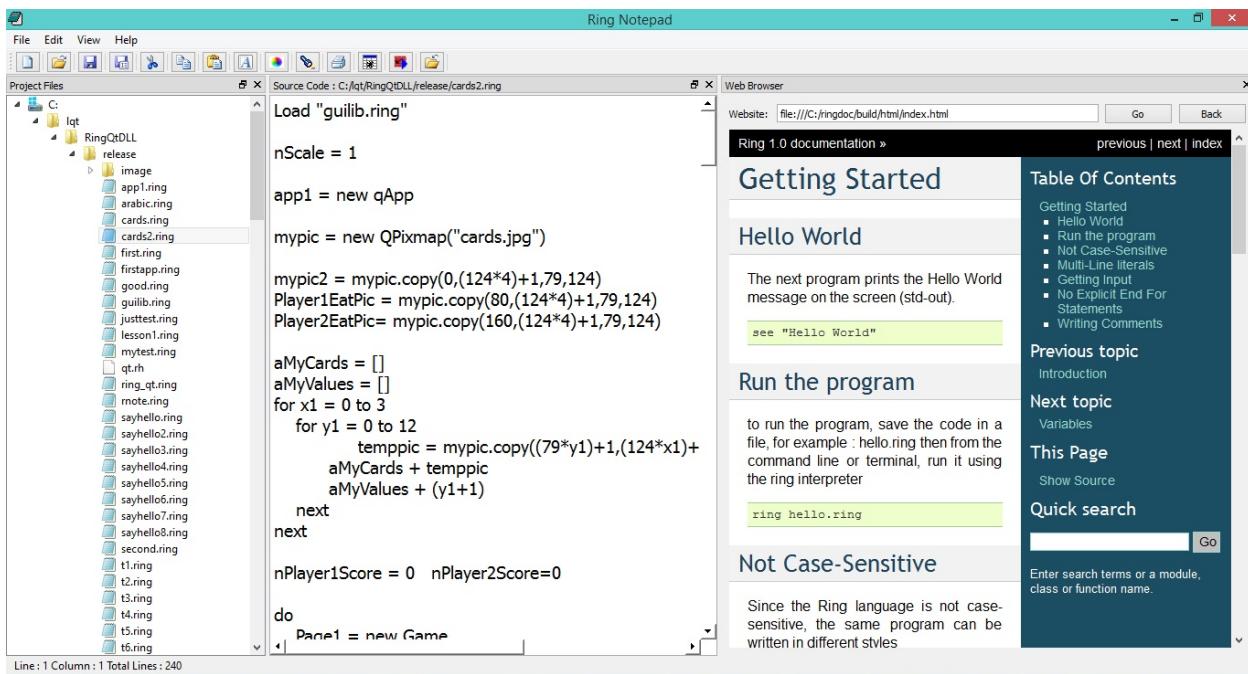
The next screen shot demonstrates the “File” menu



The next window for “search and replace”



The next screen shot demonstrates the application main window



Note: the functions pDebug(), pRun() and pRunNoConsole() in the previous sample are not portable! They are written in this sample for MS-Windows and we can update them for other operating systems.

45.57 The Cards Game

In the next example we will see a simple Cards game developed using RingQt

Each player get 5 cards, the cards are unknown to any one. each time one player click on one card to see it. if the card is identical to another card the play get point for each card. if the card value is “5” the player get points for all visible cards.

```

Load "guilib.ring"

nScale = 1

app1 = new qApp

mopic = new QPixmap("cards.jpg")

mopic2 = mopic.copy(0,(124*4)+1,79,124)
Player1EatPic = mopic.copy(80,(124*4)+1,79,124)
Player2EatPic= mopic.copy(160,(124*4)+1,79,124)

aMyCards = []
aMyValues = []
for x1 = 0 to 3
    for y1 = 0 to 12
        tempPic = mopic.copy((79*y1)+1,(124*x1)+1,79,124)
        aMyCards + tempPic
        aMyValues + (y1+1)
    next
next

nPlayer1Score = 0 nPlayer2Score=0
do
    Page1 = new Game

```

(continues on next page)

(continued from previous page)

```

next
next

nPlayer1Score = 0    nPlayer2Score=0

do
    Page1 = new Game
    Page1.Start()
again Page1.lnewgame

mypic.delete()
mypic2.delete()
Player1EatPic.delete()
Player2EatPic.delete()

for t in aMyCards
    t.delete()
next

func gui_setbttnpixmap pBtn,pPixmap
pBtn {
    setIcon(new QIcon(pPixmap.scaled(width(),height(),0,0)))
    setIconSize(new QSize(width(),height())))
}

Class Game

nCardsCount = 10
win1 layout1 label1 label2 layout2 layout3 aBtNS aBtNS2
aCards nRole=1 aStatus = list(nCardsCount) aStatus2 = aStatus
aValues      aStatusValues = aStatus aStatusValues2 = aStatus
Player1EatPic Player2EatPic
lnewgame = false
nDelayEat = 0.5
nDelayNewGame = 1

func start

    win1 = new QWidget() {
        setWindowTitle("Five")
        setStyleSheet("background-color: White")
        showFullScreen()
    }

    layout1 = new QVBoxLayout()

    label1 = new QLabel(win1) {
        setText("Player (1) - Score : " + nPlayer1Score)
        setAlignment(Qt.AlignHCenter | Qt.AlignVCenter)
        setStyleSheet("color: White; background-color: Purple;
                      font-size:20pt")
        setFixedHeight(200)
    }

    closebtn = new QPushButton(win1) {
        setText("Close Application")
        setStyleSheet("font-size: 18px ; color : white ;

```

(continues on next page)

(continued from previous page)

```

        background-color: black ;")
setclickevent("Page1.win1.close()")
}

aCards = aMyCards
aValues = aMyValues

layout2 = new qhboxlayout()

aBtns = []

for x = 1 to nCardsCount
    aBtns + new qpushbutton(win1)
    aBtns[x].setfixedwidth(79*nScale)
    aBtns[x].setfixedheight(124*nScale)
    gui_setbttnpixmap(aBtns[x],mypic2)
    layout2.addwidget(aBtns[x])
    aBtns[x].setclickevent("Page1.Player1click("+x+")")
next

layout1.addWidget(label1)
layout1.setLayout(layout2)

label2 = new qlabel(win1) {
    settext("Player (2) - Score : " + nPlayer2Score)
    setalignment(Qt.AlignHCenter | Qt.AlignVCenter)
    setstylesheet("color: white; background-color: red;
                   font-size:20pt")
    setfixedheight(200)
}

layout3 = new qhboxlayout()

aBtns2 = []
for x = 1 to nCardsCount
    aBtns2 + new qpushbutton(win1)
    aBtns2[x].setfixedwidth(79*nScale)
    aBtns2[x].setfixedheight(124*nScale)
    gui_setbttnpixmap(aBtns2[x],mypic2)
    layout3.addwidget(aBtns2[x])
    aBtns2[x].setclickevent("Page1.Player2click("+x+")")
next

layout1.addWidget(label2)
layout1.setLayout(layout3)
layout1.addWidget(closebtn)

win1.setLayout(layout1)

app1.exec()

Func Player1Click x
    if nRole = 1 and aStatus[x] = 0
        nPos = ((random(100)+clock())%(len(aCards)-1)) + 1
        gui_setbttnpixmap(aBtns[x],aCards[nPos])
        del(aCards,nPos)
        nRole = 2

```

(continues on next page)

(continued from previous page)

```

aStatus[x] = 1
aStatusValues[x] = aValues[nPos]
del(aValues,nPos)
Player1Eat(x,aStatusValues[x])
checknewgame()

ok

Func Player2Click x
    if nRole = 2 and aStatus2[x] = 0
        nPos = ((random(100)+clock())%(len(aCards)-1)) + 1
        gui_setbttnpixmap(aBtns2[x],aCards[nPos])
        del(aCards,nPos)
        nRole = 1
        aStatus2[x] = 1
        aStatusValues2[x] = aValues[nPos]
        del(aValues,nPos)
        Player2Eat(x,aStatusValues2[x])
        checknewgame()
    ok

Func Player1Eat nPos,nValue

    app1.processEvents()

    delay(nDelayEat)
    lEat = false
    for x = 1 to nCardsCount
        if aStatus2[x] = 1 and (aStatusValues2[x] = nValue or
→nValue=5)
            aStatus2[x] = 2
            gui_setbttnpixmap(aBtns2[x],Player1EatPic)
            lEat = True
            nPlayer1Score++
        ok
        if (x != nPos) and (aStatus[x] = 1) and
            (aStatusValues[x] = nValue or nValue=5)
            aStatus[x] = 2
            gui_setbttnpixmap(aBtns[x],Player1EatPic)
            lEat = True
            nPlayer1Score++
        ok
    next
    if lEat
        nPlayer1Score++
        gui_setbttnpixmap(aBtns[nPos],Player1EatPic)
        aStatus[nPos] = 2
        label1.settext("Player (1) - Score : " +
→nPlayer1Score)
    ok

Func Player2Eat nPos,nValue

    app1.processEvents()

    delay(nDelayEat)
    lEat = false
    for x = 1 to nCardsCount

```

(continues on next page)

(continued from previous page)

```

if aStatus[x] = 1 and (aStatusValues[x] = nValue or nValue =_
↪5)
    aStatus[x] = 2
    gui_setbttnpixmap(aBtns[x],Player2EatPic)
    lEat = True
    nPlayer2Score++
ok

if (x != nPos) and (aStatus2[x] = 1) and
    (aStatusValues2[x] = nValue or nValue=5 )
    aStatus2[x] = 2
    gui_setbttnpixmap(aBtns2[x],Player2EatPic)
    lEat = True
    nPlayer2Score++
ok

next
if lEat
    nPlayer2Score++
    gui_setbttnpixmap(aBtns2[nPos],Player2EatPic)
    aStatus2[nPos] = 2
    label2.settext("Player (2) - Score : " +_
↪nPlayer2Score)
ok

Func checknewgame
if isnewgame()
    lnewgame = true

    if nPlayer1Score > nPlayer2Score
        label1.settext("Player (1) Wins!!!")
    ok
    if nPlayer2Score > nPlayer1Score
        label2.settext("Player (2) Wins!!!")
    ok

    app1.processEvents()
    delay(nDelayNewGame)

    win1.delete()
    app1.quit()
ok

Func isnewgame
for t in aStatus
    if t = 0
        return false
    ok
next
for t in aStatus2
    if t = 0
        return false
    ok
next
return true

Func delay x
nTime = x * 1000

```

(continues on next page)

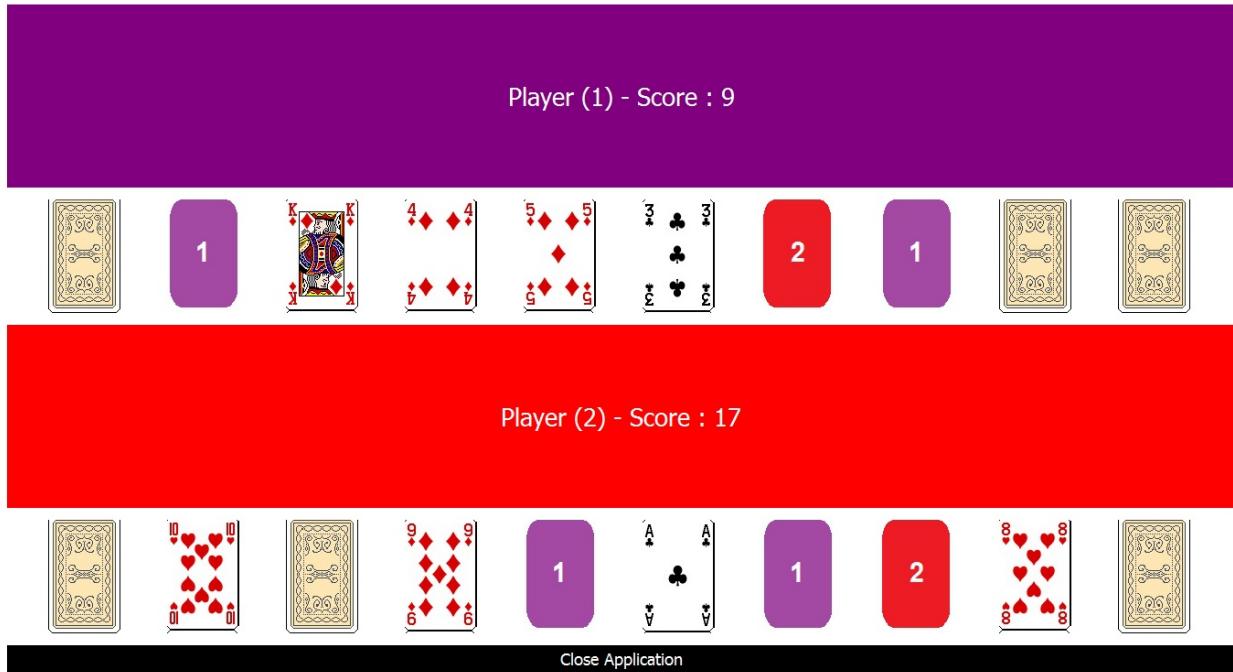
(continued from previous page)

```

oTest = new QTest
oTest.qsleep(nTime)

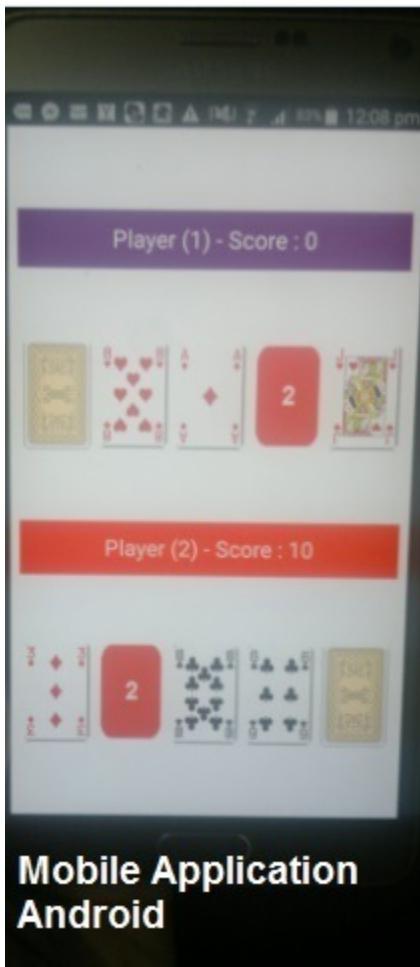
```

The application during the runtime



Note: in the previous screen shot the player get the card number '5' but his score is not increased because he opened this card while no other cards are visible!

The next screen shot while running the game using a Mobile (Android)



Note: using Qt we can run the same application on other Mobile systems

45.58 Classes and their Methods to use the default events

The next table present the class name and the methods that we have to use the default events.

Class Name	Methods to use the default Events
QPushButton	SetClickEvent()
QAction	SetClickEvent()
QLineEdit	SetTextChangedEvent() SetCursorPositionChangedEvent() SetEditingFinishedEvent()
	SetReturnPressedEvent() SetSelectionChangedEvent() SetTextEditedEvent()
QTextEdit	SetCopyAvailableEvent() SetCurrentCharFormatChangedEvent() SetCursorPositionChangedEvent()

continues on next page

Table 1 – continued from previous page

Class Name	Methods to use the default Events
	SetRedoAvailableEvent()
	SetSelectionChangedEvent()
	SetTextChangedEvent()
	SetUndoAvailableEvent()
QListWidget	SetCurrentItemChangedEvent()
	SetCurrentRowChangedEvent()
	SetCurrentTextChangedEvent()
	SetItemActivatedEvent()
	SetItemChangedEvent()
	SetItemClickedEvent()
	SetItemDoubleClickedEvent()
	SetItemEnteredEvent()
	SetItemPressedEvent()
	SetItemSelectionChangedEvent()
QTreeView	SetCollapseEvent()
	SetExpandedEvent()
	SetActivatedEvent()
	SetClickedEvent()
	SetDoubleClickedEvent()
	SetEnteredEvent()
	SetPressedEvent()
	SetViewportEnteredEvent()
QTreeWidget	SetCollapsedEvent()
	SetExpandedEvent()
	SetActivatedEvent()
	SetClickedEvent()
	SetDoubleClickedEvent()
	SetEnteredEvent()
	SetPressedEvent()
	SetViewportEnteredEvent()
	SetCurrentItemChangedEvent()
	SetItemActivatedEvent()
	SetItemChangedEvent()
	SetItemClickedEvent()
	SetItemCollapsedEvent()
	SetItemDoubleClickedEvent()
	SetItemEnteredEvent()
	SetItemExpandedEvent()
	SetItemPressedEvent()
	SetItemSelectionChangedEvent()
QComboBox	SetActivatedEvent()
	SetCurrentIndexChangedEvent()
	SetEditTextChangedEvent()
	SetHighlightedEvent()
QTabWidget	SetCurrentChangedEvent()
	SetTabCloseRequestedEvent()
QTableWidget	SetCellActivatedEvent()
	SetCellChangedEvent()
	SetCellClickedEvent()

continues on next page

Table 1 – continued from previous page

Class Name	Methods to use the default Events
	SetCellDoubleClickedEvent()
	SetCellEnteredEvent()
	SetCellPressedEvent()
	SetCurrentCellChangedEvent()
	SetCurrentItemChangedEvent()
	SetItemActivatedEvent()
	SetItemChangedEvent()
	SetItemClickedEvent()
	SetItemDoubleClickedEvent()
	SetItemEnteredEvent()
	SetItemPressedEvent()
	SetItemSelectedChangedEvent()
QProgressBar	SetValueChangedEvent()
QSpinBox	SetValueChangedEvent()
QSlider	SetActionTriggeredEvent()
	SetRangeChangedEvent()
	SetSliderMovedEvent()
	SetSliderPressedEvent()
	SetSliderReleasedEvent()
	SetValueChangedEvent()
QDial	SetActionTriggeredEvent()
	SetRangeChangedEvent()
	SetSliderMovedEvent()
	SetSliderPressedEvent()
	SetSliderReleasedEvent()
	SetValueChangedEvent()
QWebView	SetLoadFinishedEvent()
	SetLoadProgressEvent()
	SetLoadStartedEvent()
	SetSelectionChangedEvent()
	SetTitleChangedEvent()
	SetUrlChangedEvent()
QCheckBox	SetStateChangedEvent()
	SetClickedEvent()
	SetPressedEvent()
	SetReleasedEvent()
	SetToggledEvent()
QRadioButton	SetClickedEvent()
	SetPressedEvent()
	SetReleasedEvent()
	SetToggledEvent()
QButtonGroup	SetButtonClickedEvent()
	SetButtonPressedEvent()
	SetButtonReleasedEvent()
QVideoWidget	SetBrightnessChangedEvent()
	SetContrastChangedEvent()
	SetFullScreenChangedEvent()
	SetHueChangedEvent()
	SetSaturationChangedEvent()

continues on next page

Table 1 – continued from previous page

Class Name	Methods to use the default Events
QTimer	SetTimeoutEvent()
QTcpServer	SetAcceptErrorEvent()
	SetNewConnectionEvent()
QIODevice	SetAboutToCloseEvent()
	SetBytesWrittenEvent()
	SetReadChannelFinishedEvent()
	SetReadyReadEvent()
QAbstractSocket	SetConnectedEvent()
	SetDisconnectedEvent()
	SetErrorEvent()
	SetHostFoundEvent()
	SetProxyAuthenticationRequiredEvent()
	SetStateChangedEvent()
QTcpSocket	SetConnectedEvent()
	SetDisconnectedEvent()
	SetErrorEvent()
	SetHostFoundEvent()
	SetProxyAuthenticationRequiredEvent()
	SetStateChangedEvent()
	SetAboutToCloseEvent()
	SetBytesWrittenEvent()
	SetReadChannelFinishedEvent()
	SetReadyReadEvent()
QColorDialog	SetColorSelectedEvent()
	SetCurrentColorChangedEvent()
QNetworkAccessManager	SetFinishedEvent()
QThread	SetStartedEvent()
	SetFinishedEvent()

45.59 Methods to use Events with Events Filter

RingQt define a new class called QAllEvents that help you in using Events Filter

The next table presents the methods that we have

Methods to get parameters	Class Name
getKeyCode() -> Number	QAllEvents
getx() -> Number	
gety() -> Number	
getglobalx() -> Number	
getglobaly() -> Number	
getbutton() -> Number	
getbuttons() -> Number	

The next table presents the methods that we have to use events.

Method Name	Class Name
setKeyPressEvent(cEvent)	QAllEvents
setMouseButtonPressEvent(cEvent)	
setMouseButtonReleaseEvent(cEvent)	
setMouseButtonDblClickEvent(cEvent)	
setMouseMoveEvent(cEvent)	
setCloseEvent(cEvent)	
setContextMenuEvent(cEvent)	
setDragEnterEvent(cEvent)	
setDragLeaveEvent(cEvent)	
setDragMoveEvent(cEvent)	
setDropEvent(cEvent)	
setEnterEvent(cEvent)	
setFocusInEvent(cEvent)	
setFocusOutEvent(cEvent)	
setKeyReleaseEvent(cEvent)	
setLeaveEvent(cEvent)	
setNonClientAreaMouseButtonDblClickEvent(cEvent)	
setNonClientAreaMouseButtonPressEvent(cEvent)	
setNonClientAreaMouseButtonReleaseEvent(cEvent)	
setNonClientAreaMouseMoveEvent(cEvent)	
setMoveEvent(cEvent)	
setResizeEvent(cEvent)	
setWindowActivateEvent(cEvent)	
setWindowBlockedEvent(cEvent)	
setWindowDeactivateEvent(cEvent)	
setWindowStateChangeEvent(cEvent)	
setWindowUnblockedEvent(cEvent)	

45.60 The Difference between Qt and RingQt

- (1) RingQt use simple methods to set the code that will be executed for events.

Syntax:

```
Set<Event_Name>Event (cEventCode)
```

- (2) RingQt change the name of some methods to avoid conflict with Ring Keywords.

The next table present these little changes

Class Name	Qt Method Name	RingQt Method Name
QWebView	load	loadpage
QMediaPlaylist	load	loadfile
QMediaPlaylist	next	movenext
QPainter	end	endpaint
QPicture	load	loadfile
QLineEdit	end	endtext
QDialog	done	donedialog
QTextDocument	end	enddoc
QTextBlock	next	nextblock
QStringQuery	next	movenext
QImage	load	loadimage
QNetworkAccessManager	get	getvalue
QNetworkAccessManager	put	putvalue
QThread	exit	exitfromthread
QRegularExpressionMatchIterator	next	nextitem
QCamera	load	loadcamera

45.61 RingQt Classes and their Qt Documentation

Qt Documentation : <http://doc.qt.io/qt-5/classes.html>

See the “RingQt Classes and Methods Reference” chapter for supported classes and methods.

45.62 New Classes names - Index Start from 1

We added new classes to RingQt - another version of classes where the class names doesn't start with the “q” letter
Also updated methods so the index start from 1 when we deal with the GUI controls like

- ComboBox
- ListView
- TableWidget
- TreeWidget

These classes are inside guilib.ring under the package name : System.GUI

To use it

```
load "guilib.ring"
import System.GUI
```

This doesn't have any effect on our previous code, It's just another choice for better code that is consistent with Ring rules.

Also the form designer is updated to provide us the choice between using classes where (index start from 0) or (index start from 1)

Example (Uses the Form Designer)

(1) <https://github.com/ring-lang/ring/blob/master/samples/UsingFormDesigner/indexstart/indexstartView.ring>

(2) <https://github.com/ring-lang/ring/blob/master/samples/UsingFormDesigner/indexstart/indexstartController.ring>

45.63 Creating Reports using the WebLib and the GUILib

The WebLib comes with a class called HtmlPage

Using this class we can create reports quickly using WebLib & GUILib together

Example:

```

load "stdlib.ring"
load "weplib.ring"
load "guilib.ring"

import System.Web
import System.GUI

new qApp {
    open_window(:CustomersReportController)
    exec()
}

class CustomersReportController

    oView = new CustomersReportView

    func Start
        CreateReport()

    func CreateReport
        mypage = new HtmlPage {
            h1 { text("Customers Report") }
            Table
            {
                style = stylewidth("100%") + stylegradient(4)
                TR
                {
                    TD { WIDTH="10%" }
                    text("Customers Count : ")
                    TD { text (100) }
                }
            }
            Table
            {
                style = stylewidth("100%") + stylegradient(26)
                TR
                {
                    style = stylewidth("100%") +
                        stylegradient(24)
                    TD { text("Name ") }
                    TD { text("Age") }
                    TD { text("Country") }
                    TD { text("Job") }
                    TD { text("Company") }
                }
            }
        }
        for x = 1 to 100
            TR

```

(continues on next page)

(continued from previous page)

```

        {
            TD { text("Test" ) }
            TD { text("30" ) }
            TD { text("Egypt" ) }
            TD { text("Sales" ) }
            TD { text("Future" ) }
        }
    next
}
}
write("report.html",mypage.output())

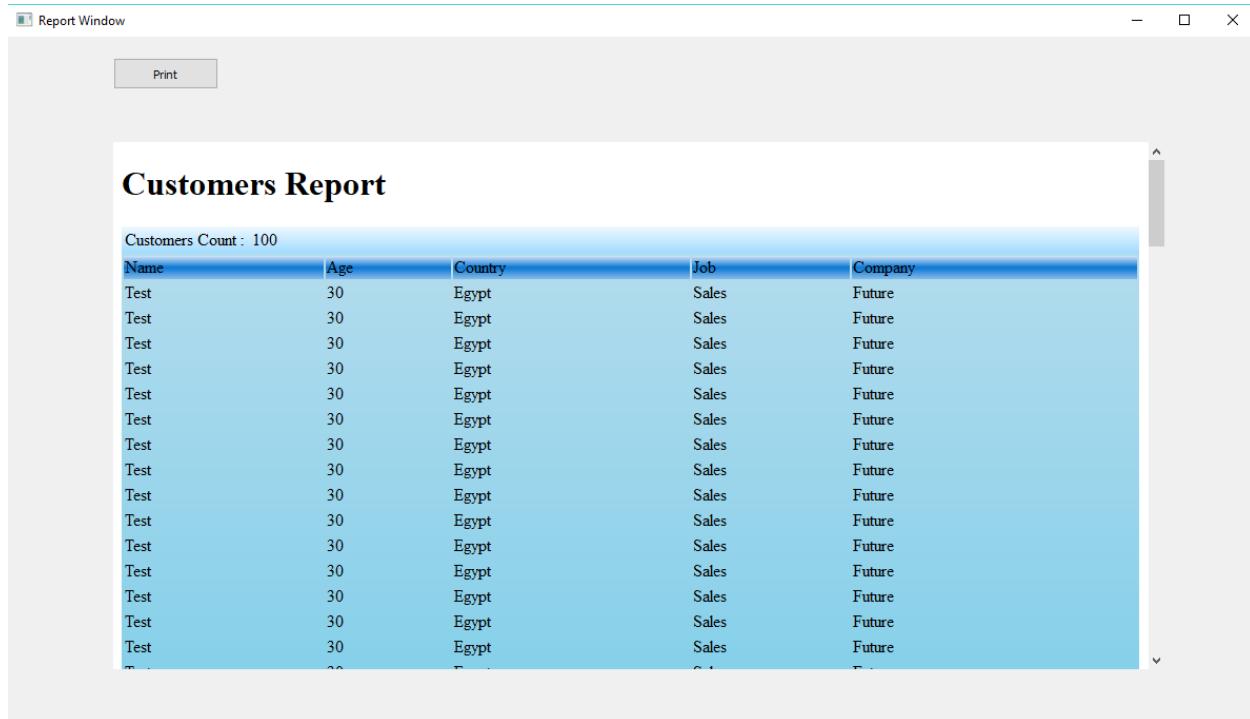
func PrintEvent
    printer1 = new qPrinter(0) {
        setoutputformat(1)
        setoutputfilename("report.pdf")
    }
    oView {
        web.print(printer1)
        web.show()
    }
    system ("report.pdf")

class CustomersReportView

    win = new window() {
        setWindowTitle("Report Window")
        setGeometry(100,100,500,500)
        web = new webview(win) {
            setGeometry(100,100,1000,500)
            loadpage(new qurl("file:///"+
                currentdir()+"report.html"))
        }
        new pushbutton(win) {
            setGeometry(100,20,100,30)
            setText("Print")
            setClickEvent(Method(:PrintEvent))
        }
        showMaximized()
    }
}

```

Screen Shot:



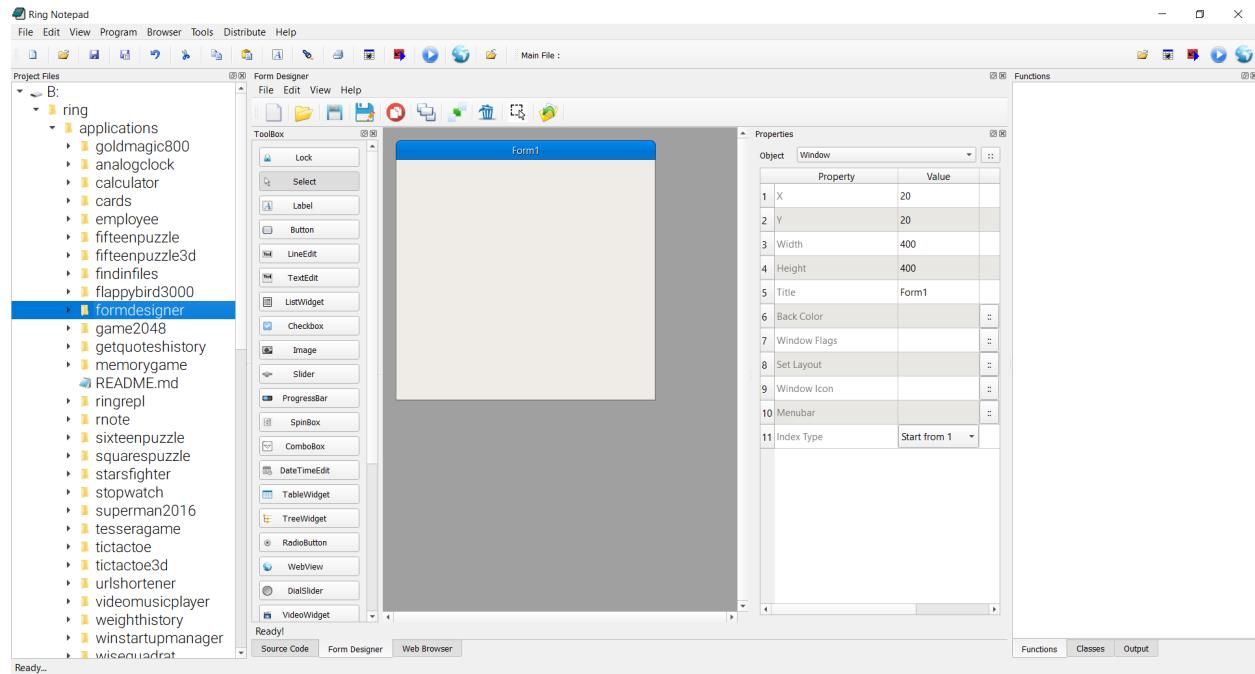
CHAPTER FORTYSIX

USING THE FORM DESIGNER

In this chapter we will learn about using the Form Designer.

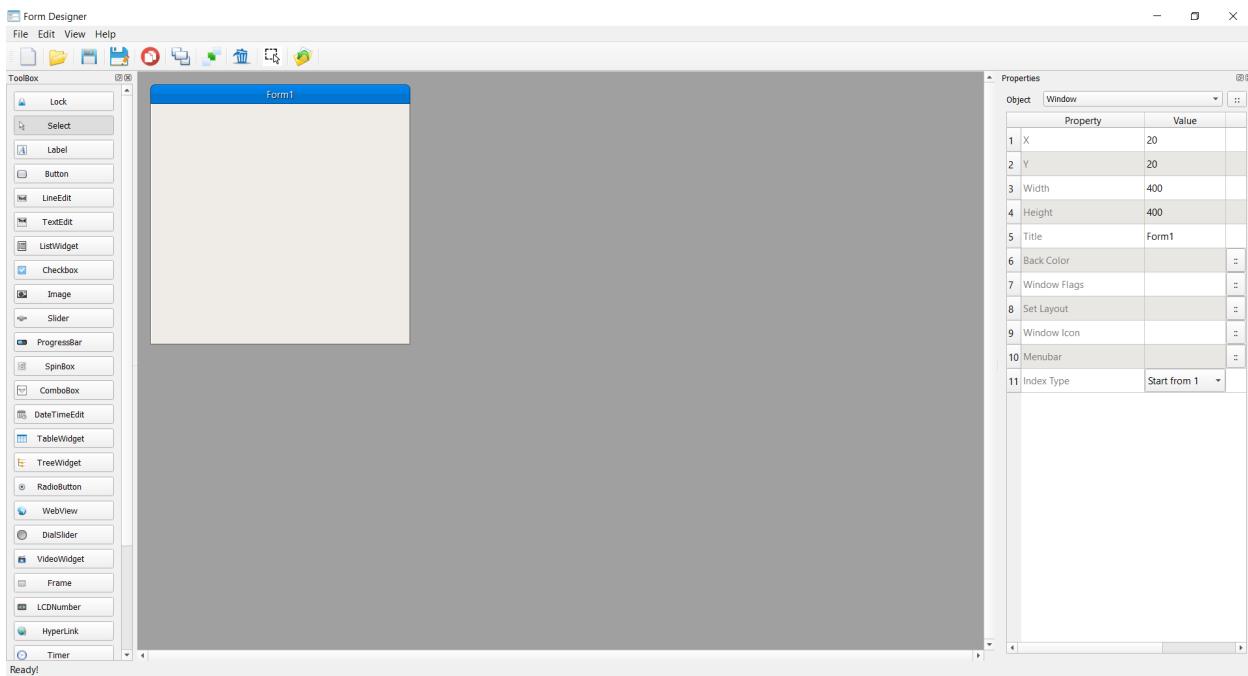
We can run the From Designer from Ring Notepad

From the Menubar in Ring Notepad - View Menu - We can Show/Hide the Form Designer window.



Also we can run the Form Designer in another window.

From the Ring Notepad - Tools Menu - Select the Form Designer.



46.1 The Designer Windows

- **Toolbox** : To select controls to be added to the window.
- **Properties** : To set the properties of the active window or controls.
- **Design Region** : To select, move and resize the window and the controls.

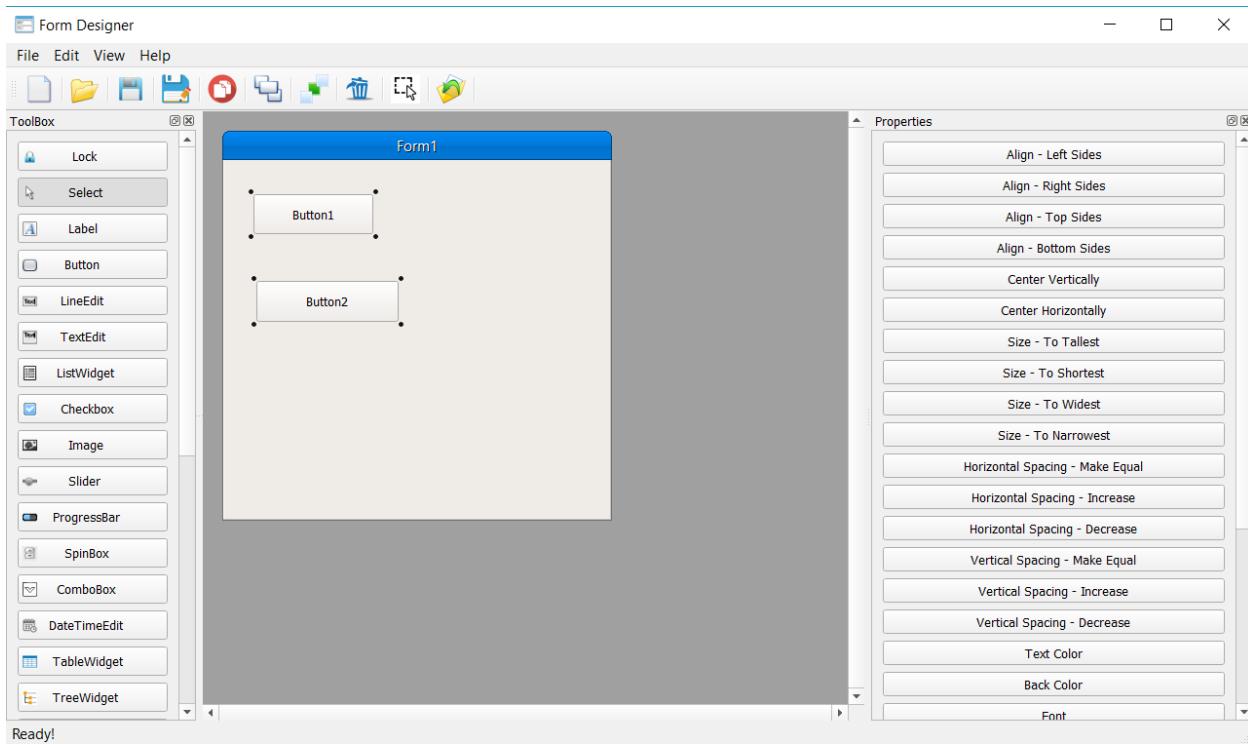
46.2 The Toolbox

We have many buttons.

- **Lock** : We can use it to draw many controls of the same type quickly.
- **Select** : We can use it to select a control in the Design Region
- **Controls Buttons** : Select a control to be added to the window.

46.3 The Properties

- When we select the window or one control, We will have the selected object properties.
- Also In the properties window we have a combobox to select the active control.
- Some properties provide a button next to the property value. We can click on the button to get more options.
- When we select more than one control, We will have options for multi-selection



46.4 Running Forms

When we save the form file (*.rform), The Form Designer will create two Ring files

- The Controller Class
- The View Class

For example, if the form file is helloworld.rform

The form designer will generate two files

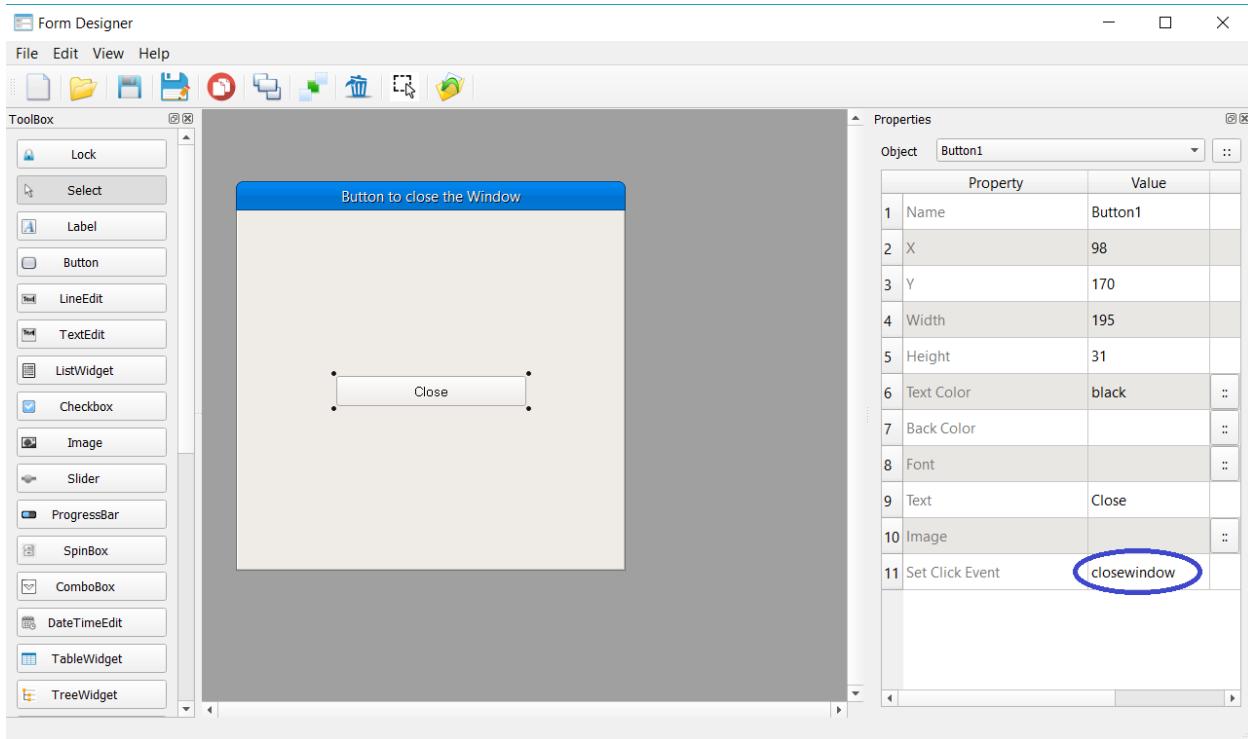
- helloworldcontroller.ring
- helloworldview.ring

To run the program, Open the controller class file then click the Run button (CTRL+F5)

Tip: When you open a form using Ring Notepad, the controller class will be opened automatically, So we can press (CTRL+F5) or click on the Run button while the form designer window is active.

46.5 Events Code

- (1) Just type the method name in the event property.



- (2) Then write the method code in the controller class.

Source Code : B:/ring/applications/formdesigner/tests/buttontoclosethewindow/buttontoclosethewindowController.ring

```

buttontoclosethewindowController.ring X
1 # Form/Window Controller - Source Code File
2
3 load "buttontoclosethewindowView.ring"
4
5 if IsMainSourceFile() {
6     new qApp {
7         StyleFusion()
8         open_window(:buttontoclosethewindowController)
9         exec()
10    }
11 }
12
13 class buttontoclosethewindowController from windowsControllerParent
14
15     oView = new buttontoclosethewindowView
16
17 func CloseWindow
18     oView.win.close()
19

```

Source Code : B:/ring/applications/formdesigner/tests/buttontoclosethewindow/buttontoclosethewindowController.ring Form Designer Web Browser

In this example we write

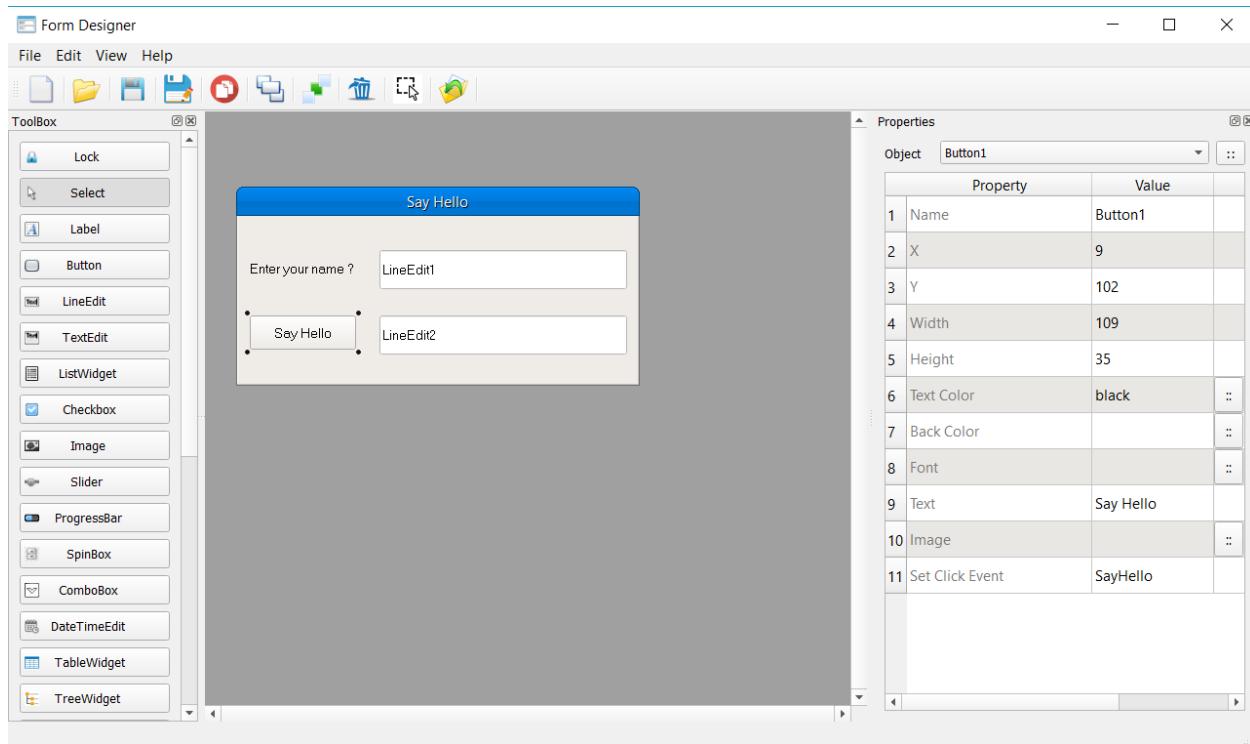
```

func CloseWindow
    oView.win.close()

```

Where inside the controller class, We uses the oView object to access the form.

Another Example :



The Event Code

```
func SayHello
    oView {
        LineEdit2.setText ("Hello " + LineEdit1.text () )
    }
```

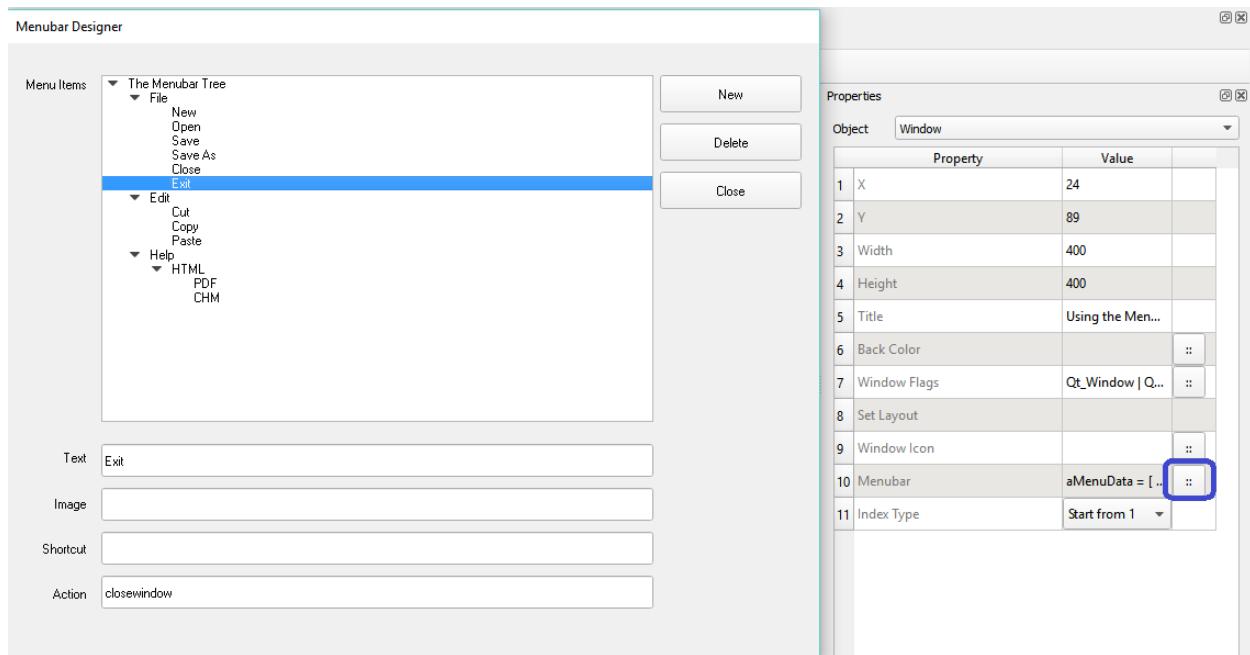
46.6 Keyboard Shortcuts

After selecting one or group of controls

- Use the Arrows (Up, Down, Left and Right) to move them around.
- Shift + the Arrows (Up, Down, Left and Right) to Resize the controls.
- Del button to delete the controls.
- CTRL+SHIFT+V to Duplicate the controls.

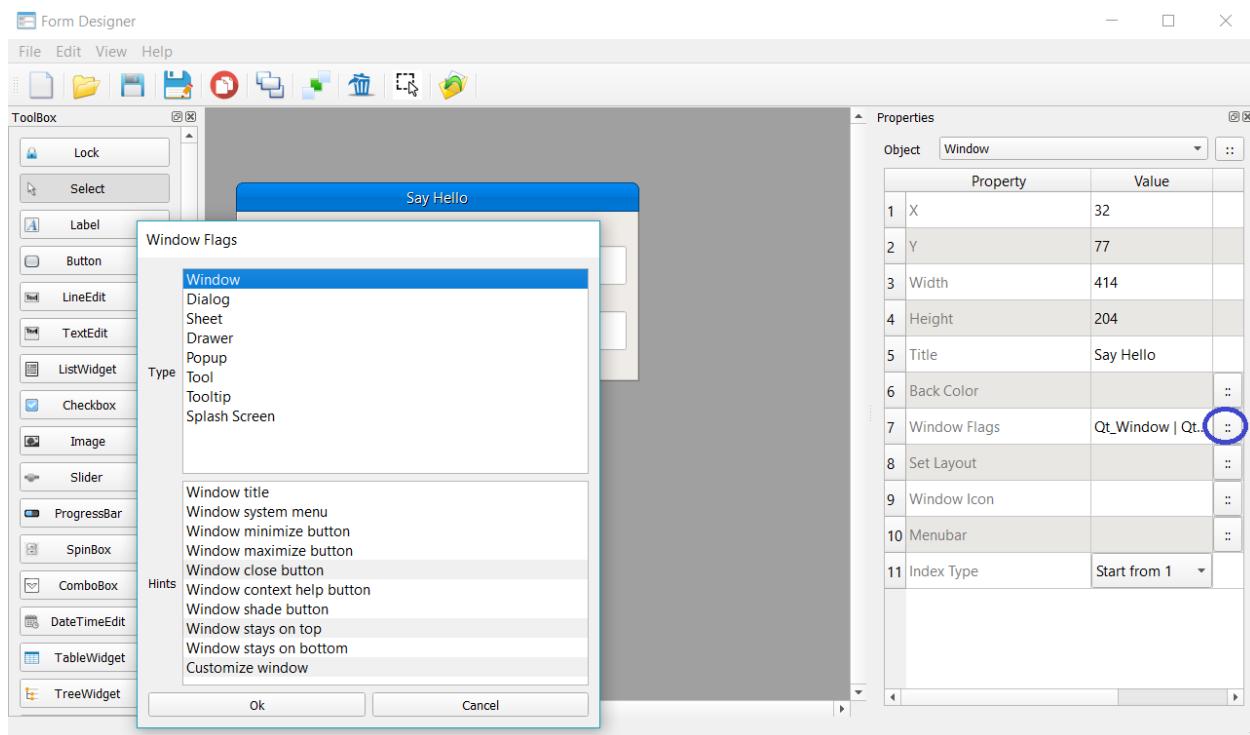
46.7 Menubar Designer

From the Window properties we can open the Menubar Designer



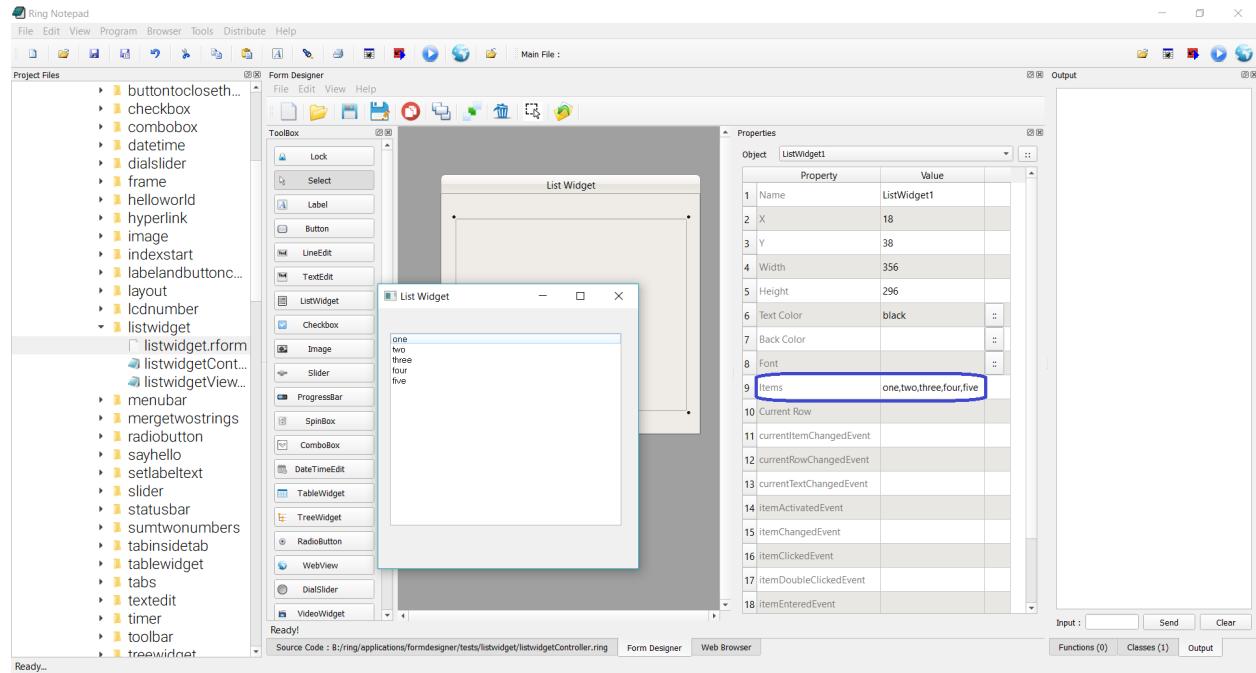
46.8 Window Flags

From the Window properties we can open the Window Flags window.



46.9 Entering Items

For some controls like the List Widget we can enter items separated by comma ‘,’



46.10 Using Layouts

- (1) To use layouts, At first add the layout control to the window.
- (2) Use the window “Set Layout” property to determine the main layout.
- (3) From the layout properties determine the controls and the layout type.

46.11 More Samples and Tests

Check the folder : ring/samples/UsingFormDesigner

Online : <https://github.com/ring-lang/ring/tree/master/samples/UsingFormDesigner>

GRAPHICS PROGRAMMING USING RINGQT3D

In this chapter we will learn how to use Qt3D through many samples.

47.1 Drawing Cube

```
load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView,oWidget,0)

    oRootEntity = new QEntity(oContainer)

    oInput = new QInputAspect(oRootEntity)
        oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

    oLightEntity = new QEntity(oRootEntity)
        oLight = new QPointLight(oLightEntity)
        oLight.setColor(new QColor() { setRGB(255,255,255,255) })
        oLight.setIntensity(1)
        oLightEntity.addComponent(oLight)

    oLightTransform = new QTransform(oLightEntity)
    oLightTransform.setTranslation(oCameraEntity.position())
    oLightEntity.addComponent(oLightTransform)

    oCamController = new QFirstPersonCameraController(oRootEntity)
        oCamController.setCamera(oCameraEntity)

    oCube = new QCuboidMesh(oRootEntity) {
        setXextent(2)
        setYextent(2)
```

(continues on next page)

(continued from previous page)

```
        setZExtent(3)
    }

    oCubeTransform = new QTransform(oCube)
    oCubeTransform.setScale(2)
    oCubeTransform.setTranslation(new QVector3D(3, 3, 3))

    oCubeMaterial = new QPhongMaterial(oCube)
    oCubeMaterial.setDiffuse(new QColor() {setRGB(200,100,100,100)})

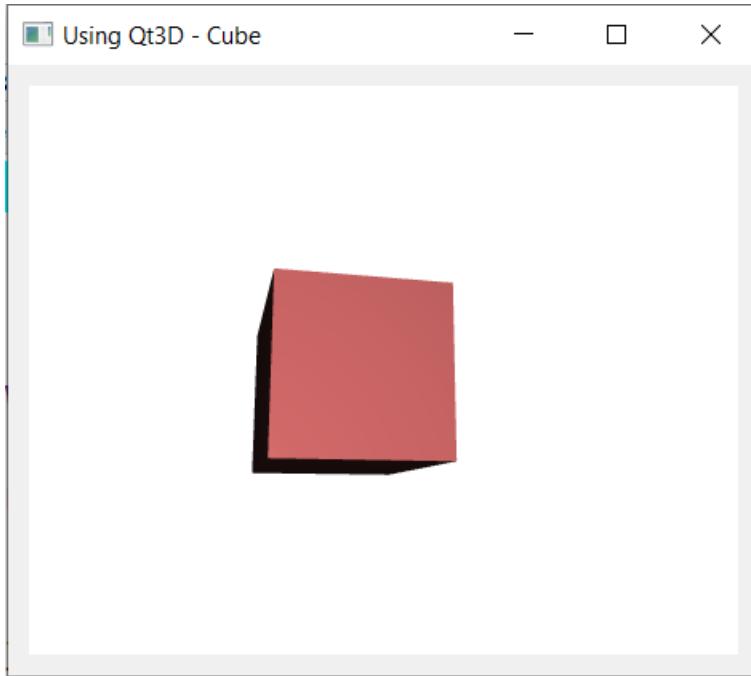
    oCubeEntity = new QEntity(oRootEntity)
    oCubeEntity.addComponent(oCube)
    oCubeEntity.addComponent(oCubeMaterial)
    oCubeEntity.addComponent(oCubeTransform)

    oView.setRootEntity(oRootEntity)

    oLayout = new QVBoxLayout()
    oLayout.addWidget(oContainer)

    oWidget {
        setWindowTitle("Using Qt3D - Cube")
        resize(800,600)
        setLayout(oLayout)
        showMaximized()
    }

    exec()
}
```



47.2 Drawing Torus

```

load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView,oWidget,0)

    oRootEntity = new QEntity(oContainer)

    oInput = new QInputAspect(oRootEntity)
        oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

    oLightEntity = new QEntity(oRootEntity)
        oLight = new QPointLight(oLightEntity)
        oLight.setColor(new QColor() { setRGB(255,255,255,255) })
        oLight.setIntensity(1)
        oLightEntity.addComponent(oLight)

    oLightTransform = new QTransform(oLightEntity)
    oLightTransform.setTranslation(oCameraEntity.position())
    oLightEntity.addComponent(oLightTransform)

    oCamController = new QFirstPersonCameraController(oRootEntity)
        oCamController.setCamera(oCameraEntity)

    oTorus = new QTorusMesh(oRootEntity)
        oTorus.setRadius(1.0)
        oTorus.setMinorRadius(0.4)
        oTorus.setRings(100)
        oTorus.setSlices(20)

    oTorusTransform = new QTransform(oTorus)
    oTorusTransform.setScale(2)
    oTorusTransform.setTranslation(new QVector3D(3, 3, 3))

    oTorusMaterial = new QPhongMaterial(oTorus)
    oTorusMaterial.setDiffuse(new QColor() { setRGB(200,100,100,100) })

    oTorusEntity = new QEntity(oRootEntity)
    oTorusEntity.addComponent(oTorus)
    oTorusEntity.addComponent(oTorusMaterial)
    oTorusEntity.addComponent(oTorusTransform)

    oView.setRootEntity(oRootEntity)

    oLayout = new QVBoxLayout()

```

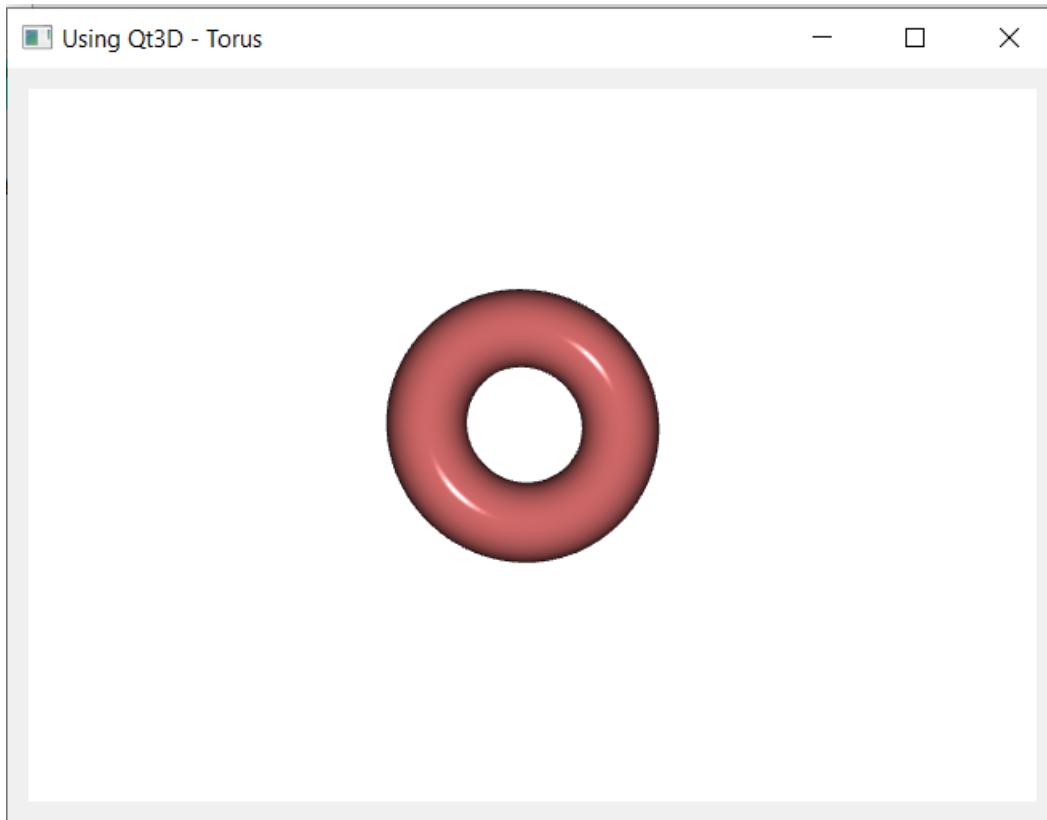
(continues on next page)

(continued from previous page)

```
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Torus")
    resize(800, 600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}
```



47.3 Drawing Sphere

```
load "guilib.ring"

new qApp {

    oView = new Qt3dWindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView, oWidget, 0)

    oRootEntity = new QEntity(oContainer)
```

(continues on next page)

(continued from previous page)

```

oInput = new QInputAspect(oRootEntity)
    oView.registerAspect(oInput)

oCameraEntity = oView.Camera()

oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
    oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
    oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
    oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

oLightEntity = new QEntity(oRootEntity)
    oLight = new QPointLight(oLightEntity)
oLight.setColor(new QColor() { setRGB(255,255,255,255) })
oLight.setIntensity(1)
oLightEntity.addComponent(oLight)

oLightTransform = new QTransform(oLightEntity)
oLightTransform.setTranslation(oCameraEntity.position())
oLightEntity.addComponent(oLightTransform)

oCamController = new QFirstPersonCameraController(oRootEntity)
    oCamController.setCamera(oCameraEntity)

oSphere = new QSphereMesh(oRootEntity)
    oSphere.setRadius(1.0)
    oSphere.setRings(100)
    oSphere.setSlices(20)

oSphereTransform = new QTransform(oSphere)
oSphereTransform.setScale(2)
oSphereTransform.setTranslation(new QVector3D(3, 3, 3))

oSphereMaterial = new QPhongMaterial(oSphere)
oSphereMaterial.setDiffuse(new QColor() { setRGB(200,100,100,100) })

oSphereEntity = new QEntity(oRootEntity)
oSphereEntity.addComponent(oSphere)
oSphereEntity.addComponent(oSphereMaterial)
oSphereEntity.addComponent(oSphereTransform)

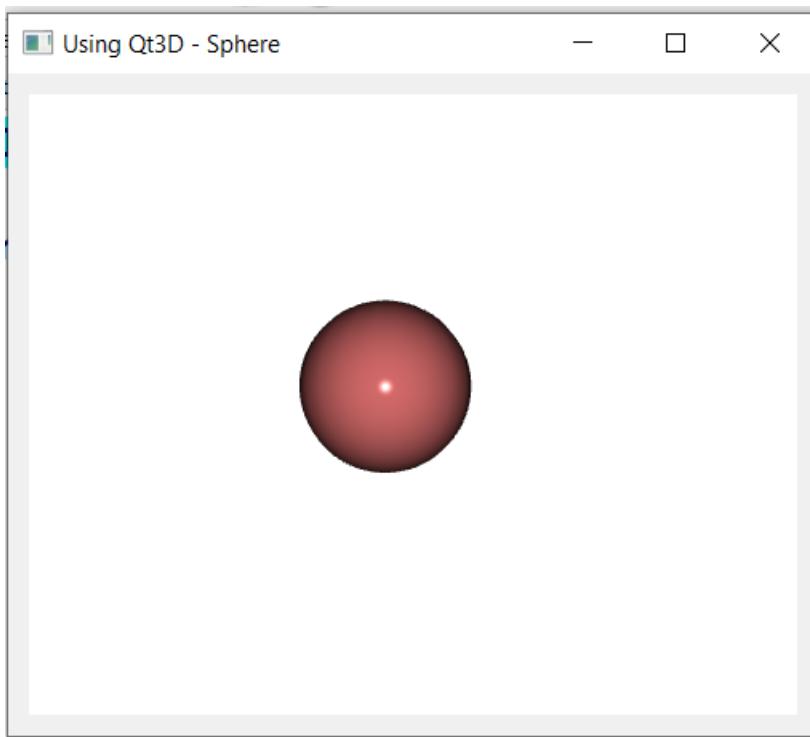
oView.setRootEntity(oRootEntity)

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Sphere")
    resize(800,600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}

```



47.4 Drawing Cylinder

```

load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView,oWidget,0)

    oRootEntity = new QEntity(oContainer)

    oInput = new QInputAspect(oRootEntity)
        oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

    oLightEntity = new QEntity(oRootEntity)
        oLight = new QPointLight(oLightEntity)
        oLight.setColor(new QColor() { setRGB(255,255,255,255) })
        oLight.setIntensity(1)
        oLightEntity.addComponent(oLight)

    oLightTransform = new QTransform(oLightEntity)

```

(continues on next page)

(continued from previous page)

```
oLightTransform.setTranslation(oCameraEntity.position())
oLightEntity.addComponent(oLightTransform)

oCamController = new QFirstPersonCameraController(oRootEntity)
oCamController.setCamera(oCameraEntity)

oCylinder = new QCylinderMesh(oRootEntity)
oCylinder.setRadius(1)
oCylinder.setRings(100)
oCylinder.setSlices(20)
oCylinder.setLength(5)

oCylinderTransform = new QTransform(oCylinder)
oCylinderTransform.setScale(2)
oCylinderTransform.setTranslation(new QVector3D(1, 0, 3))

oCylinderMaterial = new QPhongMaterial(oCylinder)
oCylinderMaterial.setDiffuse(new QColor() {setRGB(200,100,100,100)})

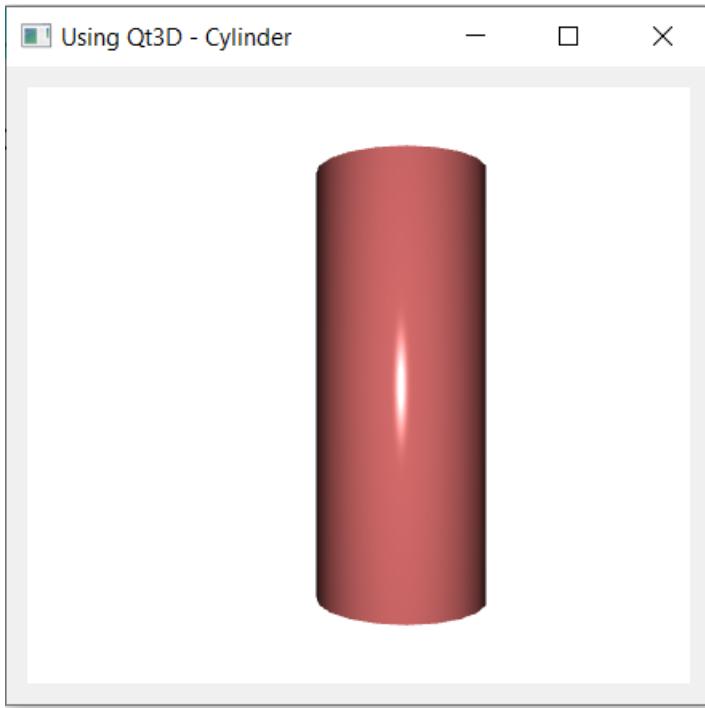
oCylinderEntity = new QEntity(oRootEntity)
oCylinderEntity.addComponent(oCylinder)
oCylinderEntity.addComponent(oCylinderMaterial)
oCylinderEntity.addComponent(oCylinderTransform)

oView.setRootEntity(oRootEntity)

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Cylinder")
    resize(800,600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}
```



47.5 Drawing Cone

```

load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView,oWidget,0)

    oRootEntity = new QEntity(oContainer)

    oInput = new QInputAspect(oRootEntity)
    oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

    oLightEntity = new QEntity(oRootEntity)
        oLight = new QPointLight(oLightEntity)
    oLight.setColor(new QColor() { setRGB(255,255,255,255) })
    oLight.setIntensity(1)
    oLightEntity.addComponent(oLight)

    oLightTransform = new QTransform(oLightEntity)

```

(continues on next page)

(continued from previous page)

```
oLightTransform.setTranslation(oCameraEntity.position())
oLightEntity.addComponent(oLightTransform)

oCamController = new QFirstPersonCameraController(oRootEntity)
oCamController.setCamera(oCameraEntity)

oCone = new QConeMesh(oRootEntity)
oCone.setRings(100)
oCone.setSlices(20)
oCone.setLength(5)

oConeTransform = new QTransform(oCone)
oConeTransform.setScale(2)
oConeTransform.setTranslation(new QVector3D(1, 0, 3))

oConeMaterial = new QPhongMaterial(oCone)
oConeMaterial.setDiffuse(new QColor() {setRGB(200,100,100,100)})

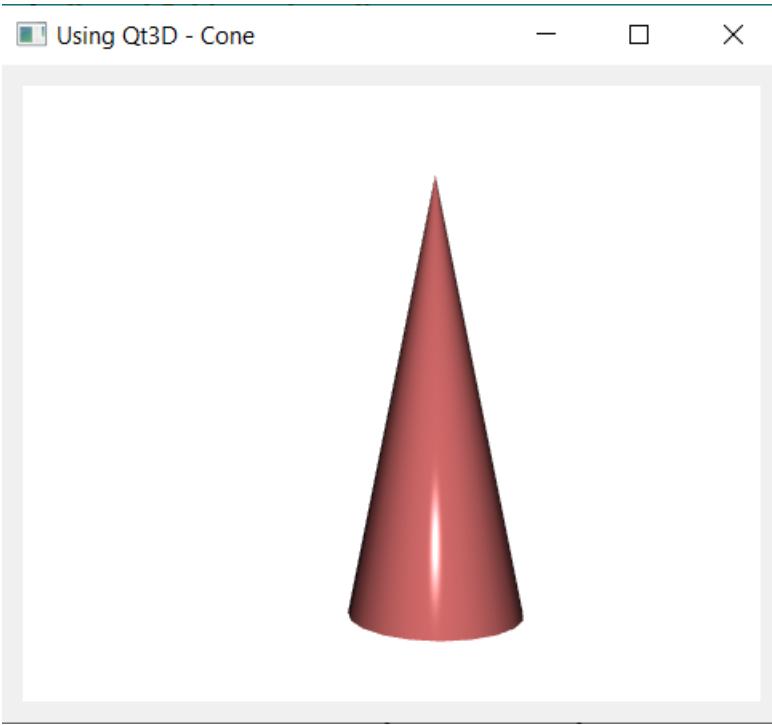
oConeEntity = new QEntity(oRootEntity)
oConeEntity.addComponent(oCone)
oConeEntity.addComponent(oConeMaterial)
oConeEntity.addComponent(oConeTransform)

oView.setRootEntity(oRootEntity)

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Cone")
    resize(800,600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}
```



47.6 Drawing Plane

```

load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView,oWidget,0)

    oRootEntity = new QEntity(oContainer)

    oInput = new QInputAspect(oRootEntity)
        oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

    oLightEntity = new QEntity(oRootEntity)
        oLight = new QPointLight(oLightEntity)
        oLight.setColor(new QColor() { setRGB(255,255,255,255) })
        oLight.setIntensity(1)
        oLightEntity.addComponent(oLight)

    oLightTransform = new QTransform(oLightEntity)

```

(continues on next page)

(continued from previous page)

```
oLightTransform.setTranslation(oCameraEntity.position())
oLightEntity.addComponent(oLightTransform)

oCamController = new QFirstPersonCameraController(oRootEntity)
oCamController.setCamera(oCameraEntity)

oPlane = new QPlaneMesh(oRootEntity)
oPlane.setHeight(5)
oPlane.setWidth(5)
oPlane.setmeshresolution(new QSize(10,10))

oPlaneTransform = new QTransform(oPlane)
oPlaneTransform.setScale(2)
oPlaneTransform.setTranslation(new QVector3D(0, -4, 4))

oPlaneMaterial = new QPhongMaterial(oPlane)
oPlaneMaterial.setDiffuse(new QColor() {setRGB(200,100,100,100)})

oPlaneEntity = new QEntity(oRootEntity)
oPlaneEntity.addComponent(oPlane)
oPlaneEntity.addComponent(oPlaneMaterial)
oPlaneEntity.addComponent(oPlaneTransform)

oView.setRootEntity(oRootEntity)

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Plane")
    resize(800,600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}
```



47.7 Texture

```

load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView,oWidget,0)

    oRootEntity = new QEntity(oContainer)

    oInput = new QInputAspect(oRootEntity)
        oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

    oLightEntity = new QEntity(oRootEntity)
        oLight = new QPointLight(oLightEntity)
        oLight.setColor(new QColor() { setRGB(255,255,255,255) })
        oLight.setIntensity(1)
        oLightEntity.addComponent(oLight)

    oLightTransform = new QTransform(oLightEntity)
    oLightTransform.setTranslation(oCameraEntity.position())
    oLightEntity.addComponent(oLightTransform)
}

```

(continues on next page)

(continued from previous page)

```
oCamController = new QFirstPersonCameraController(oRootEntity)
    oCamController.setCamera(oCameraEntity)

oCube = new QCuboidMesh(oRootEntity) {
    setXextent(2)
    setYextent(2)
    setZextent(3)
}

oCubeTransform = new QTransform(oCube)
oCubeTransform.setScale(2)
oCubeTransform.setTranslation(new QVector3D(3, 3, 3))

oTextureLoader = new QTextureLoader(oCube);
oTextureLoader.setSource(
    new QUrl("file:///"+currentdir() + "/assets/texture/gold.jpg") )
oCubeMaterial = new QTextureMaterial(oCube)
oCubeMaterial.setTexture(oTextureLoader)

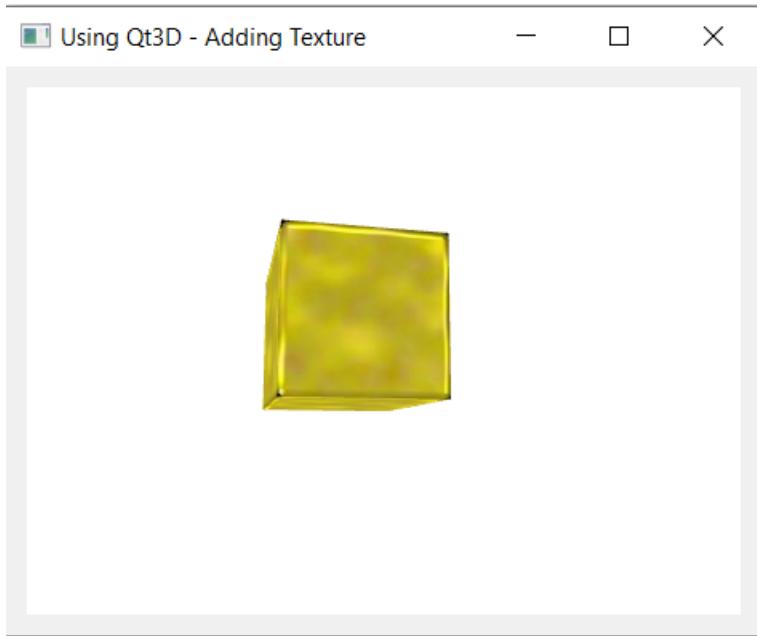
oCubeEntity = new QEntity(oRootEntity)
oCubeEntity.addComponent(oCube)
oCubeEntity.addComponent(oCubeMaterial)
oCubeEntity.addComponent(oCubeTransform)

oView.setRootEntity(oRootEntity)

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Adding Texture")
    resize(800, 600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}
```



47.8 Key Press

```

load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView, oWidget, 0)

    oRootEntity = new QEntity(oContainer)

    oFilter = new qallevents(oView)
    oFilter.setKeyPressEvent("pKeyPress()")
    oView.installEventFilter(oFilter)

    oInput = new QInputAspect(oRootEntity)
    oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

    oLightEntity = new QEntity(oRootEntity)
        oLight = new QPointLight(oLightEntity)
    oLight.setColor(new QColor() { setRGB(255,255,255,255) })
    oLight.setIntensity(1)
    oLightEntity.addComponent(oLight)
}

```

(continues on next page)

(continued from previous page)

```

oLightTransform = new QTransform(oLightEntity)
oLightTransform.setTranslation(oCameraEntity.position())
oLightEntity.addComponent(oLightTransform)

oCamController = new QFirstPersonCameraController(oRootEntity)
    oCamController.setCamera(oCameraEntity)
oCamController.setEnabled(False)

oCube = new QCuboidMesh(oRootEntity) {
    setXextent(2)
    setYextent(2)
    setZextent(3)
}

oCubeTransform = new QTransform(oCube)
oCubeTransform.setScale(2)
oCubeTransform.setTranslation(new QVector3D(3, 3, 3))

oTextureLoader = new QTextureLoader(oCube);
oTextureLoader.setSource(
    new QUrl("file:///"+currentdir() + "/assets/texture/gold.jpg"))
oCubeMaterial = new QTextureMaterial(oCube)
oCubeMaterial.setTexture(oTextureLoader)

oCubeEntity = new QEntity(oRootEntity)
oCubeEntity.addComponent(oCube)
oCubeEntity.addComponent(oCubeMaterial)
oCubeEntity.addComponent(oCubeTransform)

oView.setRootEntity(oRootEntity)

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Moving Cube using the Keyboard")
    resize(800, 600)
    setLayout(oLayout)
    showMaximized()
}

oContainer.setFocus(0)

exec()
}

func pKeyPress
    nKey = oFilter.getKeyCode()
    oX = oCubeTransform.translation().x()
    oY = oCubeTransform.translation().y()
    oZ = oCubeTransform.translation().z()
    switch nKey
        on Qt.Key_Right
            oX++
        on Qt.Key_Left
            oX--
        on Qt.Key_Up

```

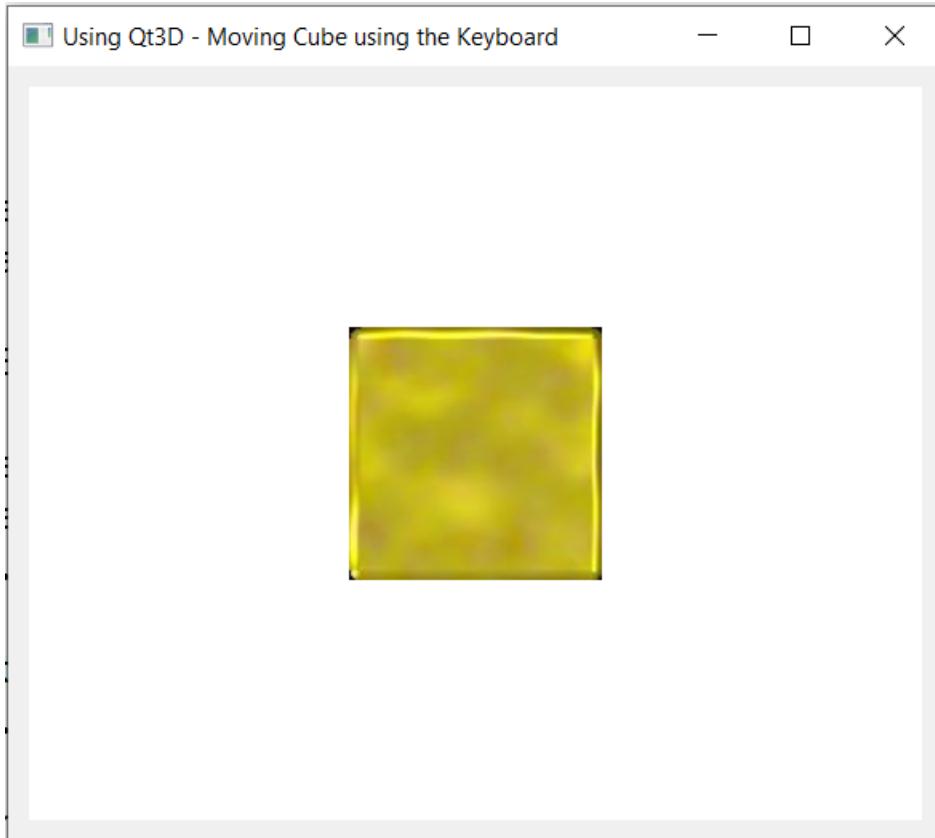
(continues on next page)

(continued from previous page)

```

    oY++
on Qt_Key_Down
    oY--
off
oCubeTransform.setTranslation(new QVector3D(oX, oY, oZ))

```



47.9 Object Picker

```

load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView, oWidget, 0)

    oRootEntity = new QEntity(oContainer)

    oFilter = new qallevents(oView)
    oFilter.setKeyPressEvent("pKeyPress()")
    oView.installEventFilter(oFilter)

    oInput = new QInputAspect(oRootEntity)
}

```

(continues on next page)

(continued from previous page)

```

oView.registerAspect(oInput)

oCameraEntity = oView.Camera()

oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
    oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
    oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
    oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

oLightEntity = new QEntity(oRootEntity)
    oLight = new QPointLight(oLightEntity)
    oLight.setColor(new QColor() { setRGB(255,255,255,255) })
    oLight.setIntensity(1)
    oLightEntity.addComponent(oLight)

oLightTransform = new QTransform(oLightEntity)
oLightTransform.setTranslation(oCameraEntity.position())
oLightEntity.addComponent(oLightTransform)

oCamController = new QFirstPersonCameraController(oRootEntity)
    oCamController.setCamera(oCameraEntity)
oCamController.setEnabled(False)

oCube = new QCuboidMesh(oRootEntity) {
    setXextent(2)
    setYextent(2)
    setZextent(3)
}

oCubeTransform = new QTransform(oCube)
oCubeTransform.setScale(2)
oCubeTransform.setTranslation(new QVector3D(3, 3, 3))

oTextureLoader = new QTextureLoader(oCube);
oTextureLoader.setSource(
    new QUrl("file:///"+currentdir()+"assets/texture/gold.jpg"))
oCubeMaterial = new QTextureMaterial(oCube)
oCubeMaterial.setTexture(oTextureLoader)

oCubeEntity = new QEntity(oRootEntity)
oCubeEntity.addComponent(oCube)
oCubeEntity.addComponent(oCubeMaterial)
oCubeEntity.addComponent(oCubeTransform)

oPicker = new qObjectPicker(oCube) {
    setClickedEvent("pClick()")
}
oCubeEntity.addComponent(oPicker)

oView.setRootEntity(oRootEntity)

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Object Picker - Click on the Cube")
    resize(800,600)
}

```

(continues on next page)

(continued from previous page)

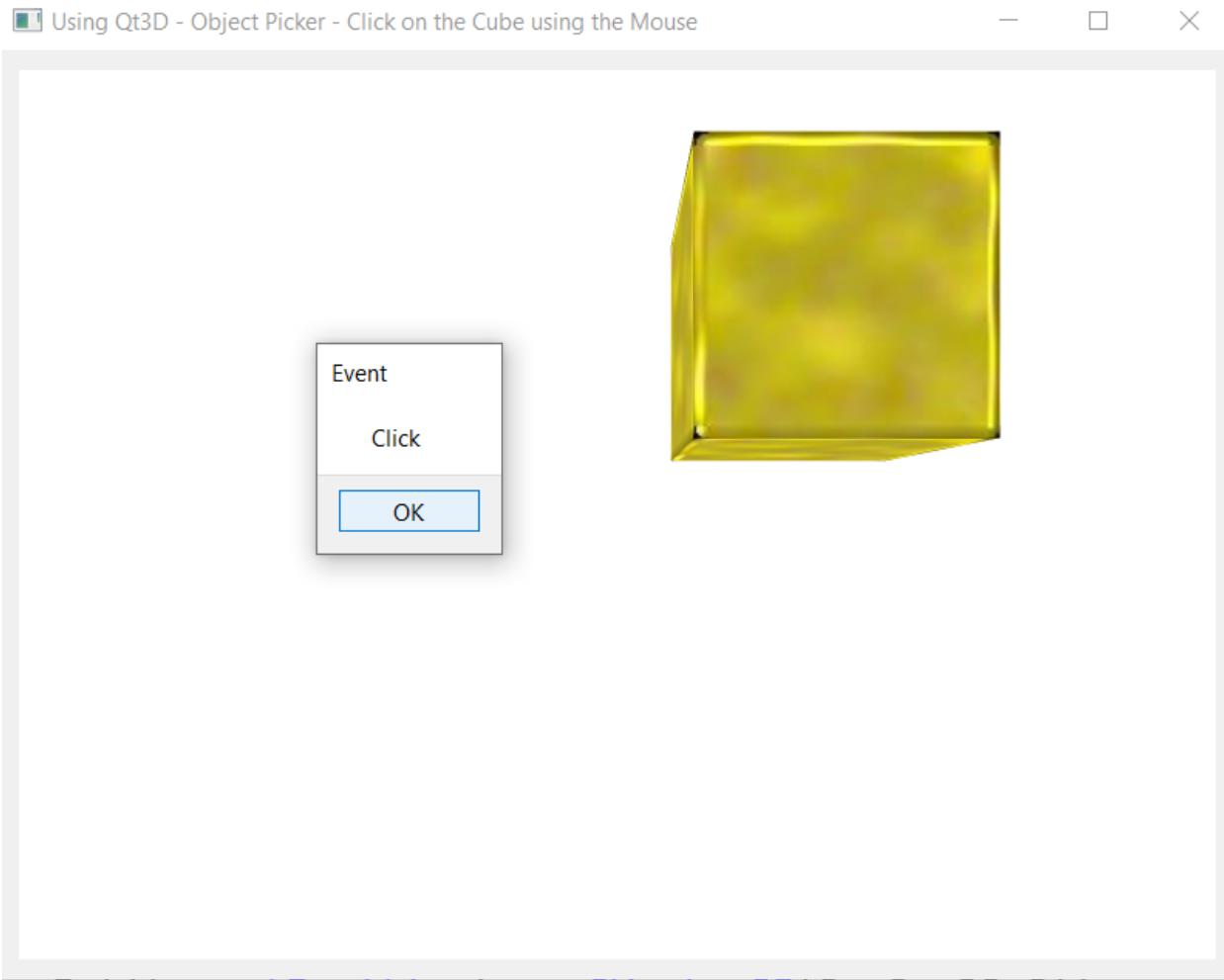
```
        setLayout(oLayout)
        showMaximized()
    }

    oContainer.setFocus(0)

    exec()
}

func pKeyPress
    nKey = oFilter.getKeycode()
    oX = oCubeTransform.translation().x()
    oY = oCubeTransform.translation().y()
    oZ = oCubeTransform.translation().z()
    switch nKey
        on Qt_Key_Right
            oX++
        on Qt_Key_Left
            oX--
        on Qt_Key_Up
            oY++
        on Qt_Key_Down
            oY--
    off
    oCubeTransform.setTranslation(new QVector3D(oX, oY, oZ))

func pClick
    msginfo("Event", "Click")
    oContainer.setFocus(0)
```



47.10 Frame Action

```
load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView,oWidget,0)

    oRootEntity = new QEntity(oContainer)

    oInput = new QInputAspect(oRootEntity)
    oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
```

(continues on next page)

(continued from previous page)

```

oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

oLightEntity = new QEntity(oRootEntity)
    oLight = new QPointLight(oLightEntity)
oLight.setColor(new QColor() { setRGB(255,255,255,255) })
oLight.setIntensity(1)
oLightEntity.addComponent(oLight)

oLightTransform = new QTransform(oLightEntity)
oLightTransform.setTranslation(oCameraEntity.position())
oLightEntity.addComponent(oLightTransform)

oCamController = new QFirstPersonCameraController(oRootEntity)
    oCamController.setCamera(oCameraEntity)
oCamController.setEnabled(False)

oCube = new QCuboidMesh(oRootEntity) {
    setXextent(1)
    setYextent(1)
    setZextent(1)
}

oCubeTransform = new QTransform(oCube)
oCubeTransform.setScale(2)
oCubeTransform.setTranslation(new QVector3D(-5, -5, -5))

oTextureLoader = new QTextureLoader(oCube);
oTextureLoader.setSource(
    new QUrl("file:///"+currentdir()+"/assets/texture/gold.jpg") )
oCubeMaterial = new QTextureMaterial(oCube)
oCubeMaterial.setTexture(oTextureLoader)

oCubeEntity = new QEntity(oRootEntity)
oCubeEntity.addComponent(oCube)
oCubeEntity.addComponent(oCubeMaterial)
oCubeEntity.addComponent(oCubeTransform)

nAngle=0           nSpeed=0.1
oFrameAction = new qFrameAction(oRootEntity) {
    settriggeredevent("pEvent()")
}

oView.setRootEntity(oRootEntity)

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setwindowtitle("Using Qt3D - Frame Action")
    resize(800,600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}

```

(continues on next page)

(continued from previous page)

```
func pEvent

    # Move the Cube
    oX = oCubeTransform.translation().x()
    oY = oCubeTransform.translation().y()
    oZ = oCubeTransform.translation().z()
    if oX >= 4
        nSpeed=-0.1
    but oX <= -10
        nSpeed=0.1
    ok
    oCubeTransform.setTranslation(
        new QVector3D(oX+nSpeed, oY+nSpeed, oZ+nSpeed))

    # Rotate the Cube
    nAngle+=5 if nAngle=360 nAngle=0 ok
    oQ = new QQuaternion(0,0,0,0)
    oCubeTransform.setRotation(
        oQ.fromAxisAndAngle(new QVector3D(0, 1, 0), nAngle))
```



47.11 Text 2D

```

load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView,oWidget,0)

    oRootEntity = new QEntity(oContainer)

    oView.defaultframegraph().setclearcolor(new QColor() {setRGB(100,250,150,255)}
→)

    oInput = new QInputAspect(oRootEntity)
    oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

    oLightEntity = new QEntity(oRootEntity)
        oLight = new QPointLight(oLightEntity)
    oLight.setColor(new QColor() { setRGB(255,255,255,255) })
    oLight.setIntensity(1)
    oLightEntity.addComponent(oLight)

    oLightTransform = new QTransform(oLightEntity)
    oLightTransform.setTranslation(oCameraEntity.position())
    oLightEntity.addComponent(oLightTransform)

    oCamController = new QFirstPersonCameraController(oRootEntity)
        oCamController.setCamera(oCameraEntity)

    oCube = new QCuboidMesh(oRootEntity) {
        setXextent(2)
        setYextent(2)
        setZextent(3)
    }

    oCubeTransform = new QTransform(oCube)
    oCubeTransform.setScale(2)
    oCubeTransform.setTranslation(new QVector3D(0, 3, 4))

    oTextureLoader = new QTextureLoader(oCube);
    oTextureLoader.setSource(
        new QUrl("file:///"+currentdir()+"assets/texture/ring.bmp") )
    oCubeMaterial = new QTextureMaterial(oCube)
    oCubeMaterial.setTexture(oTextureLoader)

    oCubeEntity = new QEntity(oRootEntity)
    oCubeEntity.addComponent(oCube)
}

```

(continues on next page)

(continued from previous page)

```
oCubeEntity.addComponent(oCubeMaterial)
oCubeEntity.addComponent(oCubeTransform)

oText2DEntity = new QText2DEntity(oRootEntity) {
    setText("Ring programming language")
    setWidth(400) setHeight(40)
    setColor(new QColor() {setRGB(128,128,128,255)})
}

oText2DTransform = new QTransform(oText2DEntity)
oText2DTransform.setScale(0.1)
oText2DTransform.setTranslation(new QVector3D(-10.5, -5, 0))

oText2DEntity.addComponent(oText2DTransform)

oView.setRootEntity(oRootEntity)

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Text2D")
    resize(800,600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}
```



47.12 Extruded Text

```

load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView, oWidget, 0)

    oRootEntity = new QEntity(oContainer)

    oView.defaultframegraph().setclearcolor(new QColor() {setRGB(100,250,150,255)})

    oInput = new QInputAspect(oRootEntity)
    oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

    oLightEntity = new QEntity(oRootEntity)
        oLight = new QPointLight(oLightEntity)
    oLight.setColor(new QColor() { setRGB(255,255,255,255) })
    oLight.setIntensity(1)
    oLightEntity.addComponent(oLight)

    oLightTransform = new QTransform(oLightEntity)
    oLightTransform.setTranslation(oCameraEntity.position())
    oLightEntity.addComponent(oLightTransform)

    oCamController = new QFirstPersonCameraController(oRootEntity)
        oCamController.setCamera(oCameraEntity)

    oCube = new QCuboidMesh(oRootEntity) {
        setXextent(2)
        setYextent(2)
        setZextent(3)
    }

    oCubeTransform = new QTransform(oCube)
    oCubeTransform.setScale(2)
    oCubeTransform.setTranslation(new QVector3D(0, 3, 4))

    oTextureLoader = new QTextureLoader(oCube);
    oTextureLoader.setSource(
        new QUrl("file:///"+currentdir()+"assets/texture/ring.bmp") )
    oCubeMaterial = new QTextureMaterial(oCube)
    oCubeMaterial.setTexture(oTextureLoader)

    oCubeEntity = new QEntity(oRootEntity)
    oCubeEntity.addComponent(oCube)
}

```

(continues on next page)

(continued from previous page)

```
oCubeEntity.addComponent(oCubeMaterial)
oCubeEntity.addComponent(oCubeTransform)

oTextEntity = new QEntity(oRootEntity)

oTextMesh = new QEExtrudedTextMesh(oTextEntity) {
    setText("Ring")
}

oTextTransform = new QTransform(oTextEntity)
oTextTransform.setScale(3)
oTextTransform.setTranslation(new QVector3D(-5.5, -4, 3))

oTextMaterial = new QPhongMaterial(oTextEntity);
oTextMaterial.setDiffuse(new QColor() {setRGB(0,0,255,255)})

oTextEntity.addComponent(oTextMesh)
oTextEntity.addComponent(oTextTransform)
oTextEntity.addComponent(oTextMaterial)

oView.setRootEntity(oRootEntity)

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Extruded Text")
    resize(800,600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}
```



47.13 Model

```

load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView,oWidget,0)

    oRootEntity = new QEntity(oContainer)

    oInput = new QInputAspect(oRootEntity)
        oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

    oLightEntity = new QEntity(oRootEntity)
        oLight = new QPointLight(oLightEntity)
    oLight.setColor(new QColor() { setRGB(255,255,255,255) })
    oLight.setIntensity(1)
    oLightEntity.addComponent(oLight)

    oLightTransform = new QTransform(oLightEntity)
    oLightTransform.setTranslation(oCameraEntity.position())
    oLightEntity.addComponent(oLightTransform)

    oCamController = new QFirstPersonCameraController(oRootEntity)
        oCamController.setCamera(oCameraEntity)

    oModel = new qmesh(oRootEntity)

    oModel.setsource(
        new qURL("file:///"+currentdir()+"assets/model/lucky_cat.obj") )

    oModelTransform = new QTransform(oModel)
    oModelTransform.setScale(0.1)
    oModelTransform.setTranslation(new QVector3D(0, 0, 0))
    oQ = new QQuaternion(0,0,0,0)
    oModelTransform.setRotation(oQ.fromAxisAndAngle(new QVector3D(0, 1, 0), 180))

    oModelMaterial = new QPhongMaterial(oModel)
    oModelMaterial.setDiffuse(new QColor() { setRGB(0,255,128,255) })

    oModelEntity = new QEntity(oRootEntity)
    oModelEntity.addComponent(oModel)
    oModelEntity.addComponent(oModelmaterial)
    oModelEntity.addComponent(oModelTransform)

    oView.setRootEntity(oRootEntity)
}

```

(continues on next page)

(continued from previous page)

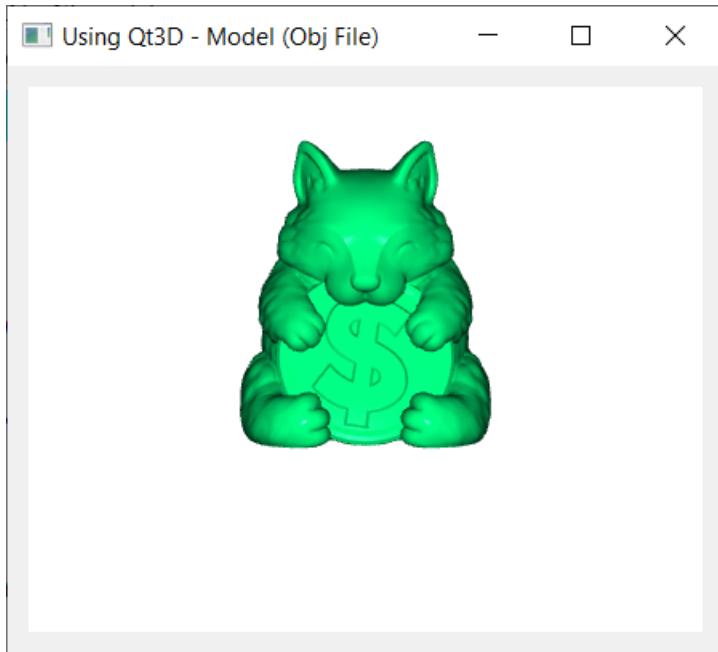
```

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Model (Obj File)")
    resize(800, 600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}

```



47.14 Model Texture

```

load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView, oWidget, 0)

    oRootEntity = new QEntity(oContainer)

    oInput = new QInputAspect(oRootEntity)
    oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()
}

```

(continues on next page)

(continued from previous page)

```

oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
    oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
    oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
    oCameraEntity.setViewCenter(new QVector3D(0, 25, 0))

oLightEntity = new QEntity(oRootEntity)
    oLight = new QPointLight(oLightEntity)
oLight.setColor(new QColor() { setRGB(255,255,255,255) })
oLight.setIntensity(1)
oLightEntity.addComponent(oLight)

oLightTransform = new QTransform(oLightEntity)
oLightTransform.setTranslation(oCameraEntity.position())
oLightEntity.addComponent(oLightTransform)

oCamController = new QFirstPersonCameraController(oRootEntity)
    oCamController.setCamera(oCameraEntity)

oModel = new qmesh(oRootEntity)

oModel.setsource(
    new qURL("file:///"+currentdir()+"assets/model/Robot.obj") )

oModelTransform = new QTransform(oModel)
oModelTransform.setScale(0.5)
oModelTransform.setTranslation(new QVector3D(0, 12, 4))

oLoader = new QTextureLoader(oModel)
oModelMaterial = new QTextureMaterial(oModel)
oLoader.setSource(
    new QUrl("file:///"+currentdir()+"assets/texture/Robot.jpg") )
oModelMaterial.setTexture(oLoader)

oModelEntity = new QEntity(oRootEntity)
oModelEntity.addComponent(oModel)
oModelEntity.addComponent(oModelMaterial)
oModelEntity.addComponent(oModelTransform)

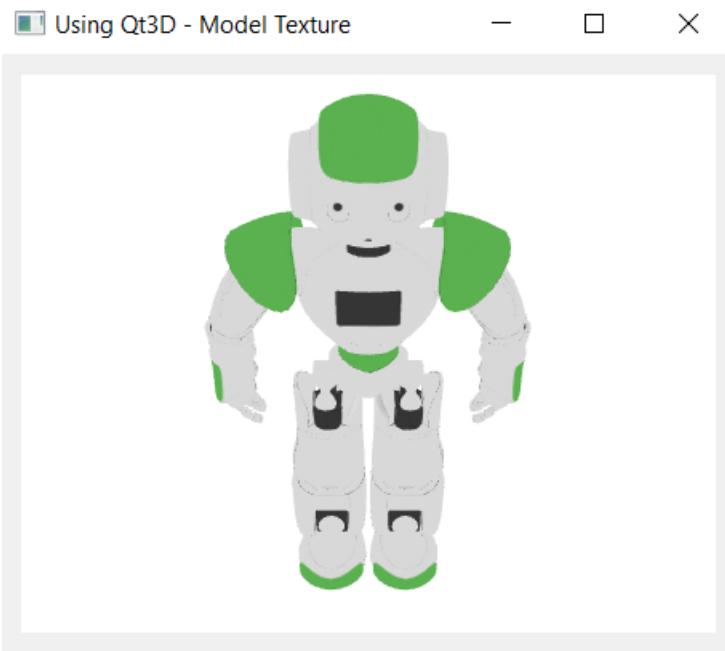
oView.setRootEntity(oRootEntity)

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Model Texture")
    resize(800,600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}

```



47.15 Draw Office

```

load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView,oWidget,0)

    oRootEntity = new QEntity(oContainer)

    oInput = new QInputAspect(oRootEntity)
    oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(0, 0, 0))

    oLightEntity = new QEntity(oRootEntity)
        oLight = new QPointLight(oLightEntity)
        oLight.setColor(new QColor() { setRGB(255,255,255,255) })
        oLight.setIntensity(1)
        oLightEntity.addComponent(oLight)

    oLightTransform = new QTransform(oLightEntity)
    oLightTransform.setTranslation(oCameraEntity.position())
    oLightEntity.addComponent(oLightTransform)
}

```

(continues on next page)

(continued from previous page)

```
oCamController = new QFirstPersonCameraController(oRootEntity)
    oCamController.setCamera(oCameraEntity)

oModel = new qmesh(oRootEntity)

oModel.setsource(
    new qURL("file:///"+currentdir() + "/assets/model/Reception_Table.obj") ↵
)

oModelTransform = new QTransform(oModel)
oModelTransform.setScale(1)
oModelTransform.setTranslation(new QVector3D(0, -2.5, 16))

oModelMaterial = new QPhongMaterial(oModel)
oModelMaterial.setDiffuse(new QColor() {setRGB(0, 255, 128, 255)})

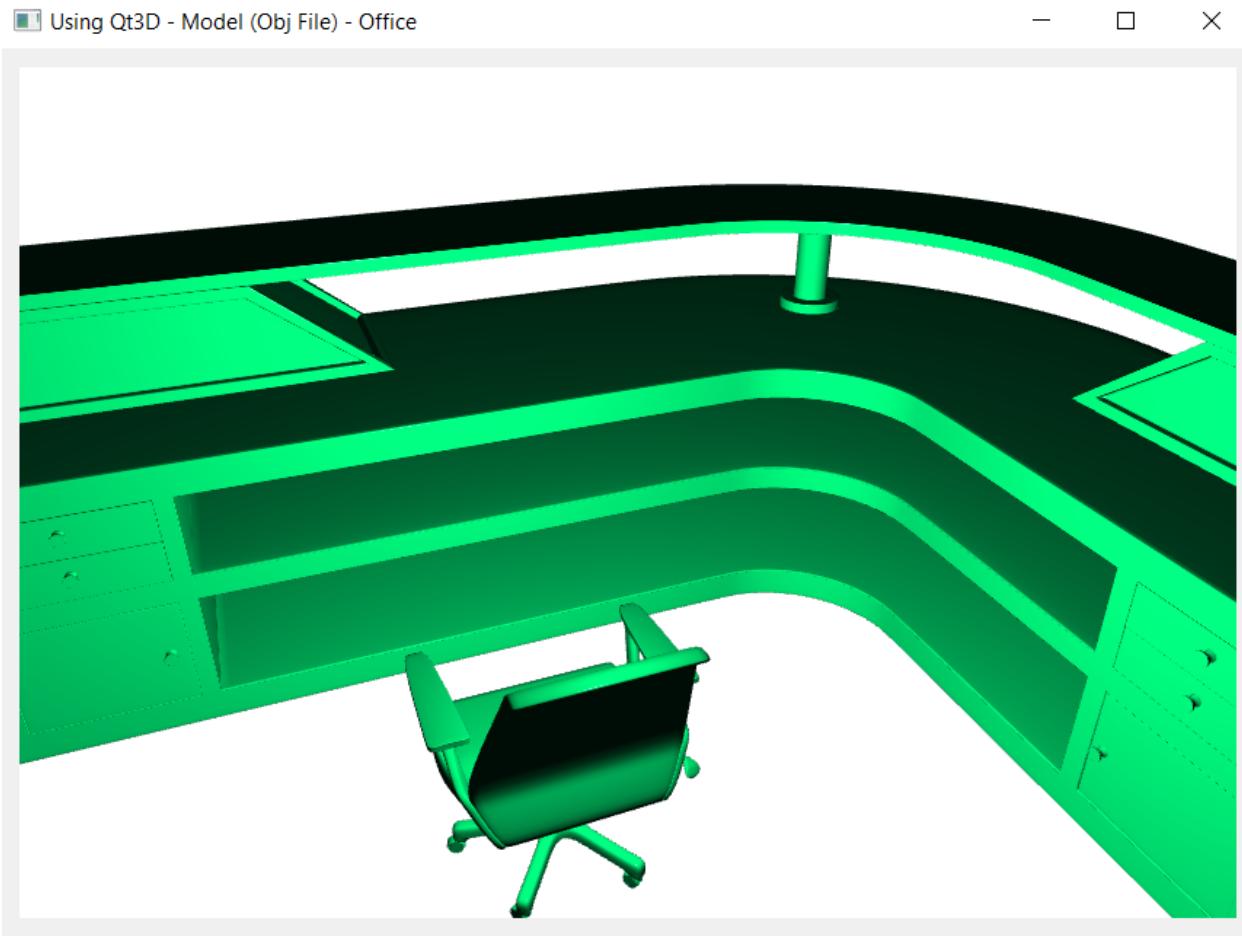
oModelEntity = new QEntity(oRootEntity)
oModelEntity.addComponent(oModel)
oModelEntity.addComponent(oModelmaterial)
oModelEntity.addComponent(oModelTransform)

oView.setRootEntity(oRootEntity)

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Model (Obj File) - Office")
    resize(800, 600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}
```



47.16 Many Objects

```
load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView,oWidget,0)

    oRootEntity = new QEntity(oContainer)

    oInput = new QInputAspect(oRootEntity)
        oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(0, 20, 0))
```

(continues on next page)

(continued from previous page)

```

oLightEntity = new QEntity(oRootEntity)
    oLight = new QPointLight(oLightEntity)
oLight.setColor(new QColor() { setRGB(255,255,255,255) })
oLight.setIntensity(1)
oLightEntity.addComponent(oLight)

oLightTransform = new QTransform(oLightEntity)
oLightTransform.setTranslation(oCameraEntity.position())
oLightEntity.addComponent(oLightTransform)

oCamController = new QFirstPersonCameraController(oRootEntity)
    oCamController.setCamera(oCameraEntity)

oModel = new qmesh(oRootEntity)
oModel.setsource(
    new qURL("file:///"+currentdir()+"assets/model/Robot.obj") )

oModelTransform = new QTransform(oModel)
oModelTransform.setScale(0.2)
oModelTransform.setTranslation(new QVector3D(0, 10, 10))

oModelMaterial = new QPhongMaterial(oModel)
oModelMaterial.setDiffuse(new QColor() {setRGB(0,100,0,0)})

oModelEntity = new QEntity(oRootEntity)
oModelEntity.addComponent(oModel)

oLoader = new QTextureLoader(oModel);
oModelMaterial = new QTextureMaterial(oModel)
oLoader.setSource(
    new QUrl("file:///"+currentdir()+"assets/texture/gold.jpg") )
oModelMaterial.setTexture(oLoader)

oModelEntity.addComponent(oModelMaterial)
oModelEntity.addComponent(oModelTransform)

for n = 1 to 10

    oTorus = new QTorusMesh(oRootEntity)
        oTorus.setRadius(1.0*n)
        oTorus.setMinorRadius(0.4*n)
        oTorus.setRings(100)
        oTorus.setSlices(20)

    oTorusTransform = new QTransform(null)
    oTorusTransform.setScale(2)
    oTorusTransform.setTranslation(new QVector3D(5.0*n, 4.0*n, 0.0))

    oTorusMaterial = new QPhongMaterial(null);
    oTorusMaterial.setDiffuse(new QColor() {setRGB(200,100,100,100)})

    oTorusEntity = new QEntity(oRootEntity)
    oTorusEntity.addComponent(oTorus)

    oLoader = new QTextureLoader(oTorus);
    oTorusMaterial = new QTextureMaterial(oTorus)

```

(continues on next page)

(continued from previous page)

```
oLoader.setSource(
    new QUrl("file:///"+currentdir()+"/assets/texture/gold.jpg") )
oTorusMaterial.setTexture(oLoader)

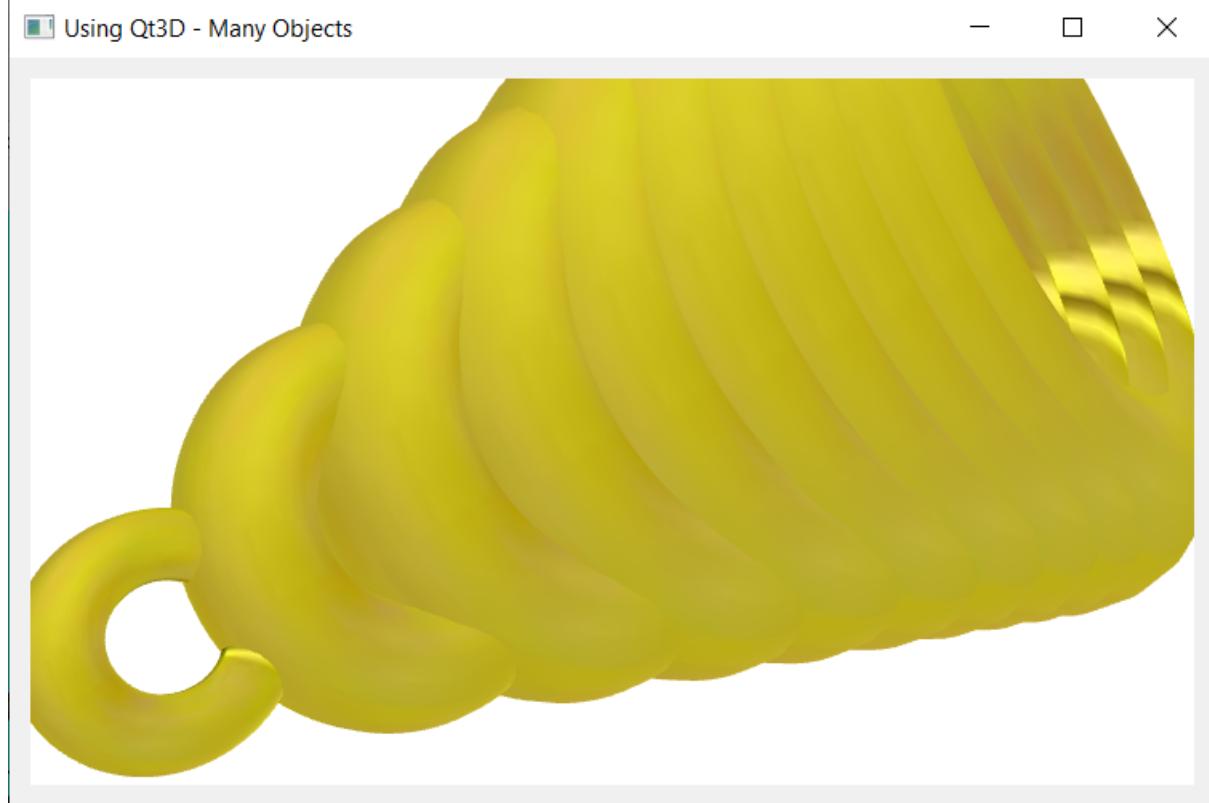
oTorusEntity.addComponent(oTorusMaterial)
oTorusEntity.addComponent(oTorusTransform)
next

oView.setRootEntity(oRootEntity)

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)

oWidget {
    setWindowTitle("Using Qt3D - Many Objects")
    resize(800,600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}
```



47.17 Camera

```

load "guilib.ring"

new qApp {

    oView = new Qt3dwindow()

    oWidget = new QWidget()
    oContainer = oWidget.createWindowContainer(oView,oWidget,0)

    oRootEntity = new QEntity(oContainer)

    oInput = new QInputAspect(oRootEntity)
        oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000.0)
        oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(0, 20, 0))

    oLightEntity = new QEntity(oRootEntity)
        oLight = new QPointLight(oLightEntity)
    oLight.setColor(new QColor() { setRGB(255,255,255,255) })
    oLight.setIntensity(1)
    oLightEntity.addComponent(oLight)

    oLightTransform = new QTransform(oLightEntity)
    oLightTransform.setTranslation(oCameraEntity.position())
    oLightEntity.addComponent(oLightTransform)

    oCamController = new QFirstPersonCameraController(oRootEntity)
        oCamController.setCamera(oCameraEntity)

    oModel = new qmesh(oRootEntity)
    oModel.setsource(
        new qURL("file:///"+currentdir()+"assets/model/Robot.obj") )

    oModelTransform = new QTransform(oModel)
    oModelTransform.setScale(0.2)
    oModelTransform.setTranslation(new QVector3D(0, 10, 10))

    oModelMaterial = new QPhongMaterial(oModel)
    oModelMaterial.setDiffuse(new QColor() { setRGB(0,100,0,0) })

    oModelEntity = new QEntity(oRootEntity)
    oModelEntity.addComponent(oModel)

    oLoader = new QTextureLoader(oModel);
    oModelMaterial = new QTextureMaterial(oModel)
    oLoader.setSource(
        new QUrl("file:///"+currentdir()+"assets/texture/gold.jpg") )
    oModelMaterial.setTexture(oLoader)

    oModelEntity.addComponent(oModelMaterial)
}

```

(continues on next page)

(continued from previous page)

```

oModelEntity.addComponent(oModelTransform)

for n = 1 to 10

    oTorus = new QTorusMesh(oRootEntity)
        oTorus.setRadius(1.0*n)
        oTorus.setMinorRadius(0.4*n)
        oTorus.setRings(100)
        oTorus.setSlices(20)

    oTorusTransform = new QTransform(null)
    oTorusTransform.setScale(2)
    oTorusTransform.setTranslation(new QVector3D(5.0*n, 4.0*n, 0.0))

    oTorusMaterial = new QPhongMaterial(null);
    oTorusMaterial.setDiffuse(new QColor() {setRGB(200,100,100,100)})

    oTorusEntity = new QEntity(oRootEntity)
    oTorusEntity.addComponent(oTorus)

    oLoader = new QTextureLoader(oTorus);
    oTorusMaterial = new QTextureMaterial(oTorus)
    oLoader.setSource(
        new QUrl("file:///"+currentdir()+"assets/texture/gold.jpg") )
    oTorusMaterial.setTexture(oLoader)

    oTorusEntity.addComponent(oTorusMaterial)
    oTorusEntity.addComponent(oTorusTransform)
next

oView.setRootEntity(oRootEntity)

btn1 = new QPushButton(oWidget) {
    setText("Move the Camera and the Robot") setClickEvent("pMove()")
}

oLayout = new QVBoxLayout()
oLayout.addWidget(oContainer)
oLayout.addWidget(btn1)

oWidget {
    setWindowTitle("Using Qt3D - Camera")
    resize(800,600)
    setLayout(oLayout)
    showMaximized()
}

exec()
}

func pMove

    oCameraEntity.setPosition(new QVector3D(0, 0, 20.0))
        oCameraEntity.setUpVector(new QVector3D(0, 1, 0))
        oCameraEntity.setViewCenter(new QVector3D(20, 15, 20))

```

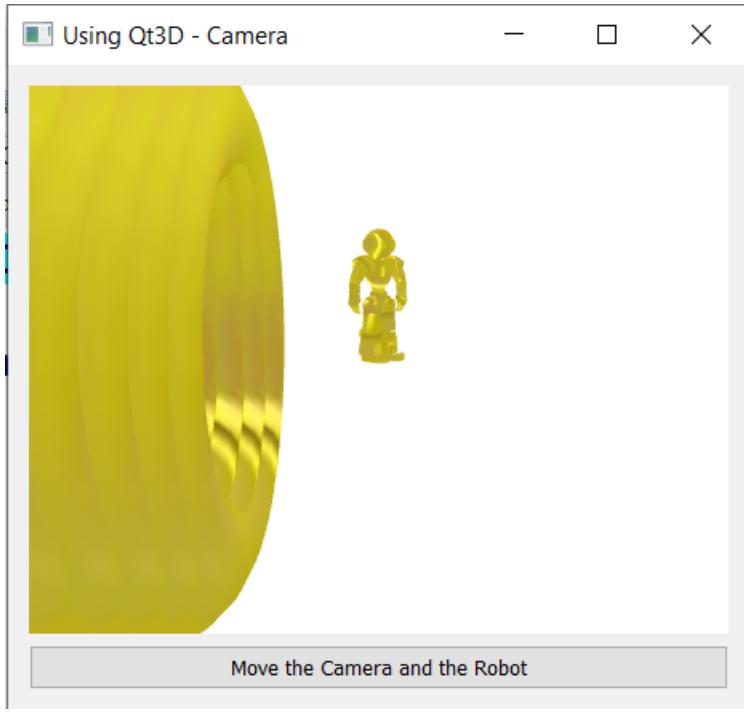
(continues on next page)

(continued from previous page)

```

oModelTransform.setTranslation(new QVector3D(20, 15, 20))
oQ = new QQuaternion(0,0,0,0)
oModelTransform.setRotation(oQ.fromAxisAndAngle(new QVector3D(1, 1, 0), 270))

```



47.18 Scence

```

load "guilib.ring"

new qApp {

    oWidget = new QWidget()

    oView = new Qt3DWindow()
    oView.defaultFrameGraph().setClearColor(new QColor() {setRGB(0,0,0,255)})

    oContainer = oWidget.createWindowContainer(oView,oWidget,0)

    oRootEntity = new QEntity(oContainer)

    oInput = new QInputAspect(oRootEntity)
        oView.registerAspect(oInput)

    oCameraEntity = oView.Camera()

    oCameraEntity.lens().setPerspectiveProjection(45.0, 16.0/9.0, 0.1, 1000)
    oCameraEntity.setPosition(new QVector3D(-13.34, -6.43, 16.47))
        oCameraEntity.setUpVector(new QVector3D(0.02, 0, 1))
        oCameraEntity.setViewCenter(new QVector3D(-13.34, 17.05, 15.42))
}

```

(continues on next page)

(continued from previous page)

```

oCameraController = new QFirstPersonCameraController(oRootEntity)
oCameraController.setCamera(oCameraEntity)
oCameraController.setEnabled(False)

oLongRoomEntity = new QEntity(oRootEntity)

oLongRoomModel = new QMesh(oLongRoomEntity)

oLongRoomModel.setSource(
    new qUrl("file:///"+CurrentDir()+"assets/model/Long_Room.obj") )

oLongRoomTransform = new QTransform(oLongRoomEntity)
oLongRoomTransform.setScale(1)
oLongRoomTransform.setTranslation(new QVector3D(5, 0, 15))

oLongRoomLoader = new QTextureLoader(oLongRoomModel)
oLongRoomMaterial = new QTextureMaterial(oLongRoomModel)
oLongRoomLoader.setSource(
    new QUrl("file:///"+currentdir()+"assets/texture/croc.jpg") )
oLongRoomMaterial.setTexture(oLongRoomLoader)

oLongRoomEntity.addComponent(oLongRoomModel)
oLongRoomEntity.addComponent(oLongRoomMaterial)
oLongRoomEntity.addComponent(oLongRoomTransform)

oTableEntity = new QEntity(oRootEntity)

oTableModel = new QMesh(oTableEntity)
oTableModel.setSource(
    new qUrl("file:///"+CurrentDir()+"assets/model/Reception_Table.obj") )
→

oTableTransform = new QTransform(oTableEntity)
oTableTransform.setScale(0.3)
oTableTransform.setTranslation(new QVector3D(5, 0, 15))
oQ = new QQuaternion(0,0,0,0)
oTableTransform.setRotation(oQ.fromAxisAndAngle(new QVector3D(0, 1, 1), -180))

oTableModelMaterial = new QPhongMaterial(oTableEntity)
oTableModelMaterial.setDiffuse(new QColor() {setRGB(255,255,255,255)})

oTableEntity.addComponent(oTableModel)
oTableEntity.addComponent(oTableModelmaterial)
oTableEntity.addComponent(oTableTransform)

oFirstLightEntity = new QEntity(oRootEntity)

oFirstLight = new QPointLight(oFirstLightEntity)
oFirstLight.setColor(new QColor() { setRGB(128,128,128,128) })
oFirstLight.setIntensity(1)

oFirstLightTransform = new QTransform(oFirstLightEntity)
oFirstLightTransform.setTranslation(new QVector3D(5, 0, 20))

oFirstLightEntity.addComponent(oFirstLight)
oFirstLightEntity.addComponent(oFirstLightTransform)

```

(continues on next page)

(continued from previous page)

```

aCats = list(5)
for n = 1 to 5
    v = n * 0.1
    aCats[n] = []
    aCats[n][:oCatModelEntity] = new QEntity(oRootEntity)
    aCats[n][:oCatModel] = new QMesh(aCats[n][:oCatModelEntity])
    aCats[n][:oCatModel].setSource(
        new qURL("file:///"+CurrentDir()+"assets/model/Lucky_Cat.obj") )
    aCats[n][:oCatModelMaterial] = new QPhongMaterial(aCats[n][:oCatModel])
    aCats[n][:oCatModelMaterial].setDiffuse(
        new QColor() {setRGB(255,255,255,255)})
    aCats[n][:oCatModelTransform] = new QTransform(aCats[n][:oCatModelEntity])
    aCats[n][:oCatModelTransform].setScale(0.01)
    aCats[n][:oCatModelTransform].setTranslation(
        new QVector3D(-5*(v+v), 1, 15.2))
    oQ = new QQuaternion(0,0,0,0)
    aCats[n][:oCatModelTransform].setRotation(
        oQ.fromAxisAndAngle(
            new QVector3D(0, 1, 1), 180))
    aCats[n][:oCatModelEntity].addComponent(aCats[n][:oCatModel])
    aCats[n][:oCatModelEntity].addComponent(aCats[n][:oCatModelmaterial])
    aCats[n][:oCatModelEntity].addComponent(aCats[n][:oCatModelTransform])
next

oSecondLightEntity = new QEntity(oRootEntity)

oSecondLight = new QPointLight(oSecondLightEntity)
oSecondLight.setColor(new QColor() { setRGB(255,255,255,255) })
oSecondLight.setIntensity(1)

oSecondLightTransform = new QTransform(oSecondLightEntity)
oSecondLightTransform.setTranslation(new QVector3D(-5, 1, 15.5))

oSecondLightEntity.addComponent(oSecondLight)
oSecondLightEntity.addComponent(oSecondLightTransform)

oRobotEntity = new QEntity(oRootEntity)

oRobotModel = new QMesh(oRobotEntity)
oRobotModel.setSource(
    new qURL("file:///"+CurrentDir()+"assets/model/Fat_Robot.obj") )
oRobotTransform = new QTransform(oRobotEntity)
oRobotTransform.setScale(0.006)

robotX = -15
robotY = -2
robotZ = 15

oRobotTransform.setTranslation(new QVector3D(-15, -2, 15))
oQ = new QQuaternion(0,0,0,0)
oRobotTransform.setRotation(
    oQ.fromAxisAndAngle(new QVector3D(0, 1, 1), 170))

oRobotMaterial = new QPhongMaterial(oRobotEntity)
oRobotMaterial.setDiffuse(new QColor() {setRGB(128,128,128,255)})

oRobotEntity.addComponent(oRobotModel)

```

(continues on next page)

(continued from previous page)

```

oRobotEntity.addComponent (oRobotTransform)
oRobotEntity.addComponent (oRobotMaterial)

oView.setRootEntity (oRootEntity)

oWidget {
    setWindowTitle ("Using Qt3D - Scene")
    showFullScreen ()
}

oContainer.resize (oWidget.width(), oWidget.height())

oFilter = new QAllEvents (oView)
oFilter.setKeyPressEvent ("pKeyPress ()")
oView.installEventFilter (oFilter)
oContainer.setFocus (0)

exec()

}

func pKeyPress

nKey = oFilter.getKeyCode()
nSpeed = 0.1
cX = oCameraEntity.position().x()
cY = oCameraEntity.position().y()
cZ = oCameraEntity.position().z()
cVCx = oCameraEntity.viewCenter().x()
cVCy = oCameraEntity.viewCenter().y()
cVCz = oCameraEntity.viewCenter().z()

switch nKey
    on Qt_Key_Right
        if cX < 4.8
            robotX+= nSpeed
            oCameraEntity.setPosition (
                new QVector3D (cX+0.1, cY, cZ))
            oCameraEntity.setViewCenter (
                new QVector3D (cVCx+nSpeed, cVCy, cVCz))
            oRobotTransform.setRotation (
                Q.fromAxisAndAngle (new QVector3D (0, 1, 1), ↵
←170))

        ok
        on Qt_Key_Left
            if cX > - 13.8
                robotX-= nSpeed
                oCameraEntity.setPosition (
                    new QVector3D (cX-0.1, cY, cZ))
                oCameraEntity.setViewCenter (
                    new QVector3D (cVCx-nSpeed, cVCy, cVCz))
                oRobotTransform.setRotation (
                    Q.fromAxisAndAngle (new QVector3D (0, 1, 1), 160))

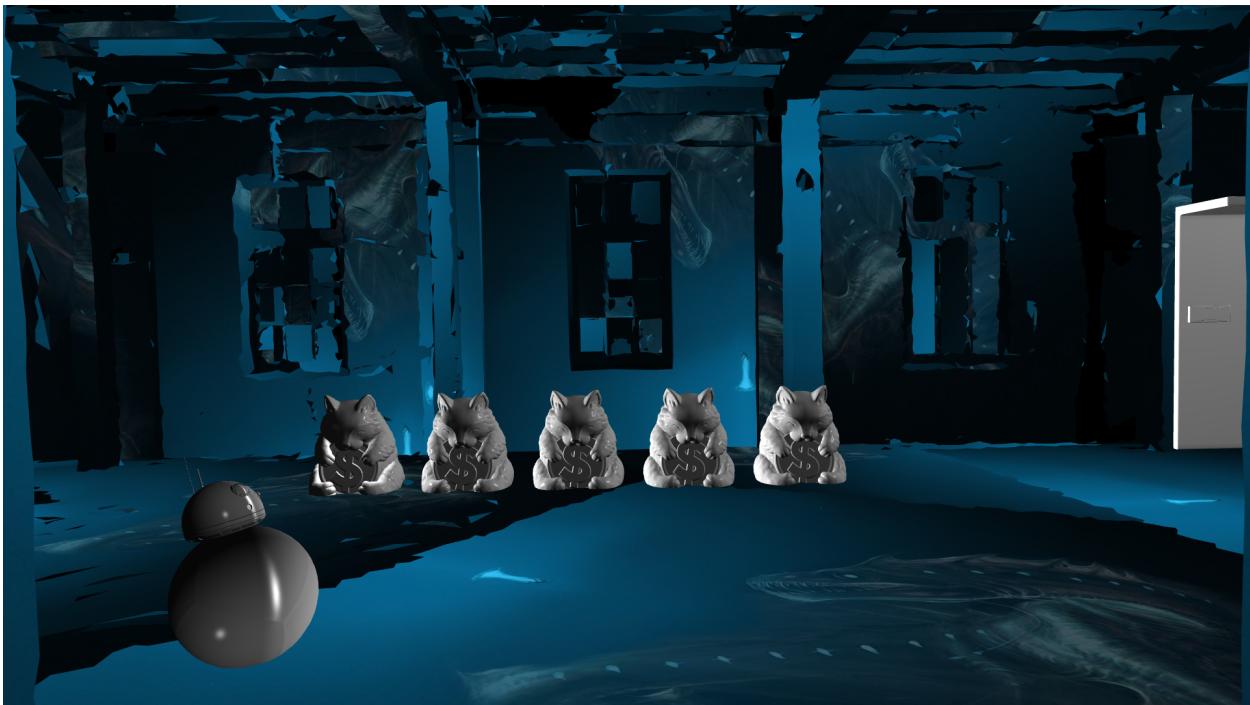
        ok
        on Qt_Key_Down
            if robotY > -3.5
                robotY-= nSpeed

```

(continues on next page)

(continued from previous page)

```
oCameraEntity.setPosition(  
    new QVector3D(cX, cY, cZ))  
oRobotTransform.setRotation(  
    Q.fromAxisAndAngle(new QVector3D(0, 1, 1), 190))  
ok  
on Qt_Key_Up  
    if robotY < 2  
        robotY+= nSpeed  
        oCameraEntity.setPosition(  
            new QVector3D(cX, cY, cZ))  
        oRobotTransform.setRotation(  
            Q.fromAxisAndAngle(new QVector3D(0, 1, 1), 180))  
ok  
on Qt_Key_Escape  
    oWidget.close()  
off  
  
oRobotTransform.setTranslation(new QVector3D(robotX, robotY, robotZ))
```



CHAPTER
FORTYEIGHT

OBJECTS LIBRARY FOR RINGQT APPLICATION

In this chapter we will learn about the objects library and using it in GUI applications.

Instead of using global variables for windows objects and connecting events to objects using the object name, the Objects Library will manage a list of the GUI objects and will provide a more natural API to quickly create one or many windows from the same class.

Also the Objects Library provide a way to quickly set methods to be executed when an event is fired. Also the library provide a natural interface to quickly use the parent or the caller windows from the child or sub windows and the other way around.

The Objects Library is designed to be used with the MVC Design Pattern.

The Objects Library uses reflection and meta-programming to add new methods to Controller classes to provide an easy way for communication between these classes.

The Objects Library is called automatically by the GUILib

Also we can call it alone by using the next command

```
load "objectslib.ring"
```

The ObjectsLib provide functions like openObject(), lastObject() and a class called ObjectsParent

The GUILib provide a new specific API for GUI applications like openWindow(), lastWindow(), etc.

48.1 Library Usage with GUI Applications

- Use the openWindow(cWindowControllerClassName) function to open new Windows
- Create at least Two Classes for each window, The Controller Class and the View Class
- Create each controller class from the WindowsControllerParent Class
- Create each view class from the WindowsViewParent Class
- Use the lastWindow() function to get the object of the last window created (The Controller object).
- When you call a sub window, use the SetParentObject() method and pass the self object.
- In the View Class, To determine the event method use the Method(cMethodName) function.
- The Method(cMethodName) function determine the method in the controller class that will be executed.
- Each controller class contains by default the CloseAction() method that you can call to close the window.
- You don't need to call the Show() Method for each window, When you use openWindow() It will be called.
- In the view class, Define the GUI window object as an attribute called win.

- You can use openWindowNoShow() to avoid displaying the window.
- You can use openWindowAndLink() to quickly get methods to access the windows.

48.2 Example

In the next example we will create two types of windows.

- Main Window contains a button. When the user click on the button a sub window will be opened.
- The User Can click on the button many times to open many sub windows.
- Each Sub Window contains Two buttons.
- The first button in the sub window change the Main and the Sub Windows Titles.
- The second button in the sub window close the Sub Window.

```
load "guilib.ring"

new qApp {
    openWindow( :MainWindowController )
    exec()
}

class MainWindowController from WindowsControllerParent
    oView = new MainWindowView
    func SubWindowAction
        openWindow( :SubWindowController )
        lastWindow().SetParentObject(self)

    class MainWindowView from WindowsViewParent
        win = new QWidget() {
            SetWindowTitle("Main Window")
            btnSub = new QPushButton(win) {
                setText("Sub Window")
                setClickEvent( Method( :SubWindowAction ) )
            }
            resize(400,400)
        }

    class SubWindowController from WindowsControllerParent
        oView = new SubWindowView
        func SetMainWindowTitleAction
            Parent().oView.win.SetWindowTitle("Message from the Sub Window")
            oView.win.SetWindowTitle("Click Event Done!")

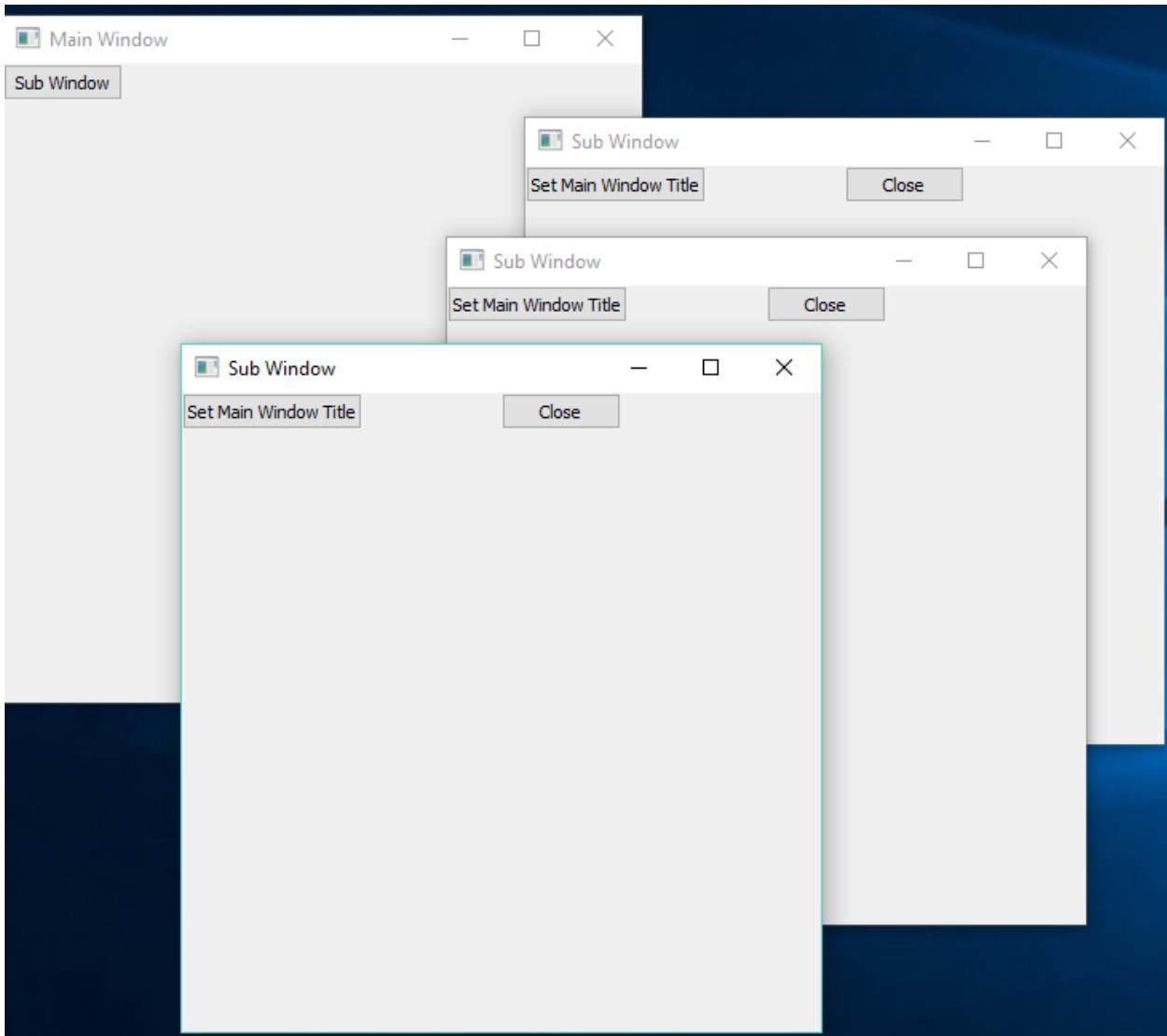
    class SubWindowView from WindowsViewParent
        win = new QWidget() {
            SetWindowTitle("Sub Window")
            btnMsg = new QPushButton(win) {
                setText("Set Main Window Title")
                setClickEvent( Method( :SetMainWindowTitleAction ) )
            }
            btnClose = new QPushButton(win) {
                Move(200,0)
                setText("Close")
                setClickEvent( Method( :CloseAction ) )
            }
        }
```

(continues on next page)

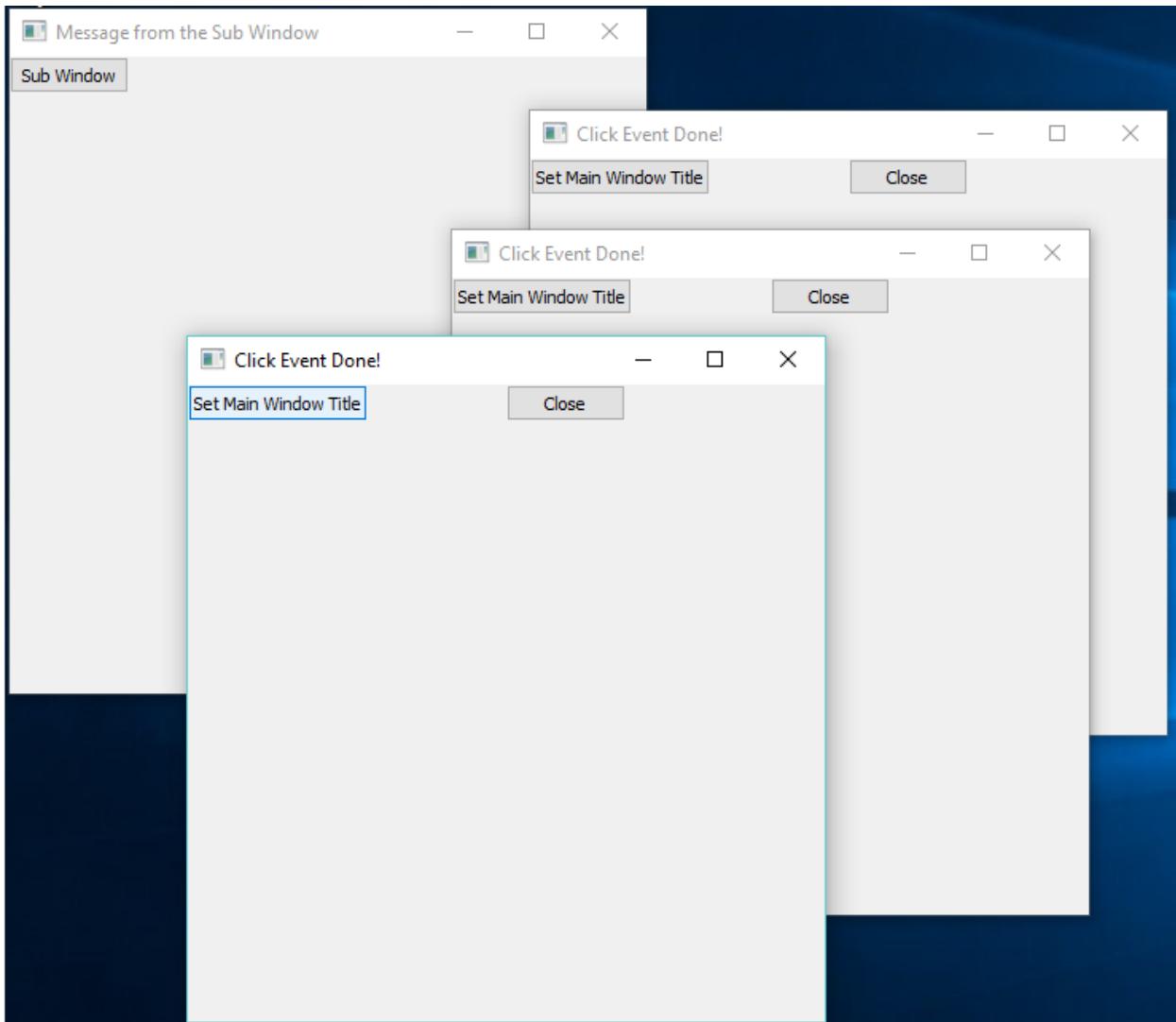
(continued from previous page)

```
        }
        resize(400,400)
    }
```

The next screen shot after creating three sub windows.



The next screen shot after clicking on the button in each sub window.



48.3 openWindowAndLink() Function

We can use the `openWindowAndLink()` function to connect between the application windows, pass messages (call methods) between the objects.

This function uses Meta-programming to define dynamic methods in the Caller Class to use the dynamic objects of other windows that we create.

Example : (Uses the Form Designer)

First Window

- (1) <https://github.com/ring-lang/ring/blob/master/samples/UsingFormDesigner/twowindowspart5/firstwindowView.ring>
- (2) <https://github.com/ring-lang/ring/blob/master/samples/UsingFormDesigner/twowindowspart5/firstwindowController.ring>

Second Window

- (1) <https://github.com/ring-lang/ring/blob/master/samples/UsingFormDesigner/twowindowpart5/secondwindowView.ring>
- (2) <https://github.com/ring-lang/ring/blob/master/samples/UsingFormDesigner/twowindowpart5/secondwindowController.ring>

In the next code for example (from FirstWindowController.ring)

The openWindowAndLink() will create an object from the SecondWindowController Class

Then will add the SecondWindow() and IsSecondWindow() Methods to the FirstWindowController Class

Also will add the FirstWindow() and IsFirstWindow() Methods to the SecondWindowController Class

So the SendMessage() method in FirstWindowController class can use the SecondWindow() method to access the object.

This is more simple than using lastWindow(), Parent() and SetParentObject() methods.

```
class firstwindowController from windowsControllerParent

    oView = new firstwindowView

    func OpenSecondWindow
        openWindowAndLink (:SecondWindowController, self)

    func SendMessage
        if IsSecondWindow()
            SecondWindow().setMessage ("Message from the first window")
        ok

    func setMessage cMessage
        oView.Label1.setText (cMessage)
```

48.4 openWindowInPackages() Function

The openWindowInPackages() function is the same as openWindow() but takes an extra list that determine the packages to import before opening the window.

Syntax:

```
openWindowInPackages (cClassName, aPackagesList)
```

Example:

The next example from the Form Designer source code, Open the Window Flags window using the openWindowInPackages() function.

We determine the class name “WindowFlagsController” and the packages name.

The Window Flags window uses the FormDesigner and System.GUI packages.

```
openWindowInPackages (:WindowFlagsController,
    "formdesigner",
    "System.GUI"
])
```

48.5 Objects Library Source Code

The library source code is very simple, You can check the source code files

The source code for the Objects Library (can be used without GUIlib)

- <https://github.com/ring-lang/ring/blob/master/libraries/objectslib/objects.ring>
- <https://github.com/ring-lang/ring/blob/master/libraries/objectslib/objectslib.ring>

The source code for the MVC classes in GUIlib

- <https://github.com/ring-lang/ring/blob/master/libraries/guilib/mvc/controllerparent.ring>
- <https://github.com/ring-lang/ring/blob/master/libraries/guilib/mvc/viewparent.ring>

MULTI-LANGUAGE APPLICATIONS

There are many ways to create multi-language Ring application!

In this chapter we will learn about using the String2Constant tool

49.1 Using String2Constant

Starting from Ring 1.8 we have the String2Constant application

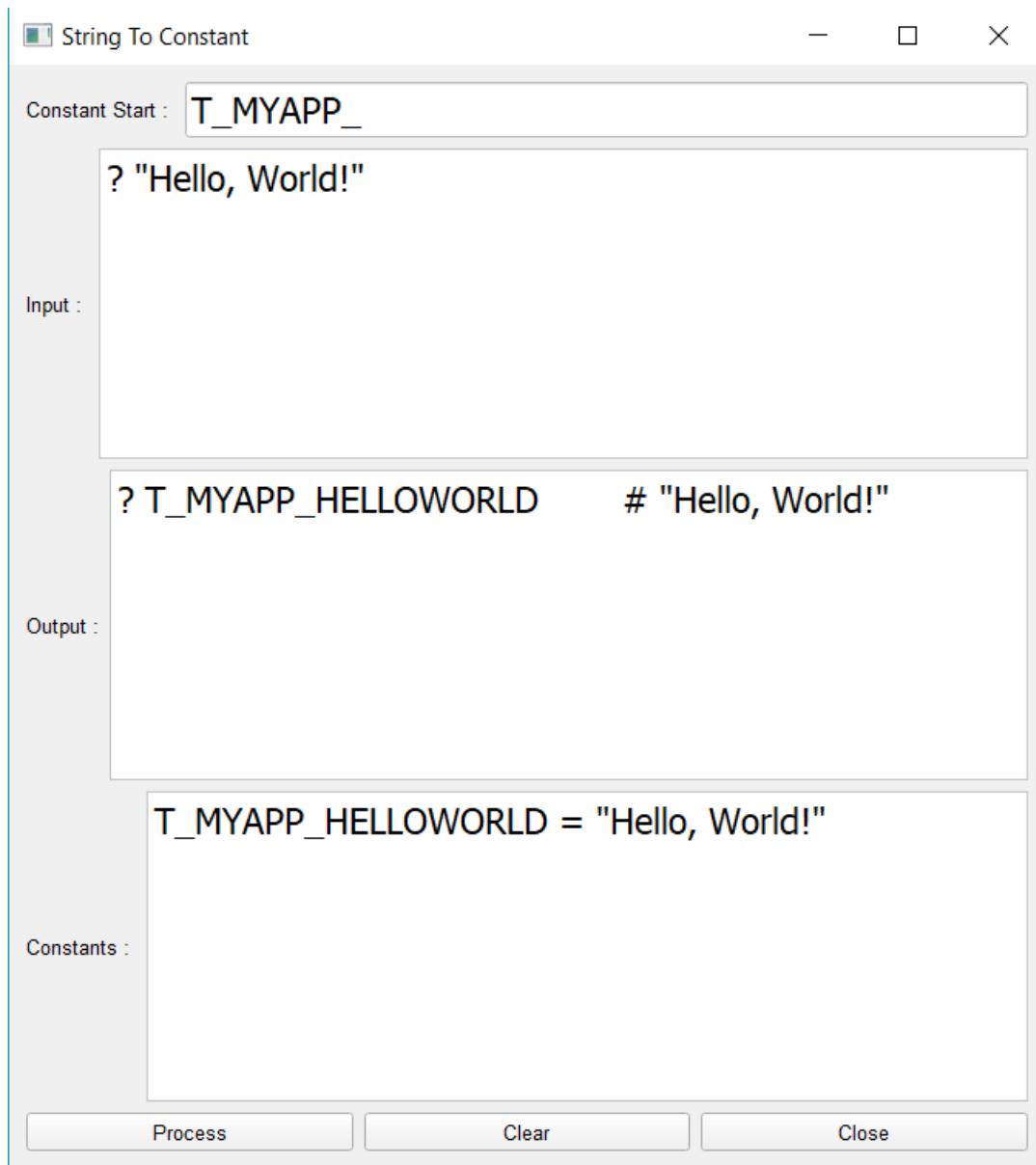
You will find this tool in the ring/tools/string2constant folder

Using this tool we can convert the source code to be based on constants instead of string literals

Then we can store constants in separate source code files that we can translate to different languages

Where we can have special file for each language, like (English.ring, Arabic.ring and so on)

Using this simple tool, the Form Designer is translated to Arabic language too just as an example.



49.2 Form Designer Translation

You will find the form designer application in the ring/applications/formdesigner folder

The files used for translation are stored in the ring/applications/formdesinger/translation folder

You will find two files

- Arabic.ring
- English.ring

You can check these files to get an idea about constants definition.

The next section from the English.ring file

```

T_LANGUAGE = "english"
T_LAYOUTDIRECTION = 0                      # Left to Right

T_FORMDESIGNER_FORMDESIGNER                = "Form Designer"
T_FORMDESIGNER_FORMTITLE                  = "Form1"

T_FORMDESIGNER_FILE                       = "File"
T_FORMDESIGNER_NEW                        = "New"
T_FORMDESIGNER_OPEN                       = "Open"
T_FORMDESIGNER_SAVE                       = "Save"
T_FORMDESIGNER_SAVEAS                    = "Save As"
T_FORMDESIGNER_CLOSE                     = "Close"

```

The form designer source code files will use these constants instead of typing the string literals
the next section from the formdesigner/mainwindow/formdesignerview.ring

```

# Create the Main Window and use the Mdi Area
win = new qMainwindow() {
    setWindowTitle(T_FORMDESIGNER_FORMDESIGNER) # "Form Designer"
    setcentralWidget(this.oArea)
    setLayoutDirection(T_LAYOUTDIRECTION)
}

```

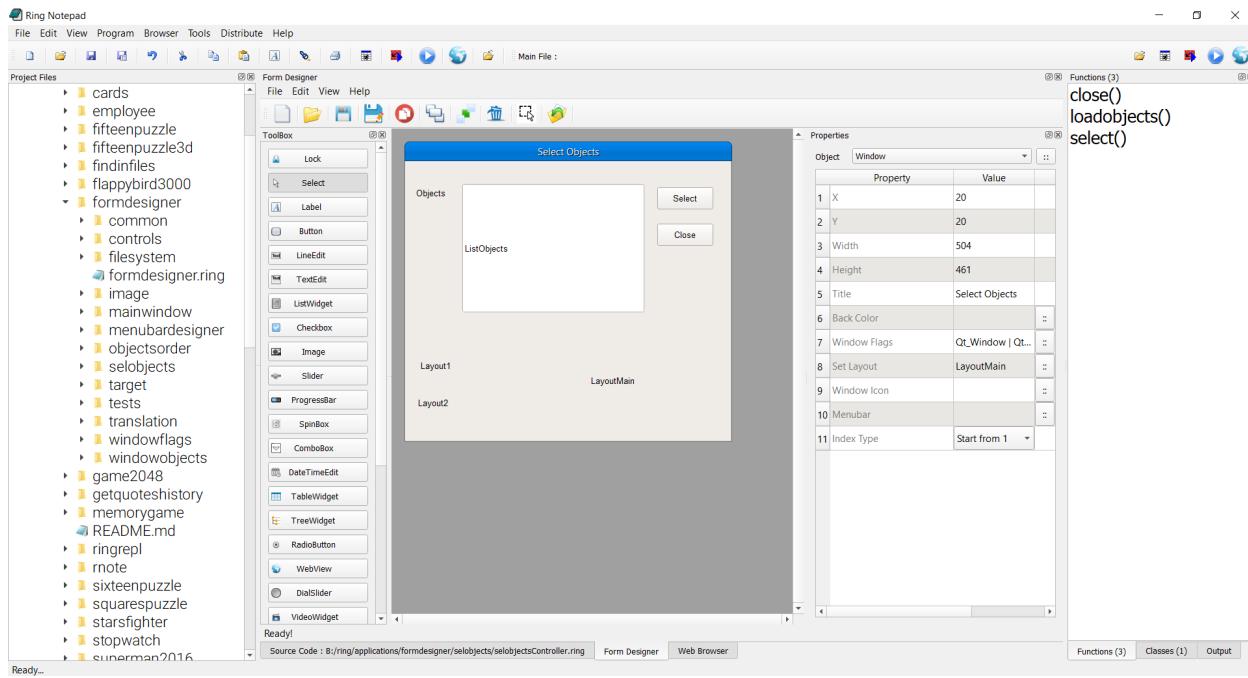
- Using comments we can write the string literal to get more readable code.
- Using setLayoutDirection() method we can set the window direction to be Right To Left.
- Using the Load command, We can determine which translation file to use.

49.3 Forms Translation

After creating the form using the Form Designer, the View class will be generated.

We don't modify the view class, We just add the translation through the Controller class.

For example, we have the form file : ring/formdesigner/selobjects/selobjects.rform



And we add the translation through the Controller class using the next code

And we define the constants in English.ring and Arabic.ring

```
class selobjectsController from windowsControllerParent

    oView = new selobjectsView {
        ListObjects.setSelectionMode(QAbstractItemView_MultiSelection)
        win.setWindowModality(2)
        # Translation
        win.setWindowTitle(T_FORMDESIGNER_SELOBJECTS_TITLE)
        win.setLayoutDirection(T_LAYOUTDIRECTION)
        labelObjects.setText(T_FORMDESIGNER_SELOBJECTS_OBJECTS)
        btnSelect.setText(T_FORMDESIGNER_SELOBJECTS_SELECT)
        btnClose.setText(T_FORMDESIGNER_SELOBJECTS_CLOSE)
    }
```

BUILDING RINGQT APPLICATIONS FOR MOBILE

In this chapter we will learn about Building RingQt Applications for Mobile.

50.1 Download Requirements

Check the next link : <http://doc.qt.io/qt-5/androidgs.html>

Download

- The Android SDK Tools

<https://developer.android.com/sdk/index.html>

- The Android NDK (Tested using android-ndk-r21)

<http://developer.android.com/tools/sdk/ndk/index.html>

- Java SE Development Kit (JDK) v6 or later

<https://www.oracle.com/technetwork/java/javase/downloads/jdk8-downloads-2133151.html>

50.2 Update the Android SDK

Update the Android SDK to get the API and tools packages required for development

Tested using Android 4.4.2 (API 19)

- In Windows - Define the next Environment Variables based on your system.

(1) JAVA_HOME

For Example : C:\Program Files (x86)\Java\jdk1.8.0_05

(2) ANDROID_HOME

For Example : C:\JavaAndroid\AndroidSDK

50.3 Install Qt for Android

- You can install Qt for Android from the next link
<https://download.qt.io/archive/qt/5.12/5.12.6/>
- Run Qt Creator, Select Tools > Options > Android to add the Android NDK and SDK paths.
<http://doc.qt.io/qtcreator/creator-developing-android.html>

50.4 Using Ring2EXE

We can use Ring2EXE to quickly prepare Qt project for our application

Example:

```
ring2exe myapp.ring -dist -mobileqt
```

Note: We can use the Distribute Menu in Ring Notepad

Tip: The option (Prepare Qt project for Mobile devices) in the Distribute Menu

50.5 The Qt project for your Ring application

After using Ring2EXE or the Distribute Menu in Ring Notepad

- Using the Qt Creator Open the generated Qt project
 - Folder : target/mobile/qtproject
 - Project file : project.pro
- Using Qt Creator, You will find the compiled Ring application in the resources (YourAppName.ringo)
 - This file (Ring Object File) is generated by the Ring compiler using

```
ring YourAppName.ring -go -norun
```

- You can build your application using Qt Creator
 - (1) You can add your application images to the resources
 - Or You can use any text editor (Notepad) and modify : project.qrc
 - (2) To find images from your Ring application, You need to use the file name in resources

Example

```
if isandroid()
    mypic = new QPixmap(":/cards.jpg")
else
    mypic = new QPixmap("cards.jpg")
ok
```

50.6 Comments about developing for Android using RingQt

- (1) The main project file is main.cpp

This file load Ring Compiler/Virtual Machine and RingQt

Then get the Ring Object File during the runtime from the resources

Then run the Ring Object File (ringapp.ringo) using the Ring VM

Through main.cpp you can extract more files from the resources to temp. folder once you add them (create projects with many files).

- (2) The next functions are missing from this Ring edition

- Database (ODBC, SQLite & MySQL)
- Security and Internet functions (LibCurl & OpenSSL)
- RingAllegro (Allegro Library)
- RingLibSDL (LibSDL Library)

Just use Qt Classes through RingQt.

For database access use the QSqlDatabase Class

Note: All of the missing libraries ((LibCurl, OpenSSL & Allegro) can be compiled for Android, but they are not included in this Qt project.

- (3) use if isandroid() when you want to modify the code just for android

Example:

```
if isandroid()
    // Android code
else
    // other platforms
ok
```

- (4) Sometimes you will find that the button text/image is repeated in drawing ! it's Qt problem that you can avoid using the next code.

```
if isandroid()
    setStyleSheet (""
        border-style: outset;
        border-width: 2px;
        border-radius: 4px;
        border-color: black;
        padding: 6px; ")
ok
```

- (5) Always use Layouts instead of manual setting of controls position and size.

This is the best way to get the expected user interface to avoid problems like (controls with small/extral size)

- (6) When you deal with Qt Classes you can determine the images from resources (you don't need to copy them using main.cpp)

Example:

```
if isandroid()
    mypic = new QPixmap(":/cards.jpg")
else
    mypic = new QPixmap("cards.jpg")
ok
```

Now RingQt comes with the AppFile() function to determine the file name

Example:

```
mypic = new QPixmap(AppFile("cards.jpg")) # Desktop or Android
```

(7) When you update your project code, You don't have to use Ring2EXE to generate the Qt project again

Just use the Distribute Menu in Ring Notepad and select (Generate Ring Object File)

Then copy the YourAppName.ringo file to target/mobile/qtproject folder and accept replacing files.

(8) If your application folder contains a Qt resource file (project.qrc)

Then when you use Ring2EXE or Ring Notepad (Distribute - Prepare Qt project for Mobile devices) the resource file will be used

See ring/applications/cards game as an example.

BUILDING RINGQT APPLICATIONS FOR WEBASSEMBLY

In this chapter we will learn about Building RingQt Applications for WebAssembly.

51.1 Download Requirements

Check the next link : <https://doc.qt.io/qt-5/wasm.html>

Tested using

- Qt (5.15.0) : <https://www.qt.io/blog/qt-5.15-released>
- Emscripten (1.39.7) : https://emscripten.org/docs/getting_started/index.html

```
emsdk install sdk-fastcomp-1.39.7-64bit
emsdk activate sdk-fastcomp-1.39.7-64bit
```

Check Emscripten installation

```
em++ --version
```

Output

```
emcc (Emscripten gcc/clang-like replacement) 1.39.7
(commit 24d88487f47629fac9d4acd231497a3a412bdee8)
Copyright (C) 2014 the Emscripten authors (see AUTHORS.txt)
This is free and open source software under the MIT license.
There is NO warranty; not even for MERCHANTABILITY or FITNESS FOR A
PARTICULAR PURPOSE.
```

51.2 Using Ring2EXE

We can use Ring2EXE to quickly prepare Qt project for our application

Example:

```
ring2exe myapp.ring -dist -webassemblyqt
```

Note: We can use the Distribute Menu in Ring Notepad

Tip: The option (Prepare Qt project for WebAssembly) in the Distribute Menu

51.3 The Qt project for your Ring application

After using Ring2EXE or the Distribute Menu in Ring Notepad

- Using the Qt Creator Open the generated Qt project
Folder : target/webassembly/qtproject
Project file : project.pro
- Using Qt Creator, You will find the compiled Ring application in the resources (YourAppName.ringo)
This file (Ring Object File) is generated by the Ring compiler using

```
ring YourAppName.ringo -go -norun
```

- You can build your application using Qt Creator
- (1) You can add your application images to the resources
Or You can use any text editor (Notepad) and modify : project.qrc
 - (2) To find images from your Ring application, You need to use the file name in resources
Example

```
if isWebAssembly()
    mypic = new QPixmap(":/cards.jpg")
else
    mypic = new QPixmap("cards.jpg")
ok
```

51.4 Comments about developing for WebAssembly using RingQt

- (1) The main project file is main.cpp

This file load Ring Compiler/Virtual Machine and RingQt

Then get the Ring Object File during the runtime from the resources

Then run the Ring Object File (ringapp.ringo) using the Ring VM

Through main.cpp you can extract more files from the resources to temp. folder once you add them (create projects with many files).

- (2) use if isWebAssembly() when you want to modify the code just for WebAssembly

Example:

```
if isWebAssembly()
    // WebAssembly code
else
    // other platforms
ok
```

- (3) When you deal with Qt Classes you can determine the images from resources (you don't need to copy them using main.cpp)

Example:

```
if isWebAssembly()
    mypic = new QPixmap(":/cards.jpg")
else
    mypic = new QPixmap("cards.jpg")
ok
```

Now RingQt comes with the AppFile() function to determine the file name

Example:

```
mypic = new QPixmap(AppFile("cards.jpg")) # Desktop, Android or WebAssembly
```

- (4) When you update your project code, You don't have to use Ring2EXE to generate the Qt project again

Just use the Distribute Menu in Ring Notepad and select (Generate Ring Object File)

Then copy the YourAppName.ringo file to target/webassembly/qtproject folder and accept replacing files.

- (5) If your application folder contains a Qt resource file (project.qrc)

Then when you use Ring2EXE or Ring Notepad (Distribute - Prepare Qt project for WebAssembly) the resource file will be used

See ring/applications/cards game as an example.

- (6) Use stdlibcore.ring instead of stdlib.ring when using StdLib functions
- (7) Use ClocksPerSecond() function instead of typing the value (1000)
- (8) Nested events loops are not supported, use events for dialogs instead of calling the exec() method
- (9) Using Sleep() or ProcessEvents() doesn't provide the expected results, use Qt Timers.
- (10) We don't have a direct access to the File System because the applications are executed in a secure environment

Tip: We can use special functions for Uploading/Downloading files (See FileContent sample)

51.5 Dialogs

See the folder: ring/samples/UsingQtWASM

Folders:

- ColorDialog
- FontDialog
- FileDialog
- FileContent

51.6 Online Applications

- Hello World : <https://ring-lang.github.io/web/helloworld/project.html>
- Matching Game : <https://ring-lang.github.io/web/matching/project.html>
- Pairs Game : <https://ring-lang.github.io/web/pairs/project.html>
- Othello Game : <https://ring-lang.github.io/web/othello/project.html>
- Game of Life : <https://ring-lang.github.io/web/gameoflife/project.html>
- Form Designer : <https://ring-lang.github.io/web/formdesigner/project.html>



CHAPTER
FIFTYTWO

WEB DEVELOPMENT (CGI LIBRARY)

In this chapter we will learn about developing Web applications using a CGI Library written in the Ring language.

52.1 Configure the Apache web server

We can use Ring with any web server that support CGI. In this section we will learn about using Ring with the Apache HTTP Server.

You can download Apache from : <http://httpd.apache.org/>

Or you can get it included with other projects like

XAMPP : <https://www.apachefriends.org/download.html>

Install then open the file:

```
xampp\apache\conf\httpd.conf
```

search for

```
<Directory />
```

Then after it add

```
Options FollowSymLinks +ExecCGI
```

So we have

```
<Directory />
Options FollowSymLinks +ExecCGI
```

Search for the next line and be sure that it's not commented

```
LoadModule cgi_module modules/mod_cgi.so
```

Search for : AddHandler cgi-script

Then add “.ring” to the supported cgi extensions

Example

```
AddHandler cgi-script .cgi .ring
```

Example

```
AddHandler cgi-script .cgi .pl .asp .ring
```

Run/Start the server

Create your web applications in a directory supported by the web server.

Example:

```
Apache2.2\htdocs\mywebapplicationfolder
```

Example:

```
xampp\htdocs\mywebapplicationfolder
```

Inside the source code file (*.ring), Add this line

```
#!ring -cgi
```

Note: Change the previous line based on the path to ring.exe in your machine

52.2 Ring CGI Hello World Program

The next program is the Hello World program

```
#!ring -cgi

See "content-type: text/html" +nl+nl+
      "Hello World!" + nl
```

52.3 Hello World Program using the Web Library

We can use the web library to write CGI Web applications quickly

Example (1) :

```
#!ring -cgi

Load "weblib.ring"

Import System.Web

New Page
{
    Text("Hello World!")
}
```

Example (2) :

```
#!ring -cgi

Load "weblib.ring"
```

(continues on next page)

(continued from previous page)

```
Import System.Web

WebPage()
{
    Text("Hello World!")
}
```

Tip: the difference between ex. 1 and ex. 2 is using WebPage() function to return the page object instead of creating the object using new statement.

52.4 Web Library Features

The next features are provided by the Web library to quickly create web applications.

- Generate HTML pages using functions
- Generate HTML pages using objects
- HTTP Get
- HTTP Post
- Files Upload
- URL Encode
- Templates
- CRUD MVC Sample
- Users Logic & Registration Sample

52.5 HTTP Get Example

The Page User Interface

```
#!ring -cgi
Load "weblib.ring"
Import System.Web
New Page
{
    Title = "Test HTTP Get"
    divstart([ :style = StyleSizeFull() ] )
    boxstart()
        text( "Test HTTP GET" )
        newline()
    boxend()
    divstart([ :style = Styledivcenter("600px", "550px") +
              StyleGradient(21) ])
    divstart([:style = stylefloatleft() + stylesize("100px", "100%") +
              stylecolor("black") + stylegradient(58)])
    formstart("ex5.ring")
```

(continues on next page)

(continued from previous page)

```

tablestart([ :style = stylesize("65%", "90%") +
            stylemarginleft("35%") +
            stylemargintop("30%") ])
    rowstart([])
        cellstart([])
            text ("Name : ")
        cellend()
        cellstart([])
            cTextboxStyle = StyleMarginLeft("5%") +
                            StyleWidth("250px") +
                            StyleColor("black") +
                            StyleBackColor("white")
            textbox([ :name = "Name", :style = cTextboxStyle ] )
        cellend()
    rowend()
    rowstart([])
        cellstart([])
            text ("Address : ")
        cellend()
        cellstart([])
            textbox([ :name = "Address", :style = cTextboxStyle] )
        cellend()
    rowend()
    rowstart([])
        cellstart([])
            text ("Phone : ")
        cellend()
        cellstart([])
            textbox([ :name = "Phone", :style = cTextboxStyle ] )
        cellend()
    rowend()
    rowstart([])
        cellstart([])
            text ("Age : ")
        cellend()
        cellstart([])
            textbox([ :name = "Age", :style = cTextboxStyle ] )
        cellend()
    rowend()
    rowstart([])
        cellstart([])
            text ("City: ")
        cellend()
        cellstart([])
            listbox([ :name = "City", :items = ["Cairo", "Riyadh", "Jeddah"],
                      :style = stylemarginleft("5%") + stylewidth("400px") ] )
        cellend()
    rowend()
    rowstart([])
        cellstart([])
            text ("Country : ")
        cellend()
        cellstart([])
            combobox([ :name = "Country",
                      :items = ["Egypt", "Saudi Arabia", "USA"],
                      :style = stylemarginleft("5%") +
                                stylewidth("400px") + ]
        cellend()
    rowend()

```

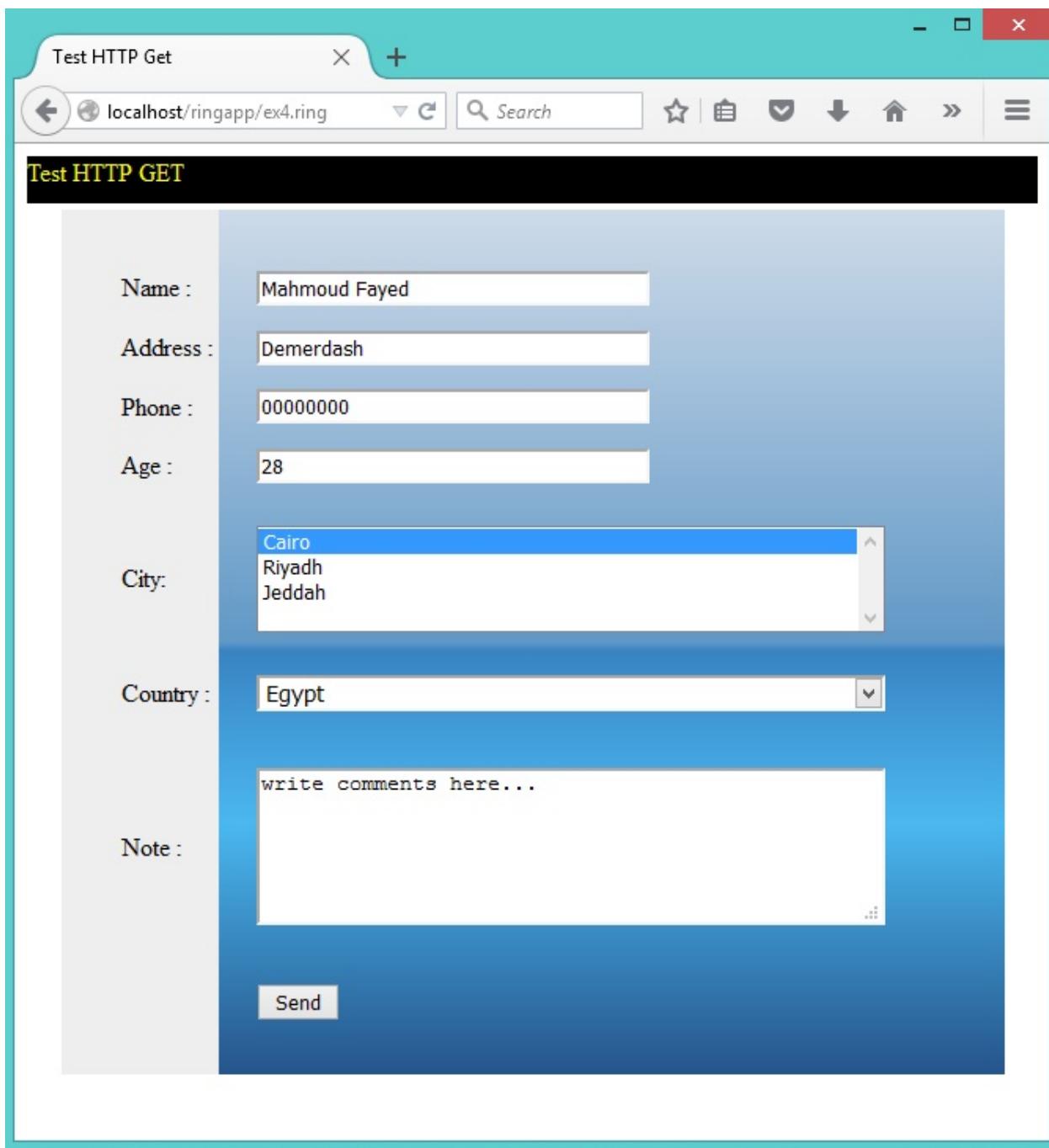
(continues on next page)

(continued from previous page)

```
        stylecolor("black")+
        stylebackcolor("white")+
        stylefontsize("14px") ] )

    cellend()
rowend()
rowstart([])
    cellstart([])
        text ( "Note : " )
    cellend()
    cellstart([])
        editbox([ :name = "Notes",
                  :style = stylemarginleft("5%") +
                            stylesize("400px","100px") +
                            stylecolor("black") +
                            stylebackcolor("white") ,
                  :value = "write comments here..." ] )
    cellend()
rowend()
rowstart([])
    cellstart([])
    cellend()
    cellstart([])
        submit([ :value = "Send" , :Style = stylemarginleft("5%") ])
    cellend()
rowend()
tableend()
formend()
divend()
divend()
divend()
}
```

Screen Shot:



The Response

```
#!/ring -cgi
Load "weplib.ring"
Import System.Web
New Page
{
    divstart([ :style = styledivcenter("800px", "500px") ])
    boxstart()
        text ( "HTTP GET Response" )  newline()
    boxend()
```

(continues on next page)

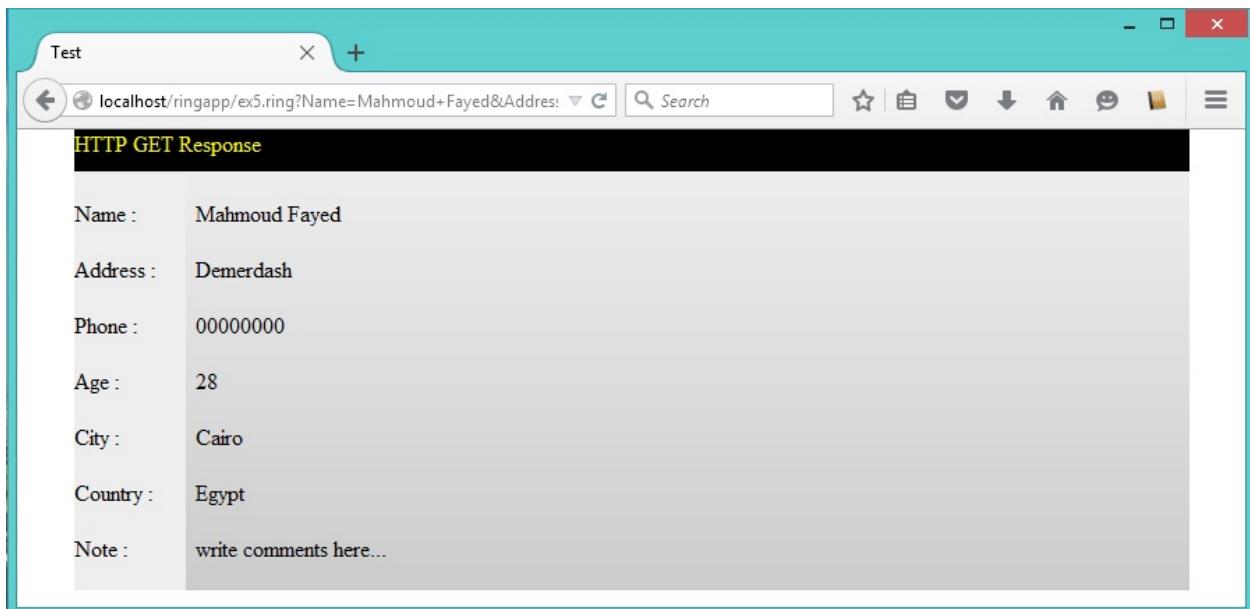
(continued from previous page)

```

divstart([ :style = stylefloatleft() + stylewidth("10%") +
           stylecolor("black") + stylegradient(58) ])
    newline()
    text ( "Name : " )
    newline() newline()
    text ( "Address : " )
    newline() newline()
    text ( "Phone : " )
    newline() newline()
    text ( "Age : " )
    newline() newline()
    text ( "City : " )
    newline() newline()
    text ( "Country : " )
    newline() newline()
    text ( "Note : " )
    newline() newline()
divend()
divstart([ :style = stylefloatleft() + stylewidth("90%") +
           stylecolor("black") + stylegradient(47) ])
    divstart([ :style = stylefloatleft() + stylewidth("1%") ])
        newline()
    divend()
    divstart([ :style = stylefloatleft() + stylewidth("95%") ])
        newline()
        text ( aPageVars["Name"] )
        newline() newline()
        text ( aPageVars["Address"] )
        newline() newline()
        text ( aPageVars["Phone"] )
        newline() newline()
        text ( aPageVars["Age"] )
        newline() newline()
        text ( aPageVars["City"] )
        newline() newline()
        text ( aPageVars["Country"] )
        newline() newline()
        text ( aPageVars["Notes"] )
        newline() newline()
    divend()
divend()
divend()
}

```

Screen Shot:

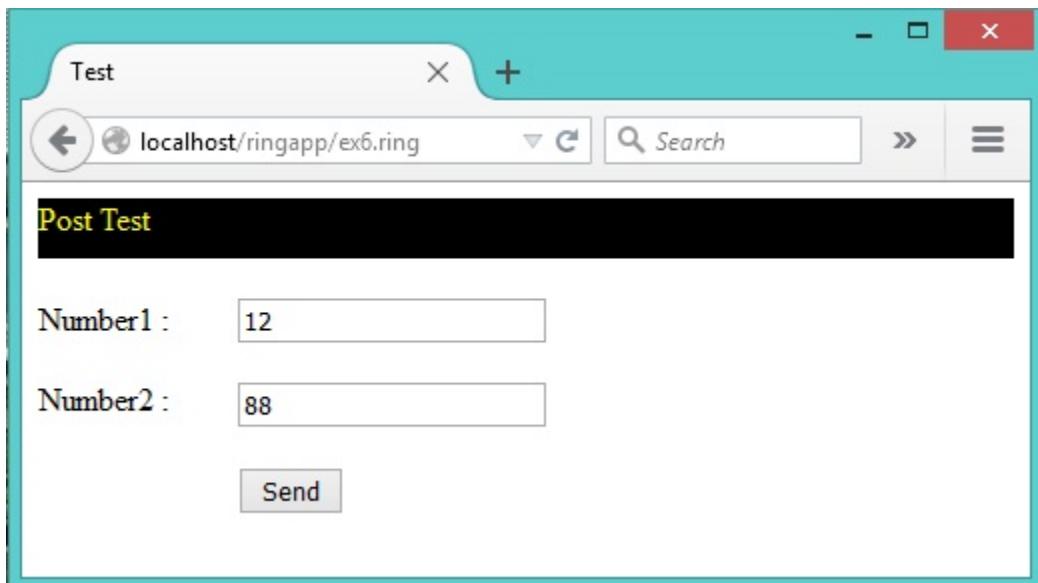


52.6 HTTP POST Example

The Page User Interface

```
#!/usr/bin/ring
Load "weblib.ring"
Import System.Web
New Page
{
    boxstart()
        text( "Post Test")
        newline()
    boxend()
    divstart([ :style=StyleFloatLeft()+StyleWidth("100px") ])
        newline()
        text( "Number1 : " )    newline() newline()
        text( "Number2 : " )    newline() newline()
    divend()
    formpost("ex7.ring")
        divstart([ :style = styleFloatLeft()+StyleWidth("200px") ])
            newline()
            textbox([ :name = "Number1" ])  newline() newline()
            textbox([ :name = "Number2" ])  newline() newline()
            submit([ :value = "Send" ] )
        divend()
    formend()
}
```

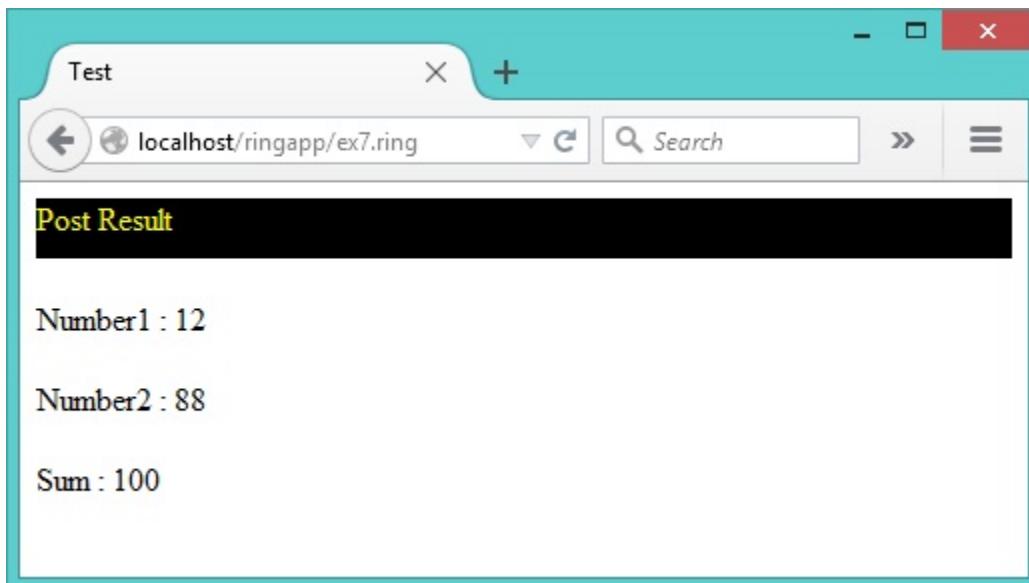
Screen Shot:



The Response

```
#!ring -cgi
Load "weblib.ring"
Import System.Web
New Page
{
    boxstart()
        text( "Post Result" )
        newline()
    boxend()
    divstart([ :style = styleFloatLeft()+styleWidth("200px") ])
        newline()
        text( "Number1 : " + aPageVars["Number1"] )
        newline() newline()
        text( "Number2 : " + aPageVars["Number2"] )
        newline() newline()
        text( "Sum : " + (0 + aPageVars["Number1"] + aPageVars["Number2"] ) )
        newline()
    divend()
}
```

Screen Shot:

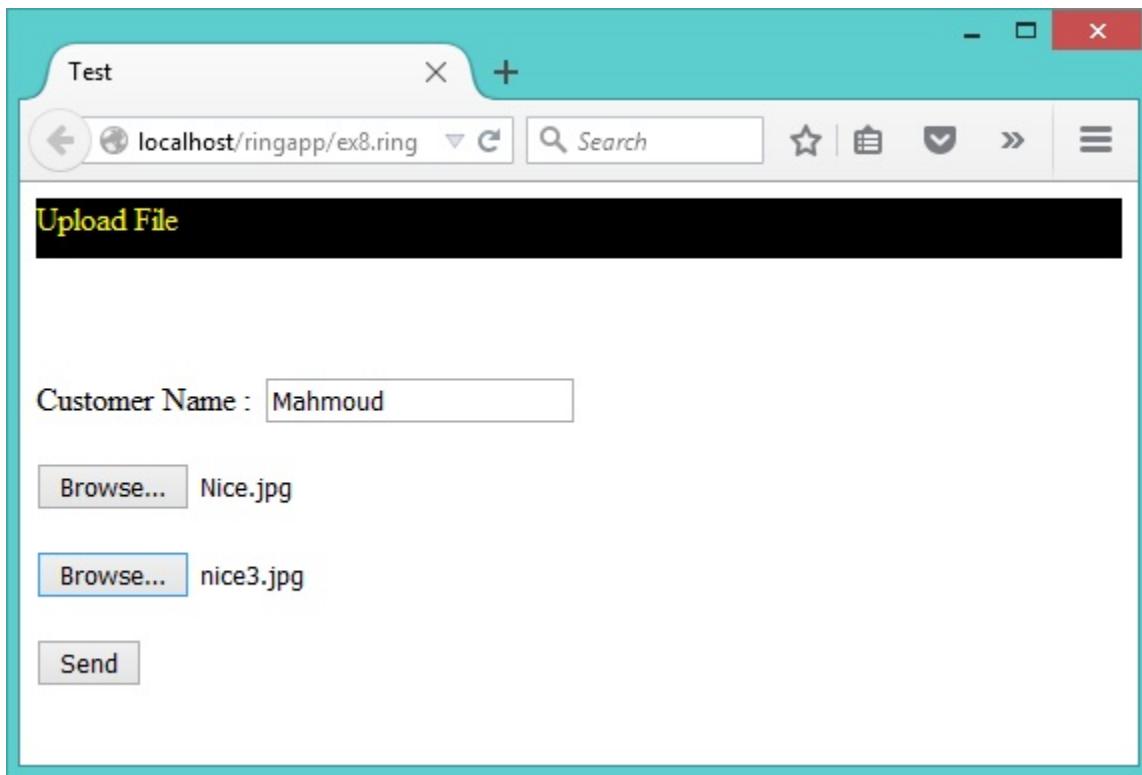


52.7 Upload Files

The Page User Interface

```
#!ring -cgi
Load "weplib.ring"
Import System.Web
New page
{
    boxstart()
        text( "Upload File" )
        newline()
    boxend()
    for x = 1 to 3 newline() next
    formupload("ex9.ring")
        text( "Customer Name : " )
        textbox([ :name = "custname" ])
        newline() newline()
        divstart([ :style = styleFloatLeft() + styleWidth("90px") ])
            uploadfile("file") newline() newline()
            uploadfile("file2") newline() newline()
            submit([ :value = "Send" ])
        divend()
    formend()
}
```

Screen Shot:



The Response

```

#!/ring -cgi
Load "weblib.ring"
Import System.Web

cUploadPath = "C:/Apache2.2/htdocs/ringapp/upload/"
cUploadFolder = "/ringapp/upload/"

New page
{
    boxstart()
        text( "Upload Result" )
        newline()
    boxend()
    newline()
    divstart([ :style= styleFloatLeft() + styleWidth("100px") ])
        text( "Name : " + aPageVars["custname"] )
        newline()
    divend()
    if aPageVars["file"] != char(13)
        getuploadedfile(self,"file")
    ok
    if aPageVars["file2"] != char(13)
        getuploadedfile(self,"file2")
    ok
}

Func getuploadedfile oObj,cFile
    # here we use object.property
    # instead of object { } to avoid executing braceend method

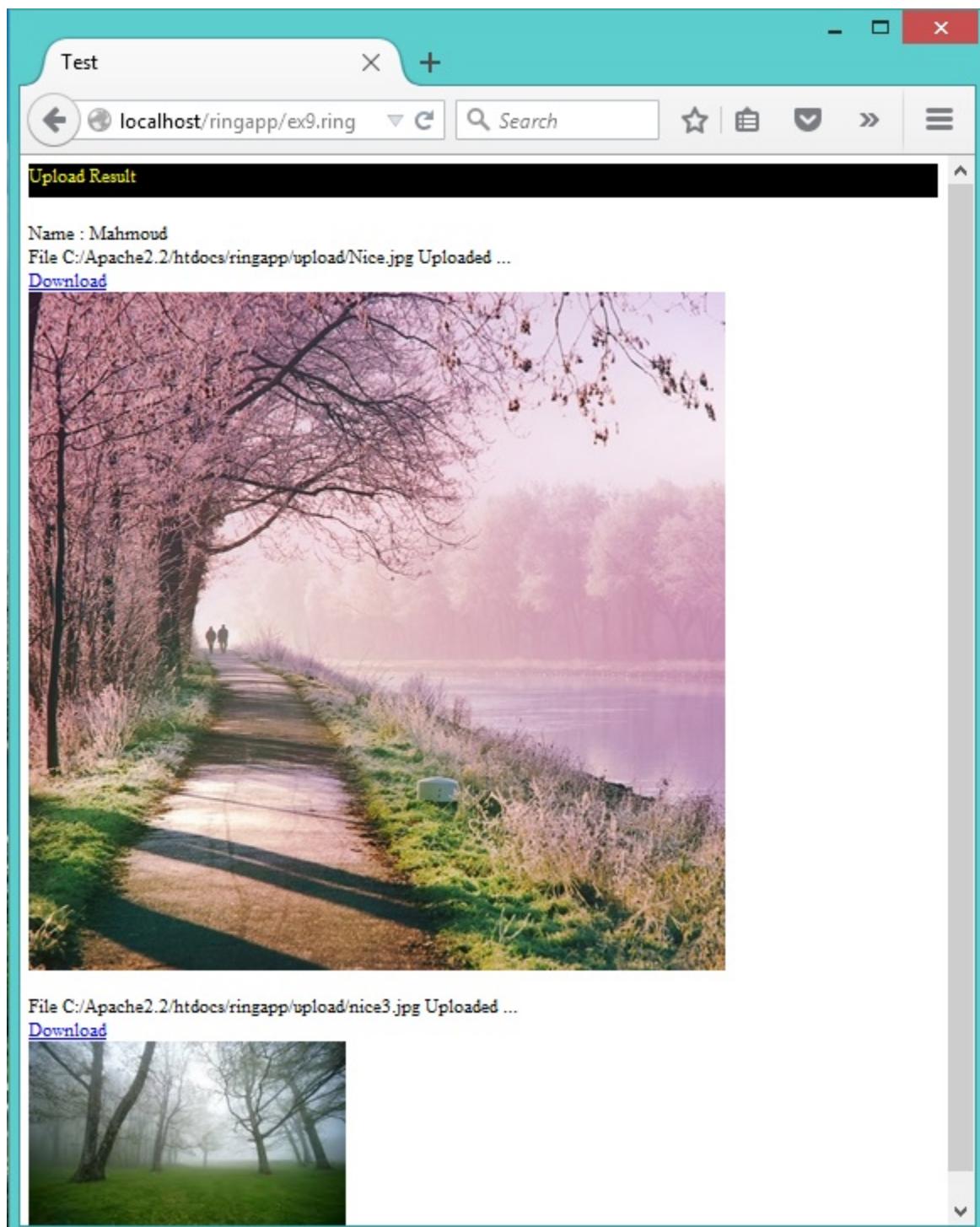
```

(continues on next page)

(continued from previous page)

```
cFileName = cUploadPath + oObj.getfilename(aPageVars,cFile)
write(cFileName,aPageVars[cFile])
system("chmod a+x "+cFileName)
oObj.newline()
oObj.text( "File "+cFileName+ " Uploaded ...")
oObj.newline()
imageURL = cUploadFolder + oObj.getfilename(aPageVars,cFile)
oObj.link([ :url = imageURL, :title = "Download" ])
oObj.newline()
oObj.image( [ :url = imageURL , :alt = :image ] )
oObj.newline()
```

Screen Shot:



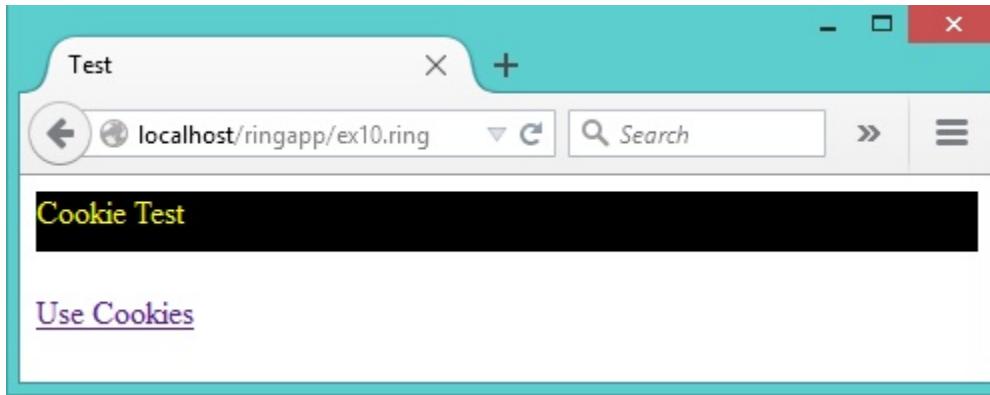
52.8 Cookies

The Page User Interface

```
#!/ring -cgi
Load "weplib.ring"
Import System.Web

New page
{
    boxstart()
        text( "Cookie Test" )
        newline()
    boxend()
    newline()
    link([ :url = "ex11.ring", :title = "Use Cookies" ])
    cookie("custname", "Mahmoud Fayed")
    cookie("custage", 28)
}
```

Screen Shot:

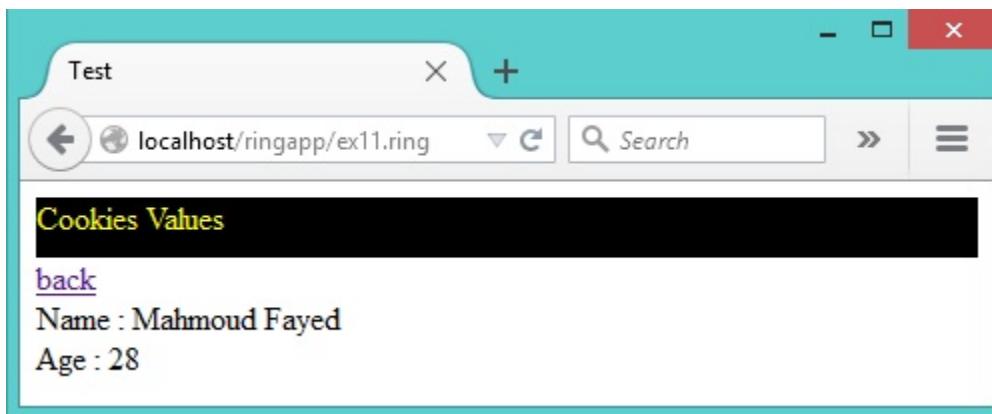


The Response

```
#!/ring -cgi
Load "weplib.ring"
Import System.Web

New Page
{
    boxstart()
        text( "Cookies Values" )
        newline()
    boxend()
    link([ :url = "ex10.ring", :title = "back" ])
    newline()
    divstart([:style="float:left;width:200px"])
        text( "Name : " + aPageVars["custname"] )
        newline()
        text( "Age : " + aPageVars["custage"] )
        newline()
    divend()
}
```

Screen Shot:



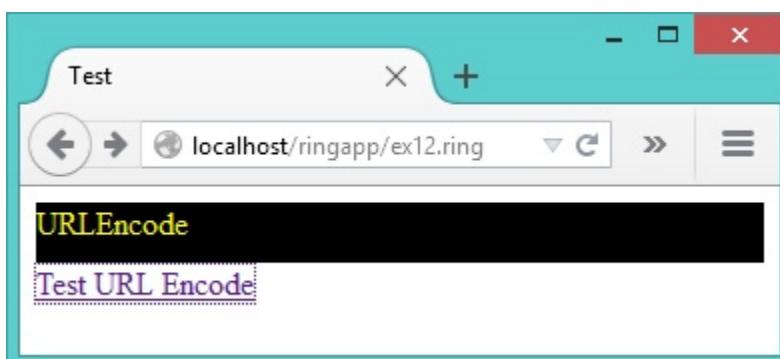
52.9 URL Encode

The Page User Interface

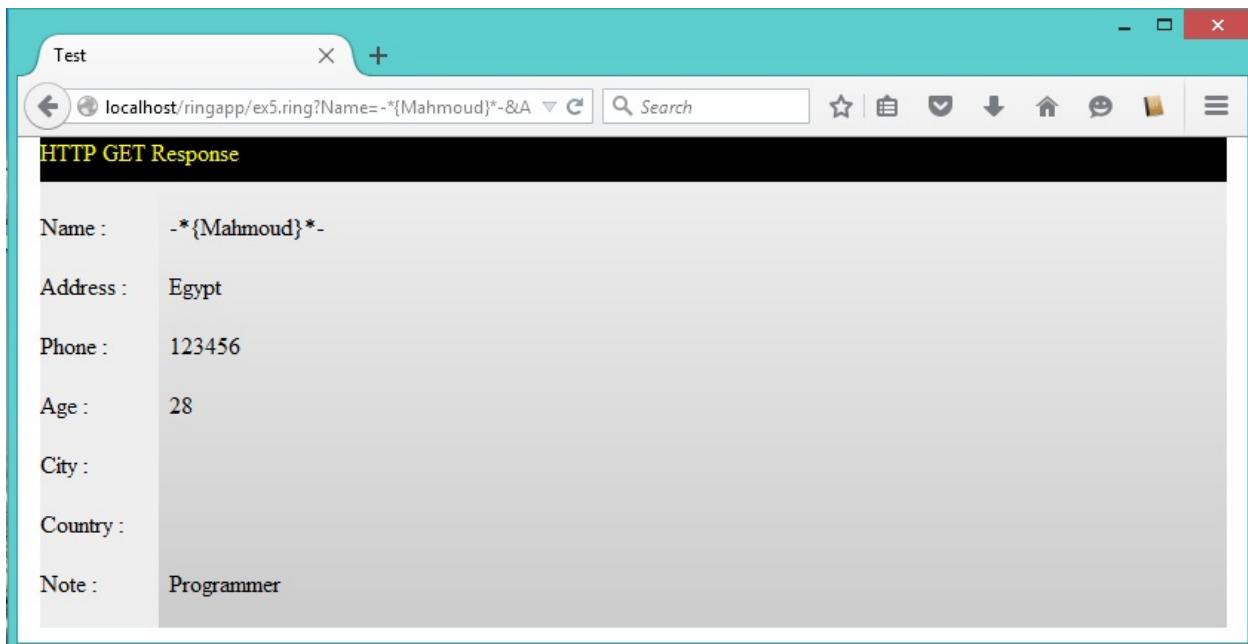
```
#!ring -cgi
Load "weblib.ring"
Import System.Web

New Page
{
    boxstart()
        text( "URLEncode" )
        newline()
    boxend()
    link([ :url = "ex5.ring?Name=" + URLEncode ("-*{Mahmoud}*-") +
           "&Address=Egypt&Phone=123456&Age=28&Notes=Programmer",
          :title = "Test URL Encode" ])
}
```

Screen Shot:



Screen Shot:



52.10 Templates

Using Templates we can write Ring code inside HTML files

Syntax:

```
<%= Ring Expression %>
<% Ring Statements %>
```

The HTML Code

```
<h1>Listing Numbers</h1>


| <%= myheader.cColumn1 %> | <%= myheader.cColumn2 %> |
|--------------------------|--------------------------|
| <th></th>                | <th></th>                |
| <th></th>                | <th></th>                |
| <th></th>                | <th></th>                |


<% for x in aNumbers %>
| <td><%= x.nValue %> | <td><%= x.nSquare %> |

<% next %>
</table>
```

The Ring Code

```
#!ring -cgi
Load "weplib.ring"
Import System.Web
```

(continues on next page)

(continued from previous page)

```

New NumbersController { start() }

Class NumbersController

    MyHeader aNumbers

    Func Start

        MyHeader = New Header
        {
            cColumn1 = "Number" cColumn2 = "Square"
        }

        aNumbers = list(20)

        for x = 1 to len(aNumbers)
            aNumbers[x] = new number
            {
                nValue = x    nSquare = x*x
            }
        next

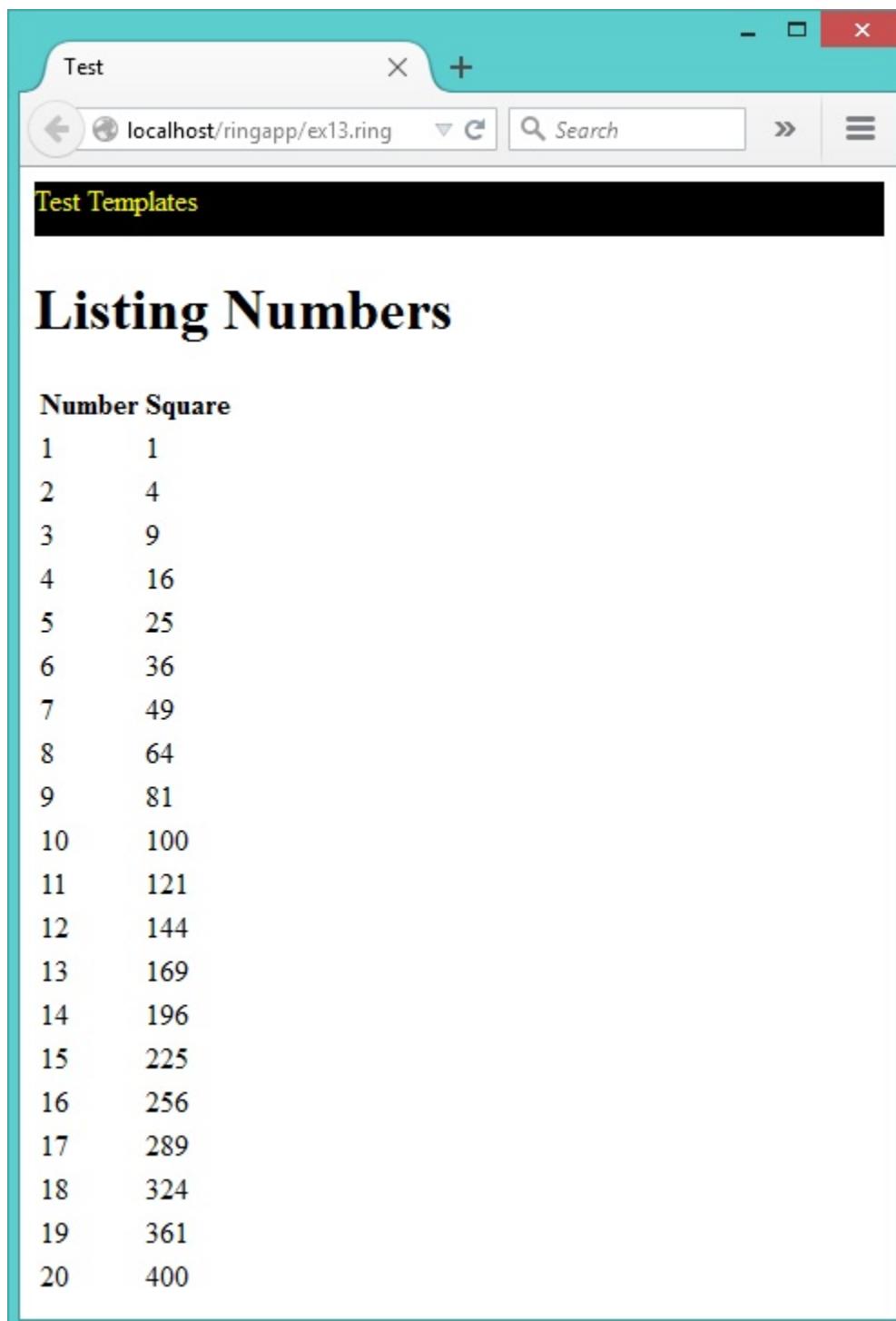
        cTemp = Template("mynumbers.html",self)

        New Page
        {
            boxstart()
            text( "Test Templates" )
            newline()
            boxend()
            html(cTemp)
        }

Class Header cColumn1 cColumn2
Class Number nValue    nSquare

```

Screen Shot:



52.11 HTML Special Characters

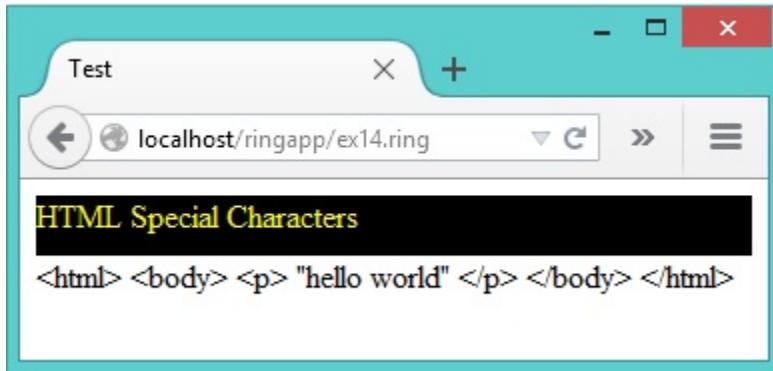
The text() function display HTML special characters.

If you want to write html code, use the html() function.

```
#!ring -cgi
Load "weplib.ring"
Import System.Web

New Page
{
    boxstart()
        text("HTML Special Characters")
        newline()
    boxend()
    text('
        <html>
            <body>
                <p> "hello world" </p>
            </body>
        </html>
    ')
}
```

Screen Shot:



52.12 Hash Functions

The Page User Interface

```
#!ring -cgi
Load "weplib.ring"
Import System.Web

New Page
{
    boxstart()
        text( "Hash Test")
        newline()
    boxend()
    divstart([ :style = StyleFloatLeft() + StyleWidth("100px") ])
}
```

(continues on next page)

(continued from previous page)

```

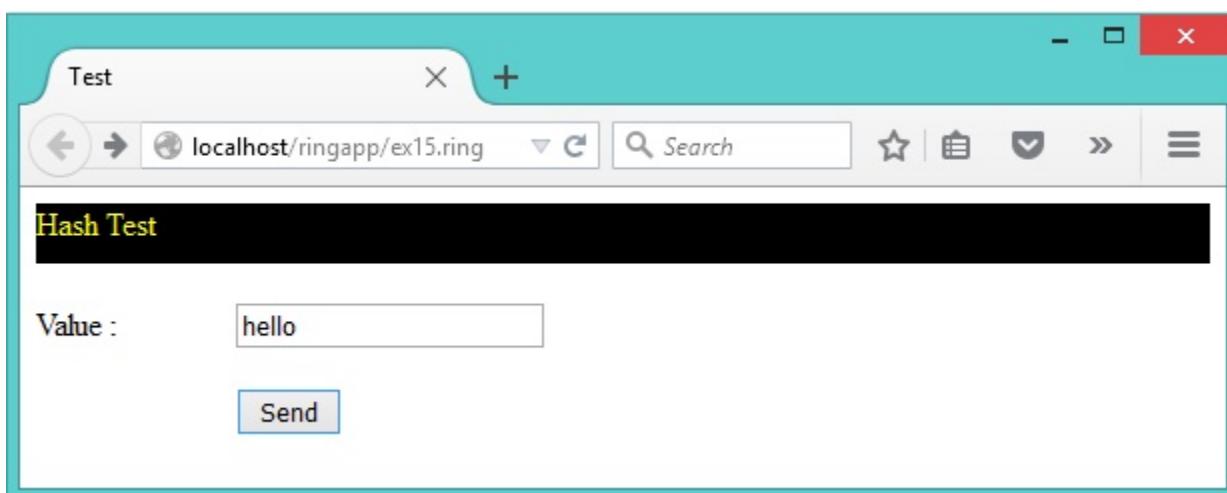
newline()
text( "Value : " )
newline() newline()

divend()
formpost("ex16.ring")
    divstart([ :style = StyleFloatLeft() + StyleWidth("300px") ])
        newline()
        textbox([ :name = "Value" ])
        newline() newline()
        submit([ :value = "Send" ])

    divend()
formend()
}

```

Screen Shot:



The Response

```

#!/ring -cgi
Load "weblib.ring"
Import System.Web

New Page
{
    boxstart()
        text( "Hash Result" )
        newline()
    boxend()
    divstart([ :style = styleFloatLeft() + styleWidth("100%") ])
        newline()
        text( "Value : " + aPageVars["Value"] )
        newline()
        text( "MD5 : " + MD5(aPageVars["Value"]) )
        newline()
        text( "SHA1 : " + SHA1(aPageVars["Value"]) )
        newline()
        text( "SHA256 : " + SHA256(aPageVars["Value"]) )
        newline()
        text( "SHA224 : " + SHA224(aPageVars["Value"]) )
        newline()

```

(continues on next page)

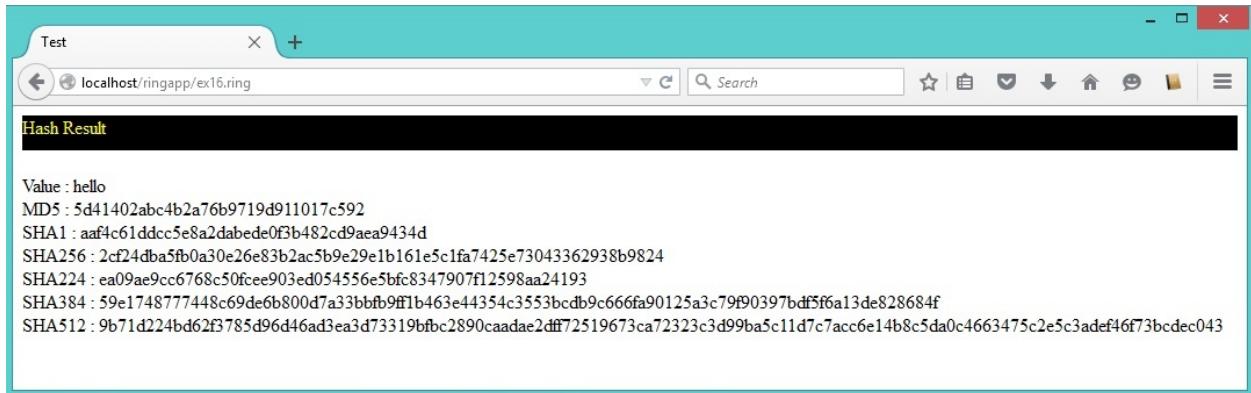
(continued from previous page)

```

        text( "SHA384 : " + SHA384(aPageVars["Value"]) )
        newline()
        text( "SHA512 : " + SHA512(aPageVars["Value"]) )
        newline()
    divend()
}

```

Screen Shot:



52.13 Random Image

```

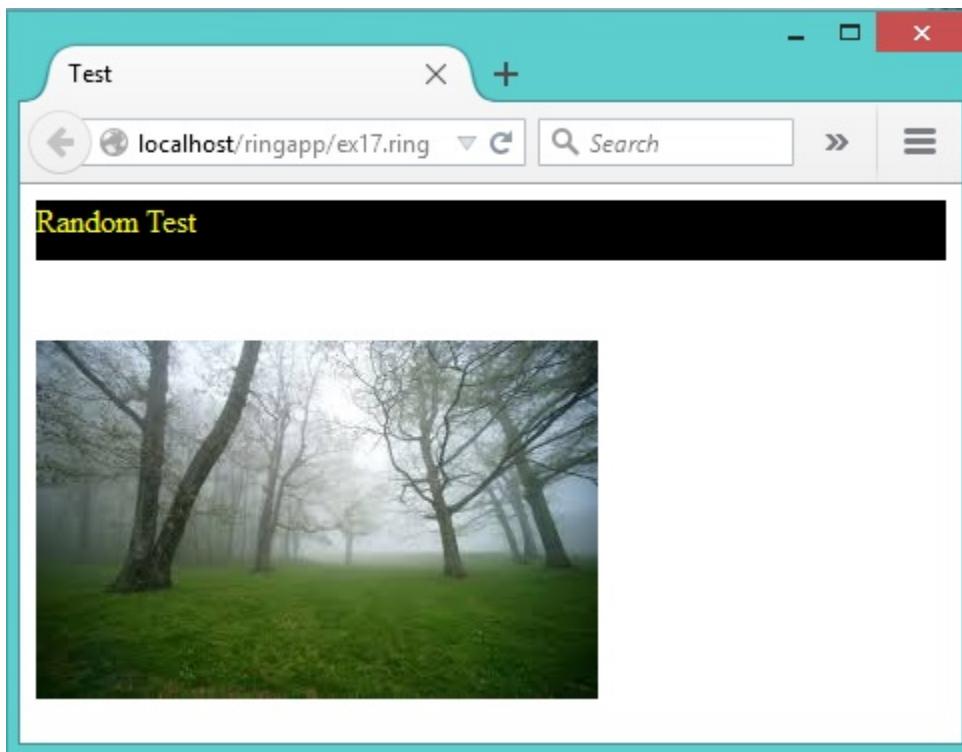
#!ring -cgi
Load "weplib.ring"
Import System.Web

cUploadPath = "C:/Apache2.2/htdocs/ringapp/upload/"

New Page
{
    boxstart()
        text( "Random Test")
        newline()
    boxend()
    divstart([ :style = styleFloatLeft() + styleWidth("400px") ])
        newline()
        aList = dir(cUploadPath)
        if len(aList) > 0
            nIndex = random(len(aList))
            if nIndex = 0 nIndex = 1 ok
            cItem = "upload/" + aList[nIndex][1]
            newline()
            image( [ :url = cItem , :alt = :image ] )
        else
            text("No images!") newline()
        ok
    divend()
}

```

Screen Shot:



52.14 HTML Lists

The next example print a list contains numbers from 1 to 10

Then print a list from Ring List.

Finally we have a list of buttons and when we press on a button we get a message contains the clicked button number.

To start the list we uses the ulstart() function.

To end the list we uses the ulend() function.

We uses liststart() and liend() to determine the list item.

```
#!ring -cgi
Load "weblib.ring"
Import System.Web

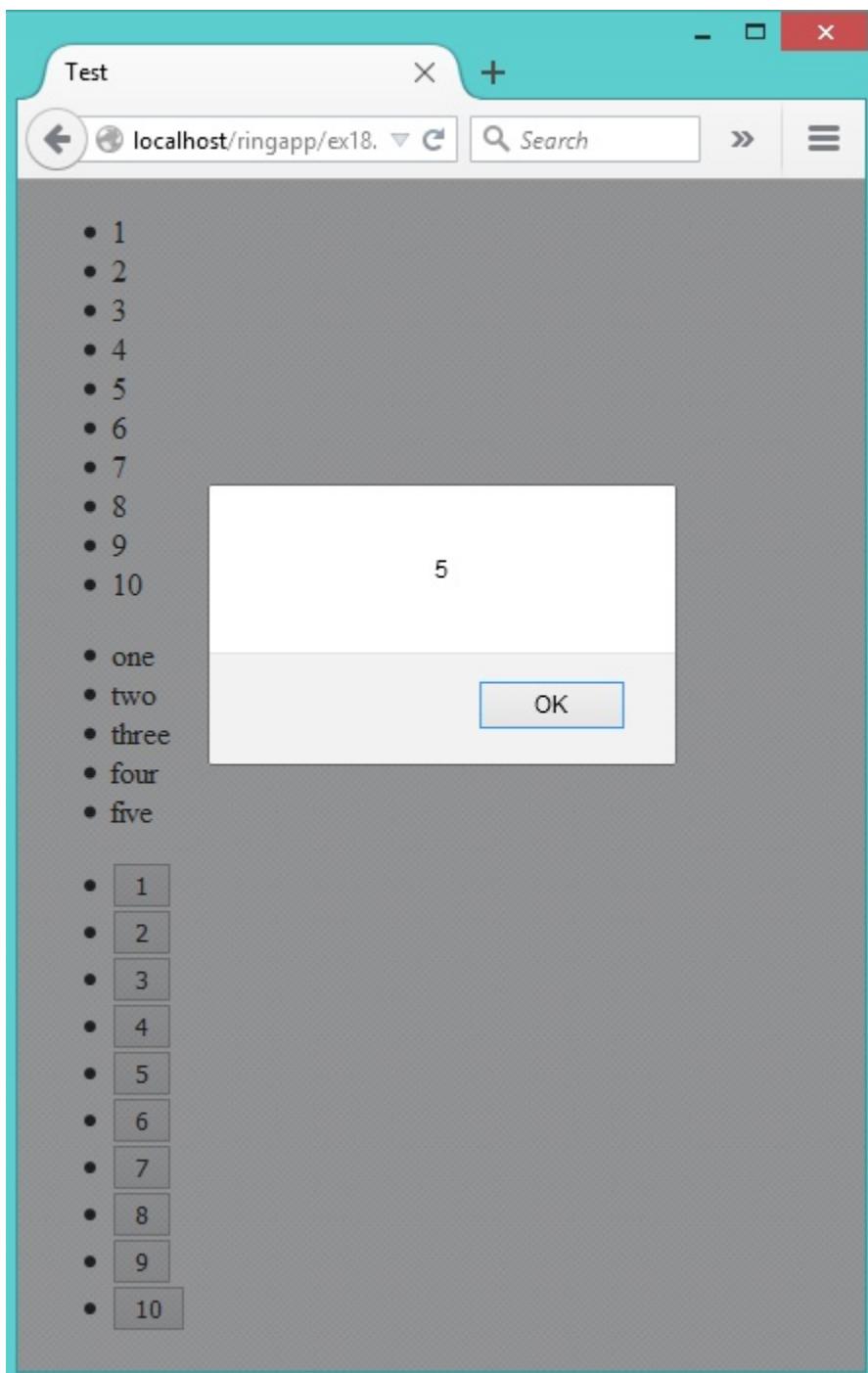
Func Main
  New Page
  {
    ulstart([])
      for x = 1 to 10
        liststart([])
          text(x)
        liend()
      next
    ulend()
    list2ul(["one", "two", "three", "four", "five"])
    ulstart([])
      for x = 1 to 10
```

(continues on next page)

(continued from previous page)

```
listart([])
    cFuncName = "btn"+x+"()"
    button([ :onclick = cFuncName , :value = x])
    script(scriptfuncalert(cFuncName, string(x)))
liend()
next
ulend()
}
```

Screen Shot:



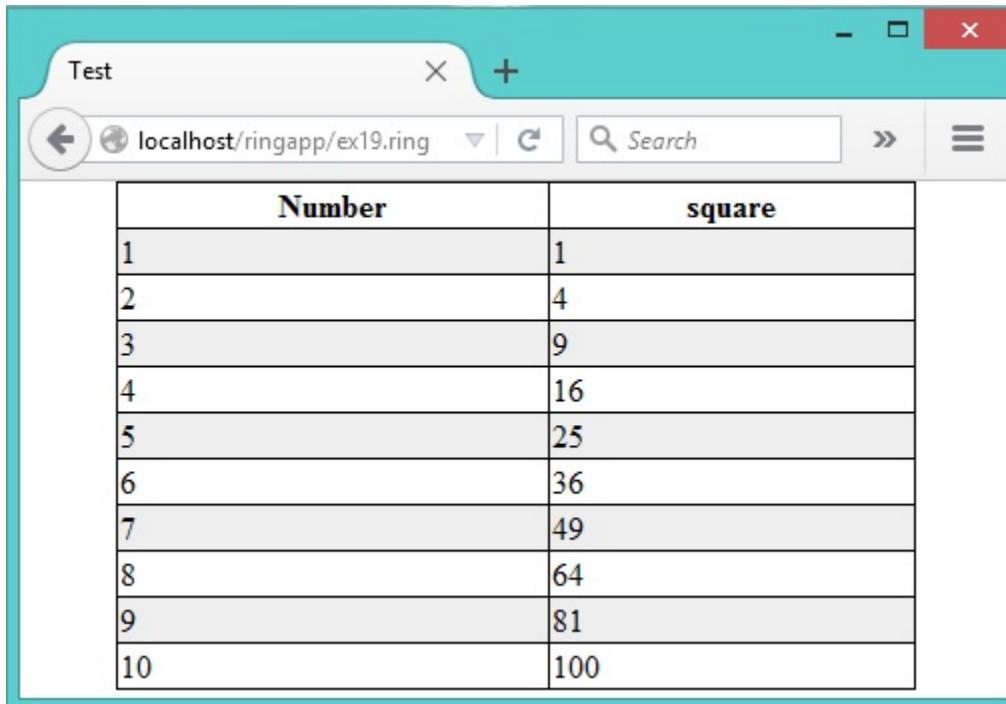
52.15 HTML Tables

In this example we will learn how to generate HTML tables using the tablestart(), tableend(), rowstart(), rowend(), headerstart(), headerend(), cellstart() and cellend() functions.

```
#!ring -cgi
Load "weplib.ring"
Import System.Web

Func Main
    New Page
    {
        divstart([ :style = styledivcenter("400px", "500px") ] )
            style(styletable() + styletablerows("t01"))
            tablestart([ :id = :t01 , :style = stylewidth("100%") ])
                rowstart([])
                    headerstart([]) text("Number") headerend()
                    headerstart([]) text("square") headerend()
                rowend()
                for x = 1 to 10
                    rowstart([])
                        cellstart([]) text(x) cellend()
                        cellstart([]) text(x*x) cellend()
                    rowend()
                next
            tableend()
        divend()
    }
}
```

Screen Shot:



52.16 Gradient

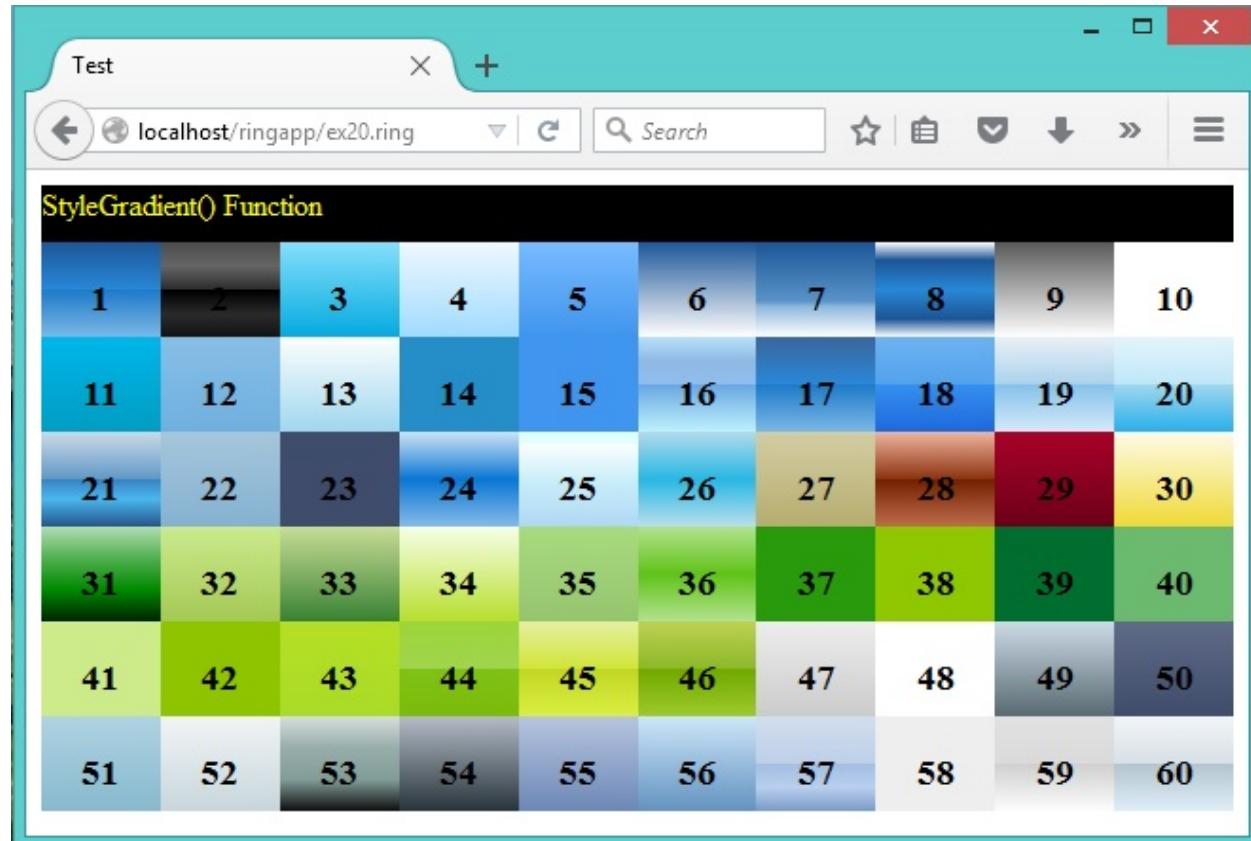
In this example we will learn how to use the StyleGradient() function.

The function takes the style number as input (range from 1 to 60).

```
#!ring -cgi
Load "weblib.ring"
Import System.Web

Func Main
    New Page
    {
        boxstart()
            text("StyleGradient() Function")
        boxend()
        for x = 1 to 60
            divstart([ :id = x , :align = "center" ,
                      :style = stylefloatleft() +
                        stylesize(string(100/60*6)+"%", "50px") +
                        stylegradient(x) ])
                h3(x)
            divend()
        next
    }
}
```

Screen Shot:



52.17 Generating Pages using Objects

Instead of using functions/methods to generate HTML pages, we can use an object for each element in the page.

This choice means more beautiful code but slower.

The fastest method is to print HTML code directly, then using functions then using templates then using objects (slower).

```
#!ring -cgi
Load "weblib.ring"
Import System.Web

Func Main

WebPage()
{
    Title = "Using objects to create the Web Page content"
    h1 { text("welcome") }
    link
    {
        Title = "Google"
        Link = "http://www.google.com"
    }
    div
    {
        id = "div1"
        style = stylegradient(30) + stylesize("50%", "50%")
        text("Outer Div")
        div
        {
            id = "div2"
            color = "white"
            backgroundcolor = "green"
            width = "50%"
            height = "50%"
            marginleft = "5%"
            margintop = "5%"
            text("Inner Div")
        }
    }
    div
    {
        id = "div3"
        color = "black"
        backgroundcolor = "silver"
        width = "100%"
        height = "100%"
        text("Form")
        form
        {
            method = "POST"
            Action = "helloworld.ring"
            Table
            {
                style = stylewidth("100%") + stylegradient(24)
                TR
                {

```

(continues on next page)

(continued from previous page)

```

        TD { WIDTH="10%" text("Name : " ) }
        TD { Input { type = "text" } }
    }
    TR
    {
        TD { WIDTH="10%" text("Email : " ) }
        TD { Input { type = "text" } }
    }
    TR
    {
        TD { WIDTH="10%" text("Password : " ) }
        TD { Input { type = "password" } }
    }
    TR
    {
        TD { WIDTH="10%" text("Notes") }
        TD { TextArea { width="100%" rows = 10 cols = 10
                        text("type text here...") } }
    }
    TR
    {
        TD { WIDTH="10%" text("Gender") }
        TD {
            select
            {
                width = "100%"
                option { text("Male") }
                option { text("Female") }
            }
        }
    }
    TR
    {
        TD { WIDTH="10%" text("Role") }
        TD {
            select
            {
                multiple = "multiple"
                width    = "100%"
                option { text("student") }
                option { text("admin") }
            }
        }
    }
    Input { type = "submit" value = "send" }
    Image { src="upload/profile1.jpg" alt="profile" }
    Input { type = "checkbox" value = "Old Member" } text("old member")
    Input { type = "range" min=1 max=100 }
    Input { type = "number" min=1 max=100 }
    Input { type = "radio" color="black" name="one"
            value = "one" } text("one")
}
}

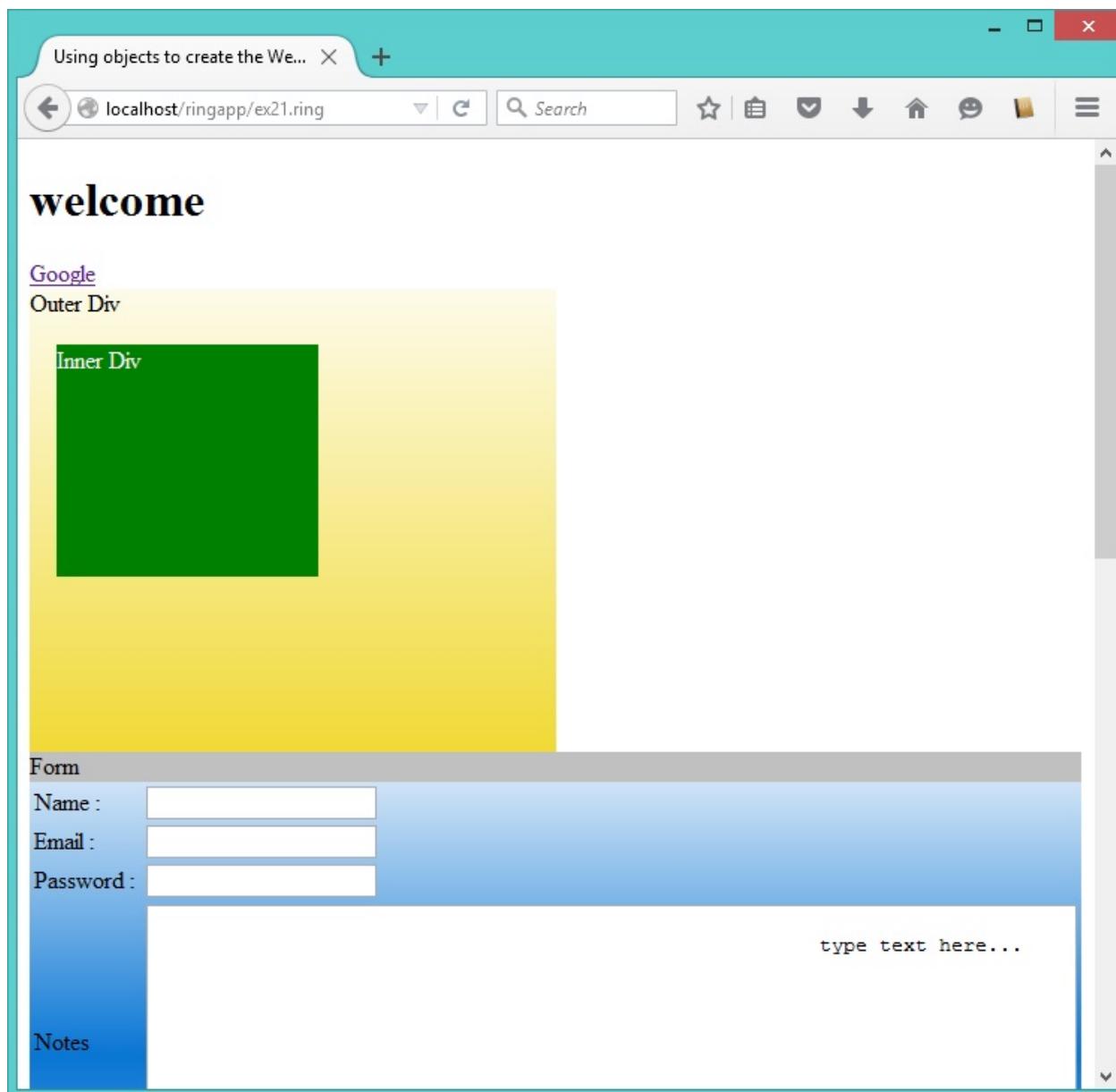
```

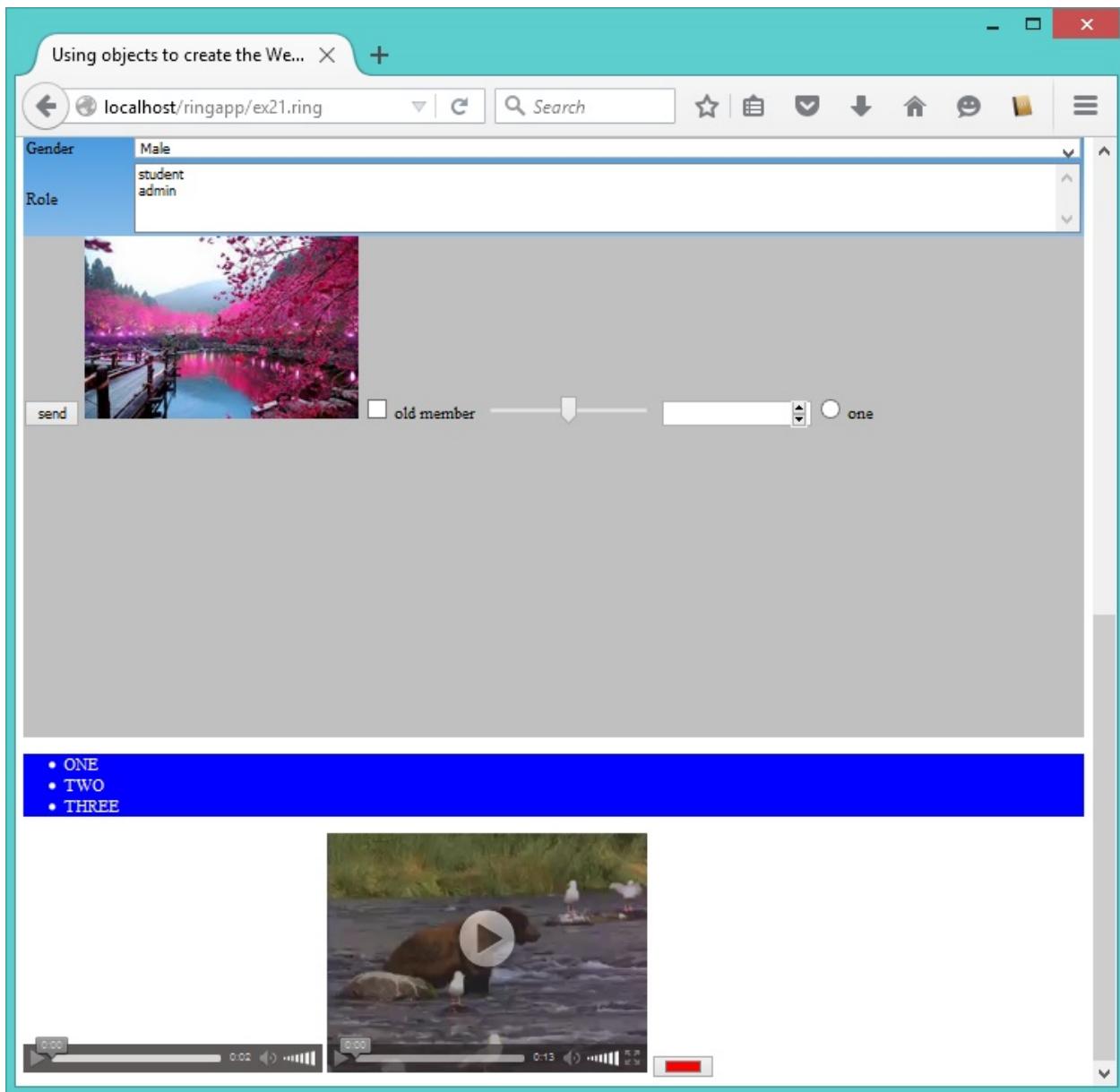
(continues on next page)

(continued from previous page)

```
{  
    color = "white"  
    backgroundcolor = "blue"  
    width = "100%"  
    UL  
    {  
        LI { TEXT("ONE") }  
        LI { TEXT("TWO") }  
        LI { TEXT("THREE") }  
    }  
}  
div  
{  
    audio  
    {  
        src = "horse.ogg"  
        type = "audio/ogg"  
    }  
  
    video  
    {  
        width = 320  
        height = 240  
        src = "movie.mp4"  
        type = "video/mp4"  
    }  
  
    Input  
    {  
        type = "color"  
        value = "#ff0000"  
        onchange = "clickColor(0, -1, -1, 5)"  
    }  
}
```

Screen Shot:





52.18 HtmlPage Class

Using this class we can create HTML documents without printing the output to the standard output

So instead of using the WebLib in Web Applications only

We can use it in Console/GUI/Mobile Applications too

Example:

```
load "stdlib.ring"
load "weplib.ring"

import System.Web
```

(continues on next page)

(continued from previous page)

```

func main

    mypage = new HtmlPage {
        h1 { text("Customers Report") }
        Table
        {
            style = stylewidth("100%") + stylegradient(4)
            TR
            {
                TD { WIDTH="10%" text("Customers Count : ") }
                TD { text(100) }
            }
        }

        Table
        {
            style = stylewidth("100%") + stylegradient(26)
            TR
            {
                style = stylewidth("100%") + stylegradient(24)
                TD { text("Name" ) }
                TD { text("Age" ) }
                TD { text("Country" ) }
                TD { text("Job" ) }
                TD { text("Company" ) }
            }
            for x = 1 to 100
            TR
            {
                TD { text("Test" ) }
                TD { text("30" ) }
                TD { text("Egypt" ) }
                TD { text("Sales" ) }
                TD { text("Future" ) }
            }
            next
        }

        write("report.html",mypage.output())
    }
}

```

52.19 Using Bootstrap Library using Functions

The next example uses the Bootstrap JavaScript Library when generating the HTML page.

```

#!ring -cgi
Load "weblib.ring"
Import System.Web

Func Main
    new BootstrapPage {
        divstart([ :class = "container" ])

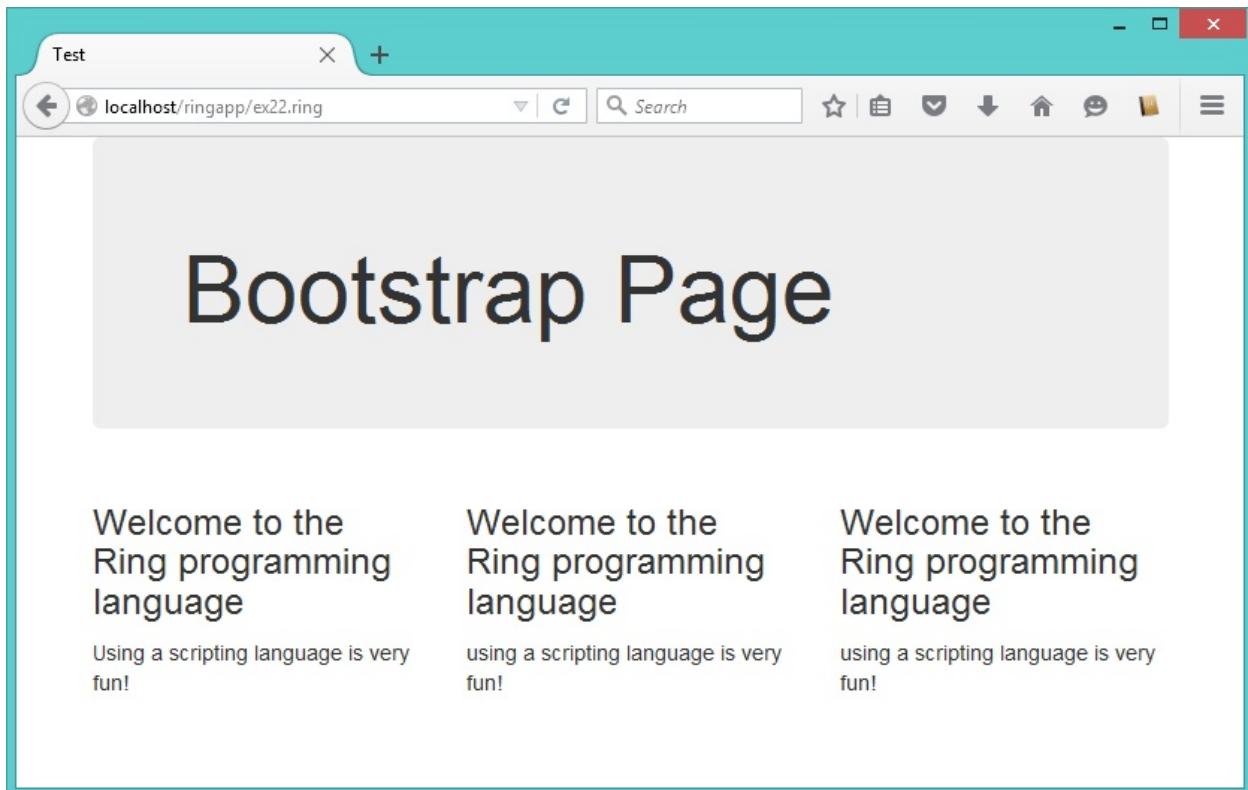
```

(continues on next page)

(continued from previous page)

```
divstart([ :class = "jumbotron" ])
    h1("Bootstrap Page")
divend()
divstart([ :class = :row ])
    divstart([ :class = "col-sm-4" ])
        h3("Welcome to the Ring programming language")
        p([ :text = "Using a scripting language is very fun!" ])
    divend()
    divstart([ :class = "col-sm-4" ])
        h3("Welcome to the Ring programming language")
        p([ :text = "using a scripting language is very fun!" ])
    divend()
    divstart([ :class = "col-sm-4" ])
        h3("Welcome to the Ring programming language")
        p([ :text = "using a scripting language is very fun!" ])
    divend()
divend()
divend()
}
```

Screen Shot:



52.20 Using Bootstrap Library using Objects

The next example uses the Bootstrap JavaScript Library when generating the HTML page.

Instead of using functions to generate the HTML elements, we will use objects.

```
#!ring -cgi
Load "weblib.ring"
Import System.Web

Func Main
    BootStrapWebPage()
    {
        div
        {
            classname = :container
            div
            {
                classname = :jumbotron
                H1 { text("Bootstrap Page") }
            }
            div
            {
                classname = :row
                for x = 1 to 3
                    div
                    {
                        classname = "col-sm-4"
                        H3 { html("Welcome to the Ring programming language") }
                        P { html("Using a scripting language is very fun!") }
                    }
                next
            }
            div
            {
                classname = :row
                div
                {
                    classname = "col-sm-4"
                    Button
                    {
                        classname = "btn btn-info btn-lg"
                        datatoggle= "modal"
                        datatarget = "#myModal"
                        text("Open Large Modal")
                    }
                }
                div
                {
                    classname = "col-sm-4"
                    Button { classname = "btn btn-default btn-lg" text("default") }
                    Button { classname = "btn btn-primary btn-md" text("primary") }
                    Button { classname = "btn btn-sucess btn-sm" text("sucess") }
                    Button { classname = "btn btn-info btn-xs" text("info") }
                    Button { classname = "btn btn-warning" text("warning") }
                    Button { classname = "btn btn-danger" text("danger") }
                    Button { classname = "btn btn-link" text("link") }
                }
            }
        }
    }
}
```

(continues on next page)

(continued from previous page)

```

}
div
{
    classname = "col-sm-4"
    Button { classname = "btn btn-default btn-block" text("default") }
    Button { classname = "btn btn-primary btn-block" text("primary") }
    Button { classname = "btn btn-sucess btn-block" text("sucess") }
    Button { classname = "btn btn-info btn-block" text("info") }
    Button { classname = "btn btn-warning btn-block" text("warning") }
    Button { classname = "btn btn-danger btn-block" text("danger") }
    Button { classname = "btn btn-link btn-block" text("link") }
}
div
{
    classname = "col-sm-4"
    div { classname = "btn-group"
        button { classname="btn btn-primary" text("one") }
        button { classname="btn btn-primary" text("two") }
        button { classname="btn btn-primary" text("three") }
    }
}
div
{
    classname = "col-sm-4"
    div { classname = "btn-group btn-group-lg"
        button { classname="btn btn-primary" text("one") }
        button { classname="btn btn-primary" text("two") }
        button { classname="btn btn-primary" text("three") }
    }
}
div
{
    classname = "col-sm-4"
    div {
        classname = "btn-group-vertical btn-group-lg"
        button { classname="btn btn-primary" text("one") }
        button { classname="btn btn-primary" text("two") }
        button { classname="btn btn-primary" text("three") }
    }
}
div { classname="modal fade" id="myModal" role="dialog"
    div { classname = "modal-dialog modal-lg"
        div { classname="modal-content"
            div { classname="modal-header"
                button { classname="close" datadismiss="modal"
                    html("&times;")
                }
                h4 { classname="modal-title"
                    text("Modal Header")
                }
            }
            div { classname = "modal-body"
                p { text("This is a large model.") }
            }
            div { classname="modal-footer"
                button { classname = "btn btn-default" datadismiss="modal"

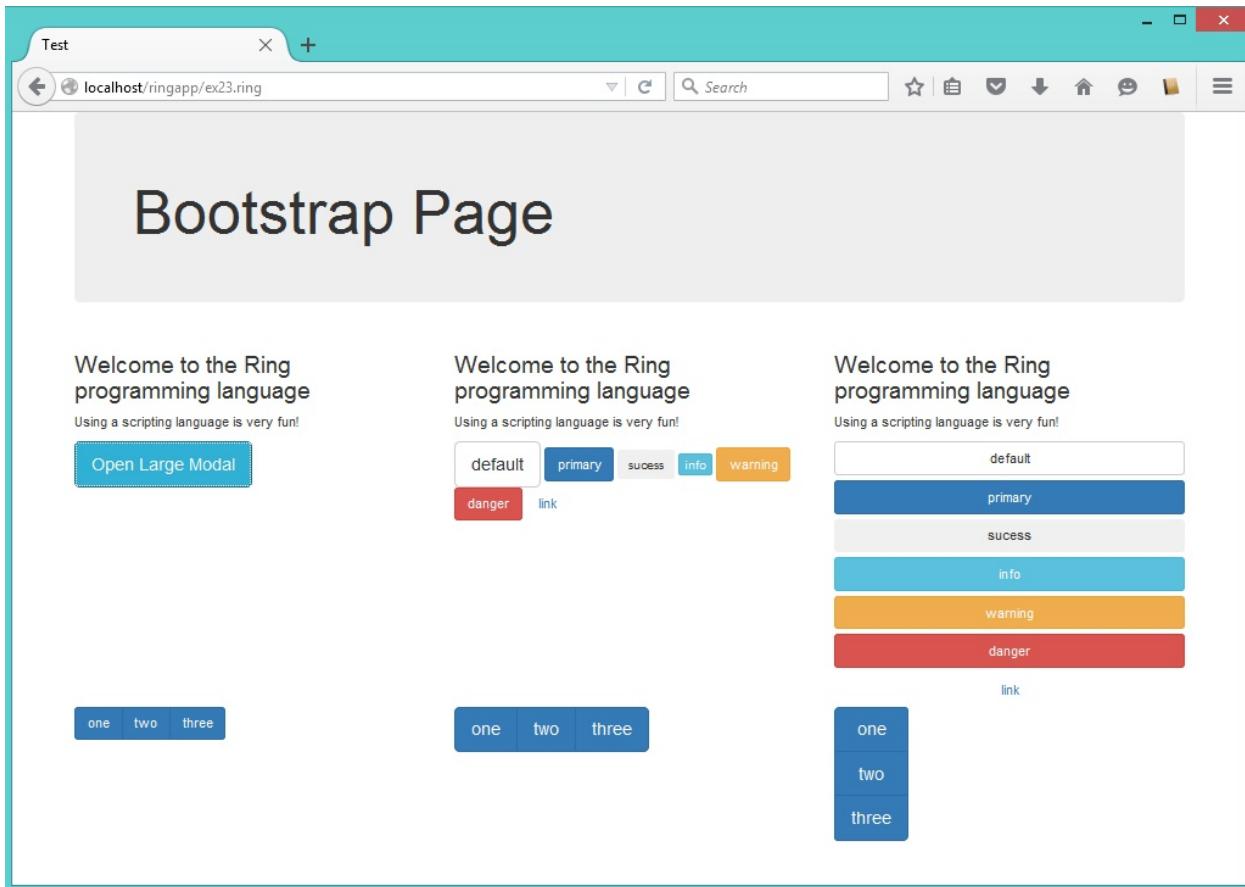
```

(continues on next page)

(continued from previous page)

```
        text("close")  
    }  
}  
}  
}  
}  
}  
}  
}  
}
```

Screen Shot:



52.21 CRUD Example using MVC

The next example uses the `weplib.ring` & `datalib.ring`.

The `datalib`.`ring` contains classes for creating database applications using MVC pattern.

In this example we create an object from the `SalaryController` class then call the `Routing` method.

We define the website variable to contains the basic url of the page.

When we create the `SalaryModel` class from the `ModelBase` class, the salary table will be opened and the columns data will be defined as attributes in the model class.

The SalaryView class create an object from the SalaryLanguageEnglish class to be used for translation.

The method AddFuncScript is used to call the form for adding/modifying record data.

The method FormViewContent is used to determine the controls in the form when we add or modify a record.

```
#!ring -cgi
Load "weplib.ring"
Load "datalib.ring"
Import System.Web

website = "ex24.ring"

New SalaryController { Routing() }

Class SalaryModel from ModelBase

Class SalaryController From ControllerBase

Class SalaryView From ViewBase

oLanguage = new SalaryLanguageEnglish

Func AddFuncScript oPage,oController
    return oPage.scriptfuncajax("myadd",oController.cMainURL+
        oController.cOperation+"=add","mysubpage")

Func FormViewContent oController,oTranslation,oPage
    return [
        [ oTranslation.aColumnsTitles[2], "textbox", "name",
            oController.oModel.Name, oPage.stylewidth("100%") ],
        [ oTranslation.aColumnsTitles[3], "textbox", "salary",
            oController.oModel.Salary, oPage.stylewidth("50%") ]
    ]

Class SalaryLanguageEnglish
    cTitle = "Salary Table"
    cBack = "back"
    aColumnsTitles = ["ID","Name","Salary"]
    cOptions = "Options"
    cSearch = "Search"
    comboitems = ["Select Option...","Edit","Delete"]
    cAddRecord = "Add Record"
    cEditRecord = "Edit Record"
    cRecordDeleted = "Record Deleted!"
    aMovePages = ["First","Prev","Next","Last"]
    cPage = "Page"
    cOf = "of"
    cRecordsCount = "Records Count"
    cSave = "Save"
    temp = new page
    c TextAlign = temp.StyleTextRight()
    cNoRecords = "No records!"
```

Screen Shot:

The screenshot displays two windows of a Ring application. The top window shows a 'Salary Table' with 15 records. The bottom window shows a search result for 'm' and an open 'Edit Record' dialog for the first record.

Top Window: Salary Table

URL: localhost/ringapp/ex24.ring

Table Headers: ID, Name, Salary, Options

Table Data:

ID	Name	Salary	Options
1	Mahmoud	15000	Select Option...
2	Samir	16000	Select Option...
4	Ahmed	50000	Select Option...
5	Ibrahim	50000	Select Option...
12	Mohammed	56786	Select Option...

Buttons: First, Prev, Next, Last, Add Record

Records Count (15) : Page 1 of 3

Bottom Window: Salary Table - Edit Record

URL: localhost/ringapp/ex24.ring?part=1&searchname=m

Search Result:

ID	Name	Salary	Options
1	Mahmoud	15000	Select Option...
12	Mohammed	56786	Select Option... Edit Delete
131	Mageed	23623	Delete

Buttons: First, Prev, Next, Last, Add Record

Records Count (3) : Page 1 of 1

Edit Record Dialog:

Name: Mahmoud

Salary: 15000

Save

52.22 Users registration and Login

We have the users classes (Model, View & Controller) to deal with the users data like username & email.

The next code is stored in ex25_users.ring

```

Class UsersModel from ModelBase
cSearchColumn = "username"

Class UsersController From ControllerBase
aColumnsNames = ["id", "username", "email"]

Func UpdateRecord
    oModel.id = aPageVars[cRecID]
    oModel.updatecolumn("username", aPageVars[:username] )
    oModel.updatecolumn("email", aPageVars[:email] )
    oView.UpdateView(self)

Class UsersView from ViewBase

    oLanguage = new UsersLanguageEnglish

    Func AddFuncScript oPage, oController
        return oPage.scriptfunc("myadd", oPage.scriptredirection("ex26.ring"))

    Func FormViewContent oController, oTranslation, oPage
        return [
            [oTranslation.aColumnsTitles[2], "textbox", "username",
             oController.oModel.UserName, oPage.stylewidth("100%")],
            [oTranslation.aColumnsTitles[3], "textbox", "email",
             oController.oModel.Email, oPage.stylewidth("50%")]
        ]

Class UsersLanguageEnglish
    cTitle = "Users Table"
    cBack = "back"
    aColumnsTitles = ["ID", "User Name", "Email"]
    cOptions = "Options"
    cSearch = "Search"
    comboitems = ["Select Option...", "Edit", "Delete"]
    cAddRecord = "Add Record"
    cEditRecord = "Edit Record"
    cRecordDeleted = "Record Deleted!"
    aMovePages = ["First", "Prev", "Next", "Last"]
    cPage = "Page"
    cOf = "of"
    cRecordsCount = "Records Count"
    cSave = "Save"
    temp = new page
    c TextAlign = temp.StyleTextRight()
    cNoRecords = "No records!"
```

In the file ex25.ring we load ex25_users.ring then create an object from UsersController class.

Using the created object, we call the routing method.

```

#!ring -cgi
Load "weblib.ring"
```

(continues on next page)

(continued from previous page)

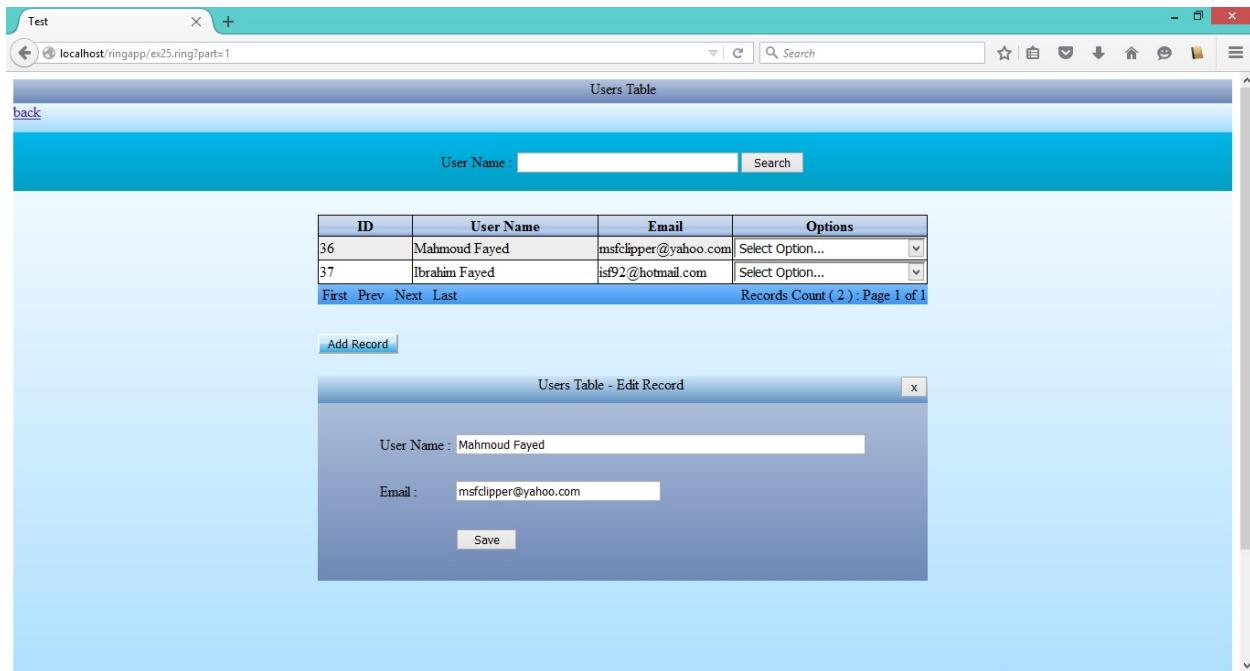
```

Load "datalib.ring"
Load "ex25_users.ring"

Import System.Web
website = "ex25.ring"
New UsersController { Routing() }

```

Screen Shot:



See the next code for the registration page

```

#!/ring -cgi
Load "weblib.ring"
Load "datalib.ring"
Import System.Web

website = "ex26.ring"

new page {
    boxstart()
        text( "Register")
        newline()
    boxend()
    divstart([:style = stylegradient(6) + stylesize("100%","95%") ])
    link([ :url = website, :title = "back" , :style = stylecolor("white")])
    newline()
    divstart([ :style= styledivcenter("500","160") + stylegradient(52) ])
    formpost("ex27.ring")
        tablestart([ :Style =      stylemarginleft("2%") + stylemargintop("2%") +
                    stylewidth("90%") ])
            rowstart([])
                cellstart([:style = stylewidth("20%") + styleheight(30)])
                    text("User Name")

```

(continues on next page)

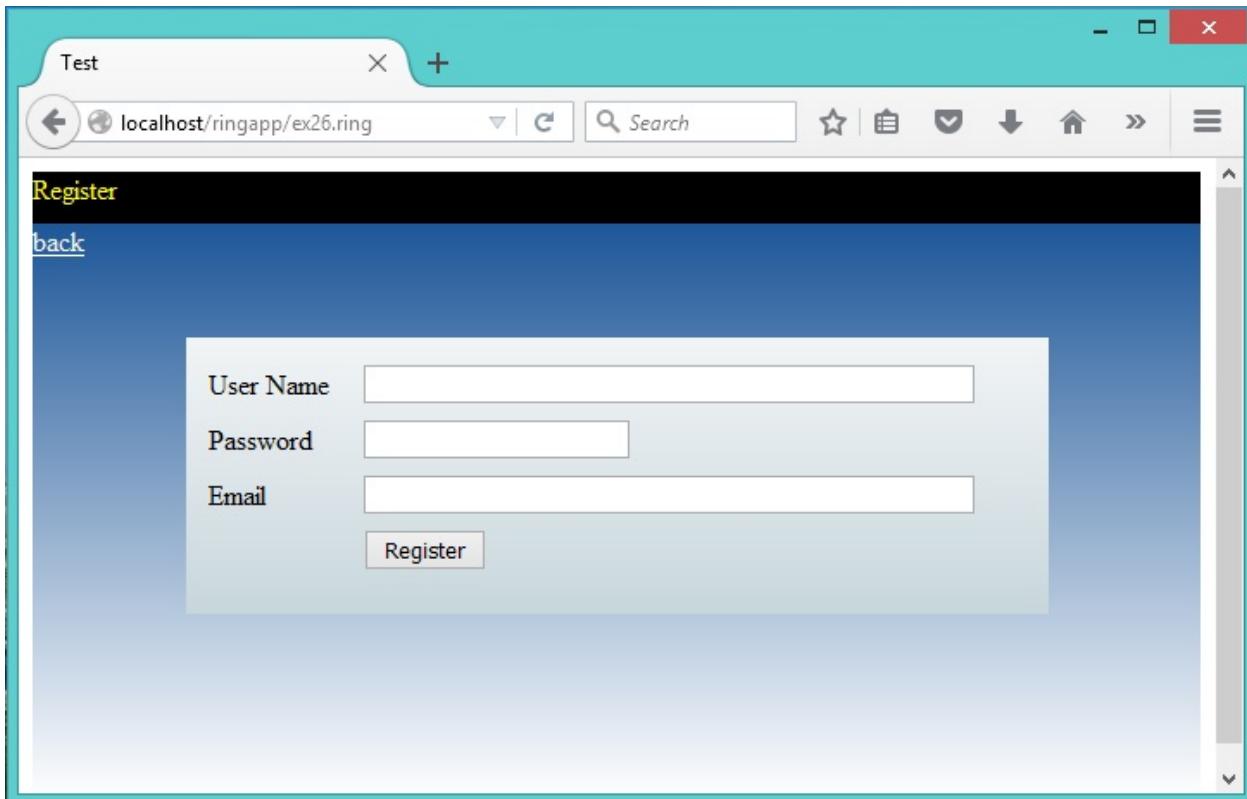
(continued from previous page)

```

cellend()
cellstart([ :style = stylewidth("80%") ])
    textbox([:name = "username", :style = stylewidth("100%")])
cellend()
rowend()
rowstart([])
    cellstart([ :style = styleheight(30)])
        text("Password")
    cellend()
    cellstart([])
        textbox([:name = "password" , :type = "password"])
    cellend()
rowend()
rowstart([])
    cellstart([ :style = styleheight(30)])
        text("Email")
    cellend()
    cellstart([])
        textbox([:name = "email" , :style = stylewidth("100%")])
    cellend()
rowend()
rowstart([])
    cellstart([ :style = styleheight(30)])
    cellend()
    cellstart([ :style = styleheight(30)])
        submit([:value = "Register" ])
    cellend()
rowend()
tableend()
formend()
divend()
divend()
}

```

Screen Shot:



The Registration response

```

#!/ring -cgi
Load "weplib.ring"
Load "datalib.ring"
Load "ex25_users.ring"

Import System.Web

oUser = new UsersModel
oUser.Connect()
if oUser.findwith("username",aPageVars["username"])
    new page {
        text("The user name is already registered")
    }
    return
ok
if oUser.findwith("email",aPageVars["email"])
    new page {
        text("This email is already registered")
    }
    return
ok

aPageVars["salt"] = str2hex(RandBytes(32))
aPageVars["pwhash"] = sha256(aPageVars["password"]+aPageVars["salt"])
aPageVars["sessionid"] = str2hex(randbytes(32))
oUser.Insert()
new page {
    cookie("sessionid",aPageVars["sessionid"])
}

```

(continues on next page)

(continued from previous page)

```

text("New User Created!")
newline()
text("User Name : " + aPageVars["username"])
newline()
}
oUser.Disconnect()

```

See the next code for the Login page

```

#!ring -cgi
Load "weplib.ring"
Load "datalib.ring"

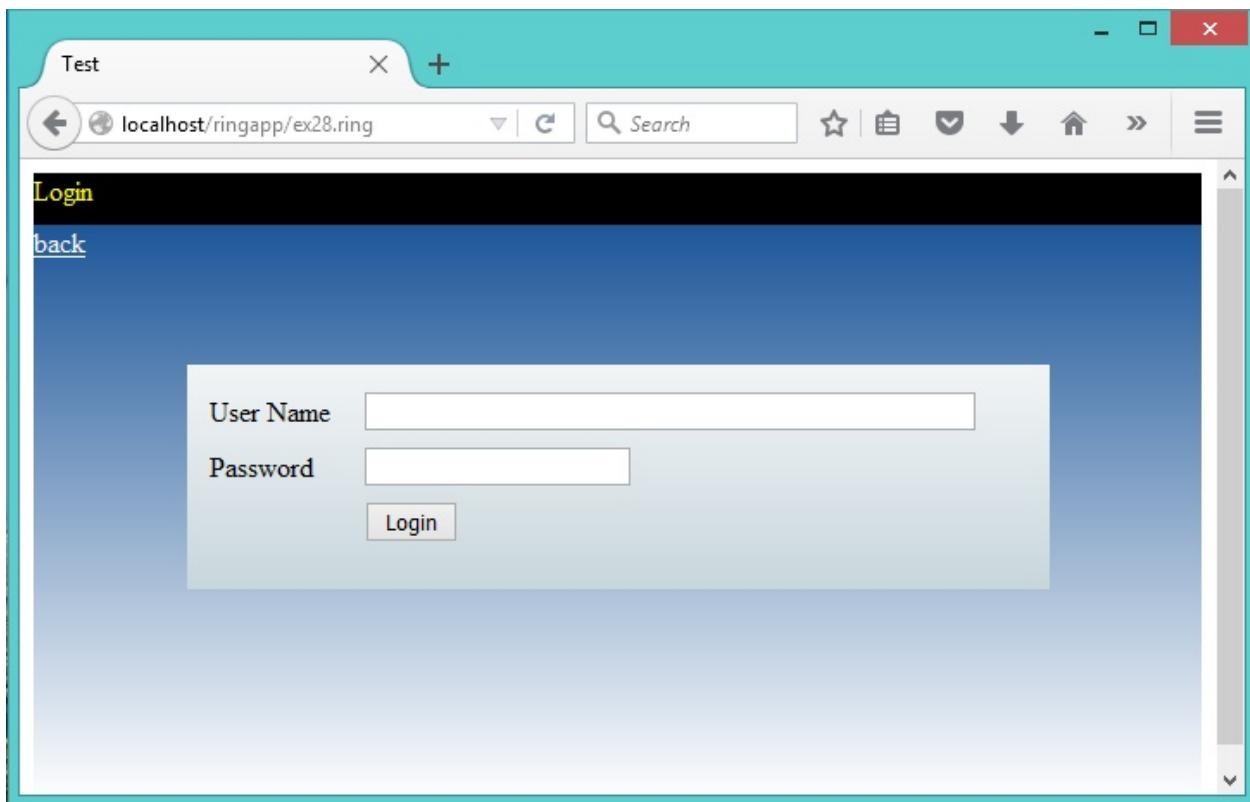
Import System.Web

website = "ex28.ring"

new page {
    boxstart()
        text( "Login")
        newline()
    boxend()
    divstart([:style = stylegradient(6) + stylesize("100%","95%") ])
    link([ :url = website, :title = "back" , :style = stylecolor("white")])
    newline()
    divstart([ :style= styledivcenter("500","130") + stylegradient(52) ])
    formpost("ex29.ring")
        tablestart([ :Style = stylemarginleft("2%") + stylemargintop("2%") +
                    stylewidth("90%") ])
            rowstart([])
                cellstart([:style = stylewidth("20%") + styleheight(30)])
                text("User Name")
                cellend()
                cellstart([ :style = stylewidth("80%") ])
                    textbox([:name = "username" , :style = stylewidth("100%")])
                    cellend()
            rowend()
            rowstart([])
                cellstart([ :style = styleheight(30)])
                text("Password")
                cellend()
                cellstart([])
                    textbox([:name = "password" , :type = "password"])
                    cellend()
            rowend()
            rowstart([])
                cellstart([ :style = styleheight(30) ])
                cellend()
                cellstart([])
                    submit([:value = "Login" ])
                    cellend()
            rowend()
        tableend()
    formend()
    divend()
    divend()
}

```

Screen Shot:



The response page

```

#!/ring -cgi
Load "weplib.ring"
Load "datalib.ring"
Load "ex25_users.ring"

Import System.Web

oUser = new UsersModel
oUser.Connect()
lResult = oUser.FindWith("username",aPageVars["username"])
new page {
    if lResult
        if sha256(aPagevars["password"]+oUser.Salt) = oUser.pwhash
            text ("Correct Password!")
            aPageVars["sessionid"] = str2hex(randbytes(32))
            oUser.UpdateColumn("sessionid",aPageVars["sessionid"])
            cookie("sessionid",aPageVars["sessionid"])
        else
            text ("Bad password!")
        ok
    else
        text ("Bad User Name!")
    ok
}
oUser.Disconnect()

```

The next code for checking if the user needs to login or not

```

#!/ring -cgi
Load "weblib.ring"
Load "datalib.ring"
Load "ex25_users.ring"

Import System.Web

oUser = new UsersModel
oUser.Connect()
lResult = oUser.FindWith("sessionid",aPageVars["sessionid"])
new page {
    if lResult
        text("User Name : " + oUser.username )
    else
        text("Please Login First!")
    ok
}
oUser.Disconnect()

```

52.23 Database, ModelBase & ControllerBase classes

In this section we will see some code from datalib.ring

The next code presents the Database, ModelBase & ControllerBase classes

```

Import System.Web

Class Database

    cServer = "localhost"
    cUserName = "root"
    cPassword = "root"
    cDatabase = "mahdb"

    Func Connect

        con = mysql_init()
        mysql_connect(con, cServer, cUserName, cPassWord, cDatabase)

    Func Disconnect

        mysql_close(con)

    Func Query cQuery

        mysql_query(con, cQuery)

    Func QueryResult

        return mysql_result(con)

    Func QueryResultWithColumns
        # return columns names + query result
        return mysql_result2(con)

```

(continues on next page)

(continued from previous page)

```

Func QueryValue
    aResult = mysql_result(con)
    if islist(aResult) and len(aResult) >= 1
        aResult = aResult[1]
        if len(aResult) >= 1
            return aResult[1]
    ok
ok
    return 0

Func EscapeString x
    if isstring(x)
        return MySQL_Escape_String(con,x)
    else
        return MySQL_Escape_String(con,string(x))
    ok

Private
    con = NULL

Class ModelBase from Database

    cTableName = ""
    cSearchColumn = "name"
    aColumns = []
    aQueryResult = []
    ID = 0

    # set table name from class name
    classname = lower(classname(self))
    if right(classname,5) = :model
        cTablename = left(classname,len(classname)-5)
    ok

Func Insert

    cValues = ""
    for x in aColumns
        cValues += " " + EscapeString(aPageVars[x]) + ", "
    Next
    cValues = left(cValues,len(cValues)-1) # remove last comma
    cColumns = ""
    for x in aColumns
        cColumns += x + ","
    next
    cColumns = left(cColumns,len(cColumns)-1)
    query("insert into " + cTableName + "("+cColumns+") values (" +
          cValues + ")")

Func Update nID

    cStr = ""
    for x in aColumns
        cStr += x + " = '" + EscapeString(aPageVars[x]) + "' , "
    # the space after comma is necessary
    Next
    cStr = left(cStr,len(cStr)-2)

```

(continues on next page)

(continued from previous page)

```

query("update " + cTableName + " set " + cStr + " where id = " + nID )

Func UpdateColumn cColumn,cValue
query("update " + cTableName + " set " + cColumn + " = '" +
EscapeString(cValue) + "' where id = " + self.ID )

Func Count cValue
query("SELECT count(*) FROM " + cTableName +
" where "+cSearchColumn+" like '" + EscapeString(cValue) + "%'"')
return queryValue()

Func Read nStart,nRecordsPerPage
query("SELECT * FROM " + cTableName+" limit " + EscapeString(nStart) + "," +
EscapeString(nRecordsPerPage) )
aQueryResult = queryResult()

Func Search cValue,nStart,nRecordsPerPage
query("SELECT * FROM " + cTableName+" where "+cSearchColumn+" like '" +
EscapeString(cValue) + "%'" +
" limit " + EscapeString(nStart) + "," + EscapeString(nRecordsPerPage) )
aQueryResult = queryResult()

Func Find nID
query("select * from " + cTableName + " where id = " + EscapeString(nID) )
aResult = queryResult()[1]
# move the result from the array to the object attributes
ID = nID
cCode = ""
for x = 2 to len(aResult)
    cCode += aColumns[x-1] + " = hex2str('" + str2hex(aResult[x]) + "')"
next
eval(cCode)

Func FindWith cColumn,cValue
query("select * from " + cTableName + " where "+cColumn+" = '" +
EscapeString(cValue) + "'")
aResult = queryResult()
if len(aResult) > 0
    aResult = aResult[1]
else
    return 0
ok
# move the result from the array to the object attributes
ID = aResult[1]
cCode = ""
for x = 2 to len(aResult)
    cCode += aColumns[x-1] + " = hex2str('" + str2hex(aResult[x]) + "')"
next
eval(cCode)
return 1

```

(continues on next page)

(continued from previous page)

```

Func Delete ID

    query("delete from " + cTableName + " where id = " + EscapeString(ID) )

Func Clear

    cCode = ""
    for x in aColumns
        cCode += x + ' = ' + nl
    next
    eval(cCode)

Func LoadModel

    # create the columns array
    query("SELECT * FROM " + cTableName + " limit 0,1")
    aQueryResult = QueryResultWithColumns() [1]
    for x = 2 to len(aQueryResult)
        aColumns + lower(trim(aQueryResult[x]))
    next

    # create attribute for each column
    for x in aColumns
        addattribute(self,x)
    next

Func Connect

    Super.Connect()
    if nLoadModel = 0
        nLoadModel = 1
        LoadModel()
    ok

private

    nLoadModel = 0

Class ControllerBase

    nRecordsPerPage = 5
    nRecordsCount = 0
    nPagesCount = 0
    nActivePage = 0

    # Dynamic creation of oView = new tablenameView and oModel = new tablename.Model
    classname = lower(classname(self))
    if right(classname,10) = :controller
        tablename = left(classname,len(classname)-10)
        cCode = "oView = new " + tablename + "View" + nl
        cCode += "oModel = new " + tablename + "Model" + nl
        eval(cCode)
        oModel.connect()
    ok

    cSearchName = "searchname"

```

(continues on next page)

(continued from previous page)

```

cPart = "part"
cPageError = "The page number is not correct"
cLast = "last"
cOperation = "operation"
cRecID = "recid"

aColumnNames = ["id"]
for t in oModel.aColumns
    aColumnNames + t
next

cMainURL = website + "?"

func Routing

    switch      aPageVars[cOperation]
    on NULL    showtable()
    on :add     addrecord()
    on :save    saverecord()
    on :delete  deleterecord()
    on :edit    editrecord()
    on :update  updaterecord()
    off

func ShowTable

    nRecordsCount = oModel.Count( aPageVars[cSearchName] )

    nPagesCount = ceil(nRecordsCount / nRecordsPerPage)

    if aPageVars[cPart] = cLast
        aPageVars[cPart] = string(nPagesCount)
    ok

    nActivePage = number(aPageVars[cPart])
    if nActivePage = 0 nActivePage = 1 ok

    if ( nActivePage > nPagesCount ) and nRecordsCount > 0
        ErrorMsg(cPageError)
        return
    ok

    nStart = (nActivePage-1)*nRecordsPerPage

    if aPageVars[cSearchName] = NULL
        oModel.Read( nStart,nRecordsPerPage )
    else
        oModel.Search( aPageVars[cSearchName],nStart,nRecordsPerPage )
    ok

    oView.GridView(self)

func AddRecord

    oModel.clear()
    oView.FormViewAdd(Self,:save,false) # false mean don't include record id

```

(continues on next page)

(continued from previous page)

```

func SaveRecord

    oModel.Insert()
    oView.SaveView(self)

func EditRecord

    oModel.Find( aPageVars[cRecID] )
    oView.FormViewEdit(Self,:update,true) # true mean include record id

func UpdateRecord

    oModel.update( aPageVars[cRecID] )
    oView.UpdateView(self)

func DeleteRecord

    oModel.Delete( aPageVars[cRecID] )
    oView.DeleteView()

func braceend

    oModel.Disconnect()

```

52.24 WebLib API

In this section we will see the web library functions, classes and methods.

Function	Parameters	Description
LoadVars	None	Save the request parameters and cookies to aPageVars List
WebPage	None	Create new object from the WebPage Class
BootStrapWebPage	None	Create new object from the BootStrapWebPage Class
HTMLSpecialChars	cString	Encode Special characters to HTML equivalent
Template	cFile,oObject	Execute Ring Code in cFile after accessing oObject using {}
Alert	cMessage	Generate HTML Web Page that display cMessage using JavaScript Alert()
HTML2PDF	cString	Generate and Display PDF File from HTML String (cString)

The Package System.Web contains the next classes

Class Name	Description
Application	Contains methods for Encoding, Decoding, Cookies & More.
Page	Contains methods to generate HTML pages.
ScriptFunctions	Contains methods to generate some JavaScript Functions.
StyleFunctions	Contains methods to generate CSS.
PageBuffer	Generate HTML Page in memory (don't print the output).
HTML2PDF	Generate PDF File from HTML code.
BootStrapPage	Using BootStrap Library.
WebPage	Generate page using objects for each element.
HtmlPage	Like WebPage but doesn't print the output to stdout.
BootStrapWebPage	Generate page using objects, using BootStrap Library.

continues on next page

Table 1 – continued from previous page

Class Name	Description
ObjsBase	Parent Class for page objects.
NewObjectsFunctions	Methods to create new objects in the page or element.
H1	Wraps HTML H1.
H2	Wraps HTML H2.
H3	Wraps HTML H3.
H4	Wraps HTML H4.
H5	Wraps HTML H5.
H6	Wraps HTML H6.
P	Wraps HTML P.
Link	Wraps HTML link.
NewLine	Wraps HTML NewLine.
Div	Wraps HTML Div.
Form	Wraps HTML Form.
Input	Wraps HTML Input.
TextArea	Wraps HTML TextArea.
Select	Wraps HTML Select.
Option	Wraps HTML Option.
Image	Wraps HTML Image.
UL	Wraps HTML UL.
LI	Wraps HTML LI.
Table	Wraps HTML Table.
TR	Wraps HTML TR.
TD	Wraps HTML TD.
TH	Wraps HTML TH.
Audio	Wraps HTML Audio.
Video	Wraps HTML Video.
Nav	Wraps HTML Nav.
Span	Wraps HTML Span.
Button	Wraps HTML Button.

52.25 Application Class

Method	Parameters	Description
DecodeString	cString	Decode request parameters
Decode	cString	Decode multipart/form-data
GetFileName	aArray,cVar	Get File Name in aArray using cVar
SetCookie	name,value,expires,path,domain,secure	Set Cookie
Cookie	name,value	Set Cookie using name and value only
GetCookies	None	Get Cookies
URLEncode	cString	URL Encode
ScriptLibs	None	Add JavaScript Libraries like BootStrap
Print	None	Print Page Content
Style	cStyle	Add cStyle to page CSS content
StartHTML	None	Add HTTP Header to page content

The method DecodeString is used to get HTTP request parameters.

The methods Decode and GetFileName are used for uploading files.

The methods SetCookie, Cookie & GetCookies are used for adding and reading cookies.

The methods StartHTML, ScriptsLibs, Style & Print are used for page structure and JS/CSS support.

The method URLEncode is used to encode a URL to be used in HTML pages.

52.26 Page Class

Method	Parameters	Description
text	x	add HTMLSpecialChars(x) to page content (accept strings and numbers)
html	cString	add html code to page content
h1	x	add x to page content between <h1> and </h1>
h2	x	add x to page content between <h2> and </h2>
h3	x	add x to page content between <h3> and </h3>
h4	x	add x to page content between <h4> and </h4>
h5	x	add x to page content between <h5> and </h5>
h6	x	add x to page content between <h6> and </h6>
p	aPara	HTML <p> </p>, uses aPara List as Hash to get attributes
NewLine	None	add to page content
AddAttributes	aPara	Convert aPara list as hash to HTML element attributes
Link	aPara	HTML <a href> and , uses aPara List as Hash to get attributes
Image	aPara	HTML , uses aPara List as Hash to get attributes
Button	aPara	HTML <input type="button">, uses aPara List as Hash to get attributes
ButtonLink	aPara	HTML <input type="button">, uses link attribute to navigate to link
Textbox	aPara	HTML <input type="text">, uses aPara List as Hash to get attributes
Editbox	aPara	HTML <textarea> and </textarea>, uses aPara to get attributes
Combobox	aPara	HTML <select>, uses items attribute as list for <option>
Listbox	aPara	HTML <select multiple='multiple'>, uses items attribute for <option>
ulstart	aPara	HTML
ulend	aPara	HTML
listart	aPara	HTML
liend	aPara	HTML
List2UL	aList	Generate HTML including items from Ring List items
DivStart	aPara	HTML <div>, uses aPara List as Hash to get attributes
NavStart	aPara	HTML <nav>, uses aPara List as Hash to get attributes
SpanStart	aPara	HTML , uses aPara List as Hash to get attributes
BoxStart	None	Generate Div with black background to be used as page header
DivEnd	None	HTML </div>
NavEnd	None	HTML </nav>
SpanEnd	None	HTML
BoxEnd	None	HTML </div>, the same as divend()
FormStart	cAction	HTML <form>, with cAction as the action attribute or an empty value
FormPost	cAction	HTML <form method="post"> , with cAction as the action attribute
FormEnd	None	HTML </form>
Submit	aPara	HTML <input type="submit">
Hidden	cName,cValue	HTML <input type="hidden">
FormUpload	x	HTML Form, method="post" enctype="multipart/form-data" and x = action
UploadFile	x	HTML <input type="file"> and name = x
Video	aPara	HTML <video>
Audio	aPara	HTML <audio>

continues on next page

Table 2 – continued from previous page

Method	Parameters	Description
GetColor	aPara	Select Color
Radio	aPara	HTML <input type="radio">
Checkbox	aPara	HTML <input type="checkbox">
Spinner	aPara	HTML <input type="number">
Slider	aPara	HTML <input type="range">
TableStart	aPara	HTML <table>
TableEnd	None	HTML </table>
RowStart	aPara	HTML <tr>
RowEnd	None	HTML </tr>
CellStart	aPara	HTML <td>
CellEnd	None	HTML </td>
HeaderStart	aPara	HTML <th>
HeaderEnd	None	HTML </th>

aPara in the page methods is a list contains attributes and values. Using aPara we can set values for the next attributes

```
classname id name align style dir value onclick oncontextmenu ondblclick
onmousedown onmouseenter onmouseleave onmousemove onmouseover onmouseout
onmouseup onkeydown onkeypress onkeyup onabort onbeforeunload onerror
onhashchange onload onpageshow onpagehide onresize onscroll onunload
onblur onchange onfocus onfocusin onfocusout oninput oninvalid onreset
onsearch onselect onsubmit ondrag ondragend ondragenter ondragleave
ondragover ondragstart ondrop oncopy oncut onpaste onafterprint
onbeforeprint oncanplay oncanplaythrough ondurationchange onemptied
onended onloadeddata onloadedmetadata onloadstart onpause onplay
onplaying onprogress onratechange onseeked onseeking onstalled onsuspend
ontimeupdate onvolumechange onwaiting animationend animationiteration
animationstart transitionend onmessage onopen onmousewheel ononline
onoffline onpostate onshow onstorage ontoggle onwheel ontouchcancel
ontouchend ontouchmove ontouchstart color opacity background backgroundattachment
backgroundcolor backgroundimage backgroundposition backgroundrepeat backgroundclip
backgroundorigin backgroundsize border borderbottom borderbottomcolor
borderbottomleftradius borderbottomrightradius borderbottomstyle borderbottomwidth
bordercolor borderimage borderimageoutset borderimagerepeat borderimageslice
borderimagesource borderimagewidth borderleft borderleftcolor borderleftstyle
borderleftwidth borderradius borderright borderrightcolor borderrightstyle
borderrightwidth borderstyle bordertop bordertopcolor bordertopleftradius
bordertoprightradius bordertopstyle bordertopwidth borderwidth boxdecorationbreak
boxshadow bottom clear clip display float height left margin marginbottom marginleft
marginright margin-top maxheight maxwidth minheight minwidth overflow overflowx
overflowy padding padding-bottom padding-left padding-right padding-top position
right top visibility width vertical-align z-index align-content align-items align-self
flex flex-basis flex-direction flex-flow flex-grow flex-shrink flex-wrap justify-content
order hanging-punctuation hyphens letter-spacing line-break line-height overflow-wrap
tab-size text-align text-align-last text-combine-upright text-indent text-justify
text-transform white-space word-break word-spacing word-wrap text-decoration
text-decoration-color text-decoration-line text-decoration-style text-shadow
text-underline-position @font-face @font-feature-values font font-family font-feature-settings
font-kerning font-language-override font-size font-size-adjust font-stretch font-style
font-synthesis font-variant font-variant-alternates font-variant-caps font-variant-east-asian
font-variant-ligatures font-variant-numeric font-variant-position font-weight direction
text-orientation unicode-bidi writing-mode border-collapse border-spacing caption-side
empty-cells table-layout counter-increment counter-reset list-style list-style-image
list-style-position list-style-type @keyframes animation animation-delay animation-direction
```

(continues on next page)

(continued from previous page)

```
animationduration animationfillmode animationiterationcount animationname
animationplaystate animationontimingfunction backfacevisibility perspective
perspectiveorigin transform transformorigin transformstyle transition
transitionproperty transitionduration transitionontimingfunction transitiondelay
boxsizing content cursor imemode navdown navindex navleft navright navup
outline outlinecolor outlineoffset outlinestyle linewidth resize textoverflow
breakafter breakbefore breakinside columncount columnfill columngap columnrule
columnrulecolor columnrulestyle columnrulewidth columnspan columnwidth columns
widows orphans pagebreakafter pagebreakbefore pagebreakinside marks quotes
filter imageorientation imagerendering imageresolution objectfit objectposition
mask masktype mark markafter markbefore phonemes rest restafter restbefore
voicebalance voiceduration voicepitch voicepitchrange voicerate voicestress
voicevolume marquedirection marqueeplaycount marquespeed marqueestyle datatoggle
dataride datatarget dataslideto dataslide datadismiss dataplaceholder datacontent
datatrigger dataspy dataoffset dataoffsettop
```

52.27 ScriptFunctions Class

This class contains methods for adding JavaScript code to the generated web page.

The class methods are merged to the Page class, so we can use the next methods with page objects directly.

Method	Parameters	Description
Script	cCode	Add cCode string between <script> and </script>
ScriptRedirection	cURL	set window.location to cURL
ScriptFunc	cFuncName,cCode	Define function cFuncName that contains cCode
ScriptFuncAlert	cFuncName,cMsg	Define function cFuncName that uses alert() to print cMsg
ScriptFuncAjax	cFuncName,cLink,cDiv	Define function cFuncName that load cLink in cDiv
ScriptFuncClean	cFuncName,cDiv	Define function cFuncName that clear the cDiv
ScriptFuncSelect	cF,aL,cD,cR,cGR,cFC,nTO,cL1,cL2	Used to Edit/Delete Grid Record
ScriptScrollFixed	cDiv,nSize	Set cDiv as Fixed Div with Size = nSize

52.28 StyleFunctions Class

This class contains methods for adding CSS to the generated web page.

Like ScriptFunctions Class, The StyleFunctions class methods are merged to the Page class, so we can use the next methods with page objects directly.

Method	Parameters	Description
StyleFloatLeft	None	Return float: left ;
StyleFloatRight	None	Return float: right ;
StyleSizeFull	None	Return width: 100% ; height: 100% ;
Stylecolor	x	Return " color: " + x + ";"
Stylebackcolor	x	Return " background-color: " + x + ";"
StyleTextCenter	None	Return "text-align: center ;"
StyleTextRight	None	Return "text-align: right ;"
StyleTextLeft	None	Return "text-align: left ;"
StyleSize	x,y	Return " width: " + x + " ; height: " + y + " ;"
StyleWidth	x	Return " width: " + x + " ;"
StyleHeight	x	Return " height: " + x + " ;"
StyleTop	x	Return " top: " + x + " ;"
StyleLeft	x	Return " Left: " + x + " ;"
StylePos	x,y	Return " top: " + x + " ;" + " Left: " + y + " ;"
StyleHorizontalCenter	None	Return " margin-right:auto ; margin-left:auto; "
StyleMarginTop	x	Return " margin-top: " + x + " ;"
StyleMarginRight	x	Return " margin-right: " + x + " ;"
StyleMarginLeft	x	Return " margin-left: " + x + " ;"
StyleDivCenter	nWidth,nHeight	Create Div in the center of the page
StyleAbsolute	None	Return " position:absolute ;"
StyleFixed	None	Return " position:fixed ;"
StyleZIndex	x	Return " z-index: " + x + " ;"
StyleFontSize	x	Return " font-size: " + x + " ;"
StyleGradient	x	Generate Gradient (x values from 1 to 60)
StyleTable	None	Set table properties
StyleTableRows	id	Set different color to even and odd rows in the table
StyleTableNoBorder	None	Return " border-style: none;"

52.29 WebPage Class

We use braces to access the active WebPage object attributes

Each one of these attribute will return a new object to access again using braces.

Attribute	Description
H1	Wraps HTML H1.
H2	Wraps HTML H2.
H3	Wraps HTML H3.
H4	Wraps HTML H4.
H5	Wraps HTML H5.
H6	Wraps HTML H6.
P	Wraps HTML P.
Link	Wraps HTML link.
NewLine	Wraps HTML NewLine.
Div	Wraps HTML Div.
Form	Wraps HTML Form.
Input	Wraps HTML Input.
TextArea	Wraps HTML TextArea.
Select	Wraps HTML Select.
Option	Wraps HTML Option.
Image	Wraps HTML Image.
UL	Wraps HTML UL.
LI	Wraps HTML LI.
Table	Wraps HTML Table.
TR	Wraps HTML TR.
TD	Wraps HTML TD.
TH	Wraps HTML TH.
Audio	Wraps HTML Audio.
Video	Wraps HTML Video.
Nav	Wraps HTML Nav.
Span	Wraps HTML Span.
Button	Wraps HTML Button.

52.30 HtmlPage Class

The same as the WebPage class with the next changes

- (1) No output to the stdout
- (2) Provide the Output Method to get the output

Syntax:

```
output() ---> The output as string
```

CHAPTER FIFTYTHREE

DEPLOYING WEB APPLICATIONS IN THE CLOUD

In this chapter we will learn about deploying Ring Web Applications in the Cloud using Heroku

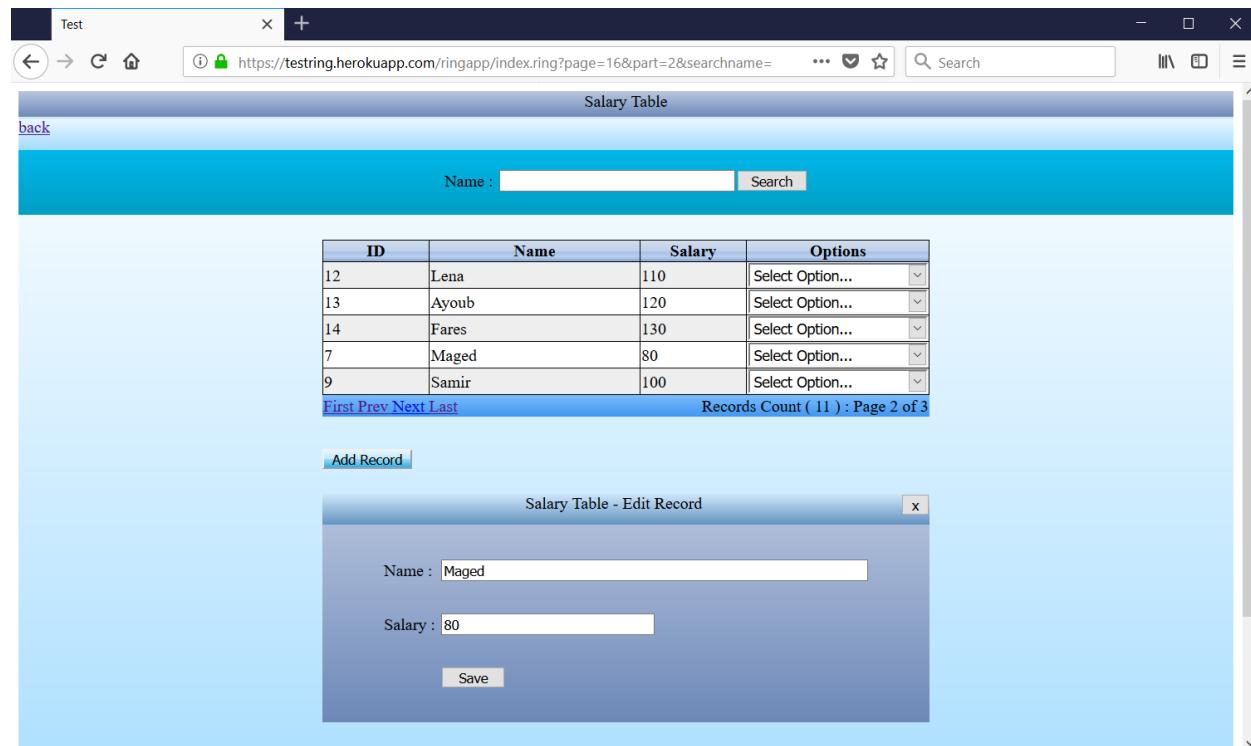
53.1 Introduction

We created a new project and tutorial to explain how to deploy Ring web applications in the Cloud using Heroku

Demo : <http://testring.herokuapp.com/>

Project : <https://github.com/ring-lang/RingWebAppOnHeroku>

Heroku Website : <https://www.heroku.com/>



The screenshot shows a web browser window with the title 'Test'. The address bar indicates the URL is <https://testring.herokuapp.com/ringapp/index.ring?page=16&part=2&searchname=>. The main content area is titled 'Salary Table' and displays a table with the following data:

ID	Name	Salary	Options
12	Lena	110	Select Option...
13	Ayoub	120	Select Option...
14	Fares	130	Select Option...
7	Maged	80	Select Option...
9	Samir	100	Select Option...

Below the table, there are navigation links: First, Prev, Next, Last, and a message indicating 'Records Count (11) : Page 2 of 3'. At the bottom of the main page, there is a button labeled 'Add Record'. A modal window titled 'Salary Table - Edit Record' is overlaid on the page, containing fields for 'Name' (Maged) and 'Salary' (80), with a 'Save' button.

53.2 Usage

To use this project and deploy it on Heroku

- (1) Create Heroku account
- (2) Open your Heroku account and create new application

Example : testring

Note (You have to select a unique name for your application)

- (3) Open the command prompt, Create new folder : MyApp

```
md MyApp
```

- (4) Open the application folder

```
cd MyApp
```

- (5) Clone this projet using Git (Don't forget the dot in the end to clone in the current directory)

```
git clone https://github.com/ring-lang/RingWebAppOnHeroku .
```

- (6) Login to Heroku (Enter your Email and Password)

```
heroku login
```

- (7) Add heroku (remote) to your Git project

change testring to your application name

```
heroku git:remote -a testring
```

- (8) Set the buildpacks (So Heroku can know how to support your project)

```
heroku buildpacks:add --index 1 https://github.com/ring-lang/heroku-buildpack-apt
heroku buildpacks:add --index 2 https://github.com/ring-lang/heroku-buildpack-ring
```

- (9) Now build your project and deploy it

```
git push heroku master
```

- (10) Test your project (In the browser)

```
heroku open
```

53.3 Ring source code files and permissions

To be able to run your new Ring scripts, Set the permission of the file to be executable using Git

For example, if you created a file : myscript.ring

```
git update-index --chmod=+x myscript.ring
git commit -m "Update file permission"
```

If you are using TortoiseGit, From windows explorer, select the file
 Right click → Properties → Git → Executable (+x)
 Then commit and deploy!

53.4 Hello World program

file : ringapp/helloworld.ring

To run it : <http://testring.herokuapp.com/ringapp/helloworld.ring>

```
#!/app/runring.sh -cgi

see "content-type: text/html" +nl+nl
see "Hello, World!" + nl
```

file : ringapp/helloworld2.ring

To run it : <http://testring.herokuapp.com/ringapp/helloworld2.ring>

```
#!/app/runring.sh -cgi
load "weblib.ring"
import System.Web
new page {
    text("Hello, World!")
}
```

53.5 Application Database

When you depoly the application, Everything will works directly!

No change is required, but in practice, You will need to update the next files to use your database

There are two scripts to interact with the database (We are using PostgreSQL in the cloud)

You will need to update the connection string in these files if you will use another database

- file: ringapp/database/newdb.ring (We run it using the browser for one time to create the tables)
- file: ringapp/datalib.ring (Class: Database)

In your practical projects, You can write better code (To be able to change the database)

Also you can create configuration file (To write the connection string in one place)

Database service : <https://www.heroku.com/postgres>

53.6 Deploying after updates

Just use Git and commit then push to heroku

file: build.bat contains the next commands for quick tests

```
git add .
git commit -m "Update RingWebAppOnHeroku"
git push heroku master
heroku open
```

53.7 Local Tests

Local tests using Ring Notepad on Windows (Using local Apache Web Server)

Replace the first line in the file : ringapp/index.ring with

```
#!ring -cgi
```

Then run it from Ring Notepad (Ctrl+F6)

CHAPTER
FIFTYFOUR

GRAPHICS AND 2D GAMES PROGRAMMING USING RINGALLEGRO

In this chapter we will learn how to use the allegro game programming library in our Ring applications.

We have the file gamelib.ring that load the DLL library that contains wrappers for the Allegro functions

```
Load "allegro.rh"
if iswindows()
    LoadLib("ring_allegro.dll")
but ismacosx()
    LoadLib("libringallegro.dylib")
else
    LoadLib("libringallegro.so")
ok
```

The file gamelib.ring uses the Load instruction to execute the file allegro.rh which is a ring source code file contains constants to be used in our programs. Then using the function LoadLib() we can load the DLL library “ring_allegro.dll”.

To write portable code we can change the gamelib.ring to check the platform before loading the DLL/So file.

54.1 Drawing, Animation and Input

The next example uses the Allegro library for drawing, moving objects on the screen and getting input from the keyboard and the mouse.

```
Load "gamelib.ring"

al_init()
al_init_image_addon()

display = al_create_display(640,480)

al_show_native_message_box(display, "Hello", "Welcome",
                           "Using Allegro from the Ring programming language",
                           "", 0);

al_clear_to_color(al_map_rgb(0,0,255))

BOUNCER_SIZE = 40
bouncer_x = 10
bouncer_y = 20
bouncer = al_create_bitmap(BOUNCER_SIZE, BOUNCER_SIZE)
al_set_target_bitmap(bouncer)
```

(continues on next page)

(continued from previous page)

```

al_clear_to_color(al_map_rgb(255,0,255))

for x = 1 to 30
    bouncer_x += x
    bouncer_y += x
    al_set_target_bitmap(al_get_backbuffer(display))
    al_clear_to_color(al_map_rgb(0,0,0))
    al_draw_bitmap(bouncer, bouncer_x, bouncer_y, 0)
    al_draw_bitmap(bouncer, 200+bouncer_x,200+ bouncer_y, 0)
    al_flip_display()
    al_rest(0.1)
next

al_clear_to_color(al_map_rgb(255,255,255))
image = al_load_bitmap("man2.jpg")
al_draw_bitmap(image,200,200,0)
al_flip_display()
al_rest(2)

event_queue = al_create_event_queue()
al_register_event_source(event_queue, al_get_display_event_source(display))

ev = al_new_allegro_event()
timeout = al_new_allegro_timeout()
al_init_timeout(timeout, 0.06)

FPS = 60
timer = al_create_timer(1.0 / FPS)
al_register_event_source(event_queue, al_get_timer_event_source(timer))
al_start_timer(timer)
redraw = true

SCREEN_W = 640
SCREEN_H = 480
BOUNCER_SIZE = 32
bouncer_x = SCREEN_W / 2.0 - BOUNCER_SIZE / 2.0
bouncer_y = SCREEN_H / 2.0 - BOUNCER_SIZE / 2.0
bouncer_dx = -4.0
bouncer_dy = 4.0

al_install_mouse()
al_register_event_source(event_queue, al_get_mouse_event_source())

al_install_keyboard()
al_register_event_source(event_queue, al_get_keyboard_event_source())

KEY_UP = 1
KEY_DOWN = 2
KEY_LEFT = 3
KEY_RIGHT = 4
Key = [false,false,false,false]

while true
    al_init_timeout(timeout, 0.06)
    al_wait_for_event_until(event_queue, ev, timeout)
    switch al_get_allegro_event_type(ev)
    on ALLEGRO_EVENT_DISPLAY_CLOSE

```

(continues on next page)

(continued from previous page)

```

exit
on ALLEGRO_EVENT_TIMER

    # Animation
    if bouncer_x < 0 or bouncer_x > SCREEN_W - BOUNCER_SIZE
        bouncer_dx = -bouncer_dx
    ok

    if bouncer_y < 0 or bouncer_y > SCREEN_H - BOUNCER_SIZE
        bouncer_dy = -bouncer_dy
    ok

    bouncer_x += bouncer_dx
    bouncer_y += bouncer_dy

    # Keyboard
    if key[KEY_UP] and bouncer_y >= 4.0
        bouncer_y -= 4.0
    ok
    if key[KEY_DOWN] and bouncer_y <= SCREEN_H - BOUNCER_SIZE - 4.0
        bouncer_y += 4.0
    ok
    if key[KEY_LEFT] and bouncer_x >= 4.0
        bouncer_x -= 4.0
    ok
    if key[KEY_RIGHT] and bouncer_x <= SCREEN_W - BOUNCER_SIZE - 4.0
        bouncer_x += 4.0
    ok

    redraw = true

on ALLEGRO_EVENT_MOUSE_AXES
    bouncer_x = al_get_allegro_event_mouse_x(ev)
    bouncer_y = al_get_allegro_event_mouse_y(ev)
on ALLEGRO_EVENT_MOUSE_ENTER_DISPLAY
    bouncer_x = al_get_allegro_event_mouse_x(ev)
    bouncer_y = al_get_allegro_event_mouse_y(ev)
on ALLEGRO_EVENT_MOUSE_BUTTON_UP
    exit
on ALLEGRO_EVENT_KEY_DOWN
    switch al_get_allegro_event_keyboard_keycode(ev)
        on ALLEGRO_KEY_UP
            key[KEY_UP] = true
        on ALLEGRO_KEY_DOWN
            key[KEY_DOWN] = true
        on ALLEGRO_KEY_LEFT
            key[KEY_LEFT] = true
        on ALLEGRO_KEY_RIGHT
            key[KEY_RIGHT] = true
    off
on ALLEGRO_EVENT_KEY_UP
    switch al_get_allegro_event_keyboard_keycode(ev)
        on ALLEGRO_KEY_UP
            key[KEY_UP] = false
        on ALLEGRO_KEY_DOWN
            key[KEY_DOWN] = false
        on ALLEGRO_KEY_LEFT

```

(continues on next page)

(continued from previous page)

```

        key[KEY_LEFT] = false
on ALLEGRO_KEY_RIGHT
        key[KEY_RIGHT] = false
on ALLEGRO_KEY_ESCAPE
        exit
off
if redraw and al_is_event_queue_empty(event_queue)
    redraw = false
    al_clear_to_color(al_map_rgb(0,0,0))
    al_draw_bitmap(bouncer, bouncer_x, bouncer_y, 0)
    al_flip_display()
ok
callgc()
end

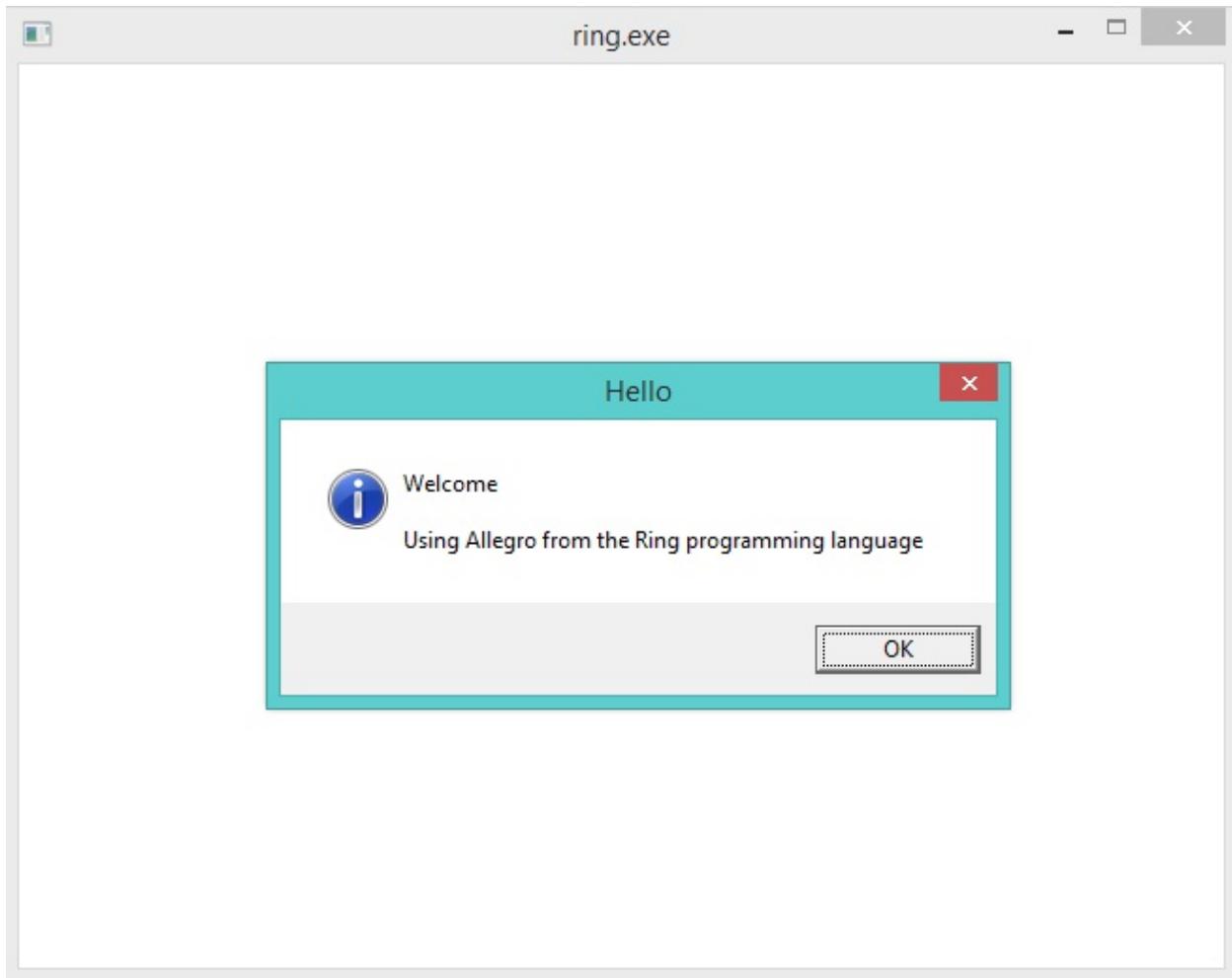
al_destroy_timer(timer)
al_destroy_allegro_event(ev)
al_destroy_allegro_timeout(timeout)
al_destroy_event_queue(event_queue)
al_destroy_bitmap(bouncer)
al_destroy_bitmap(image)
al_destroy_display(display)

```

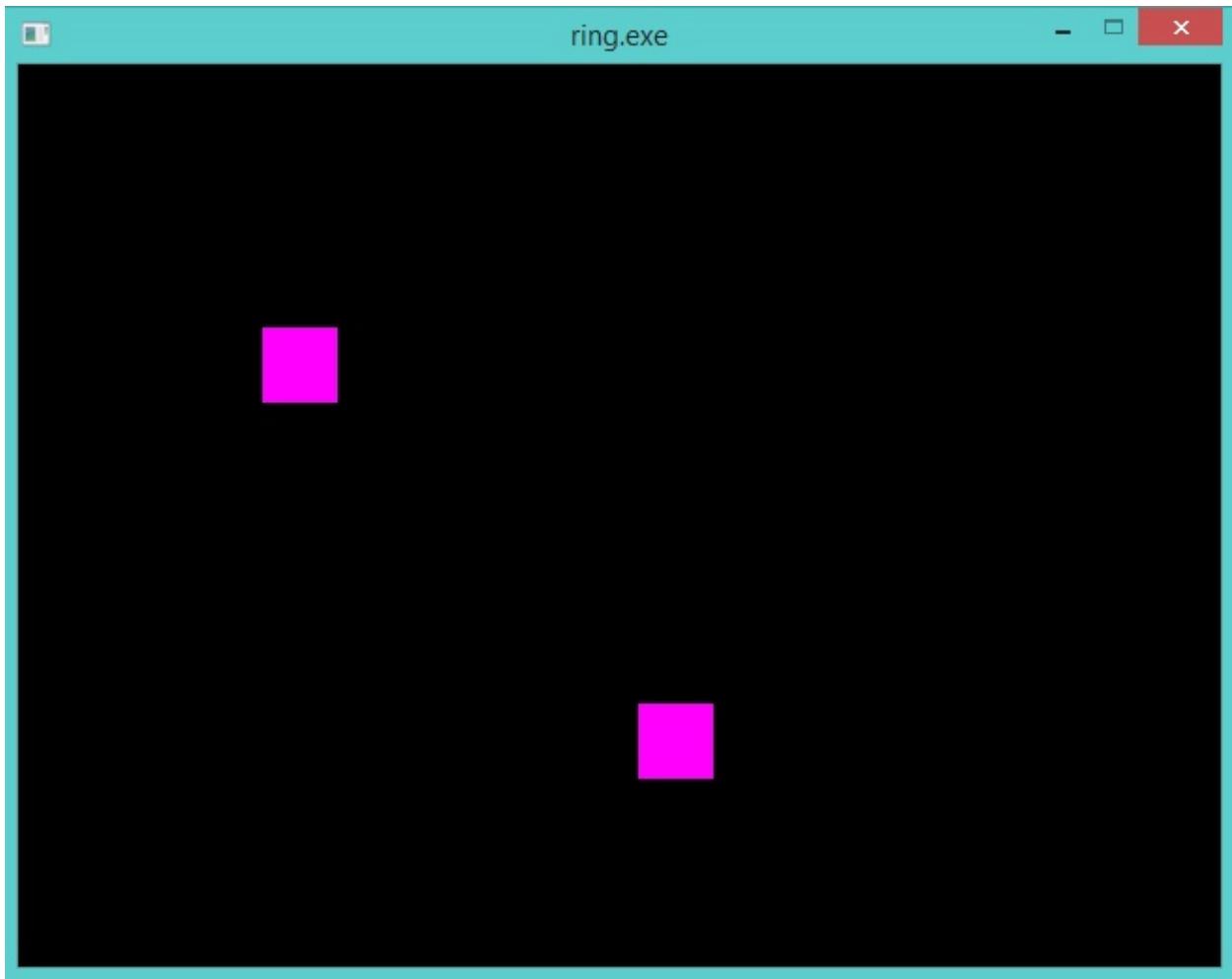
Note: In the previous example we used the function callgc() which is a Ring function to force calling the Garbage collector inside the While/End loop.

Program Output:

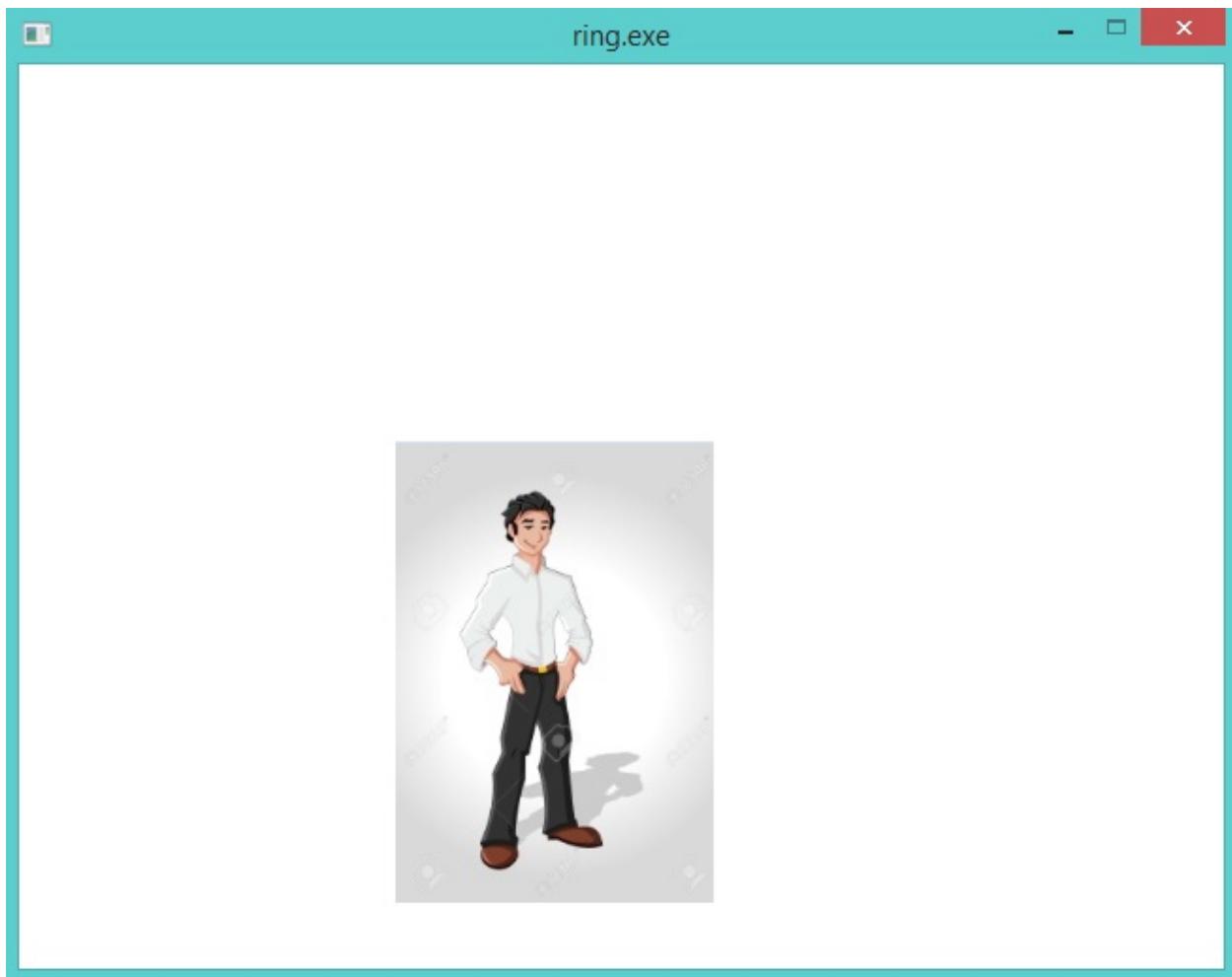
At first the program display a messagebox



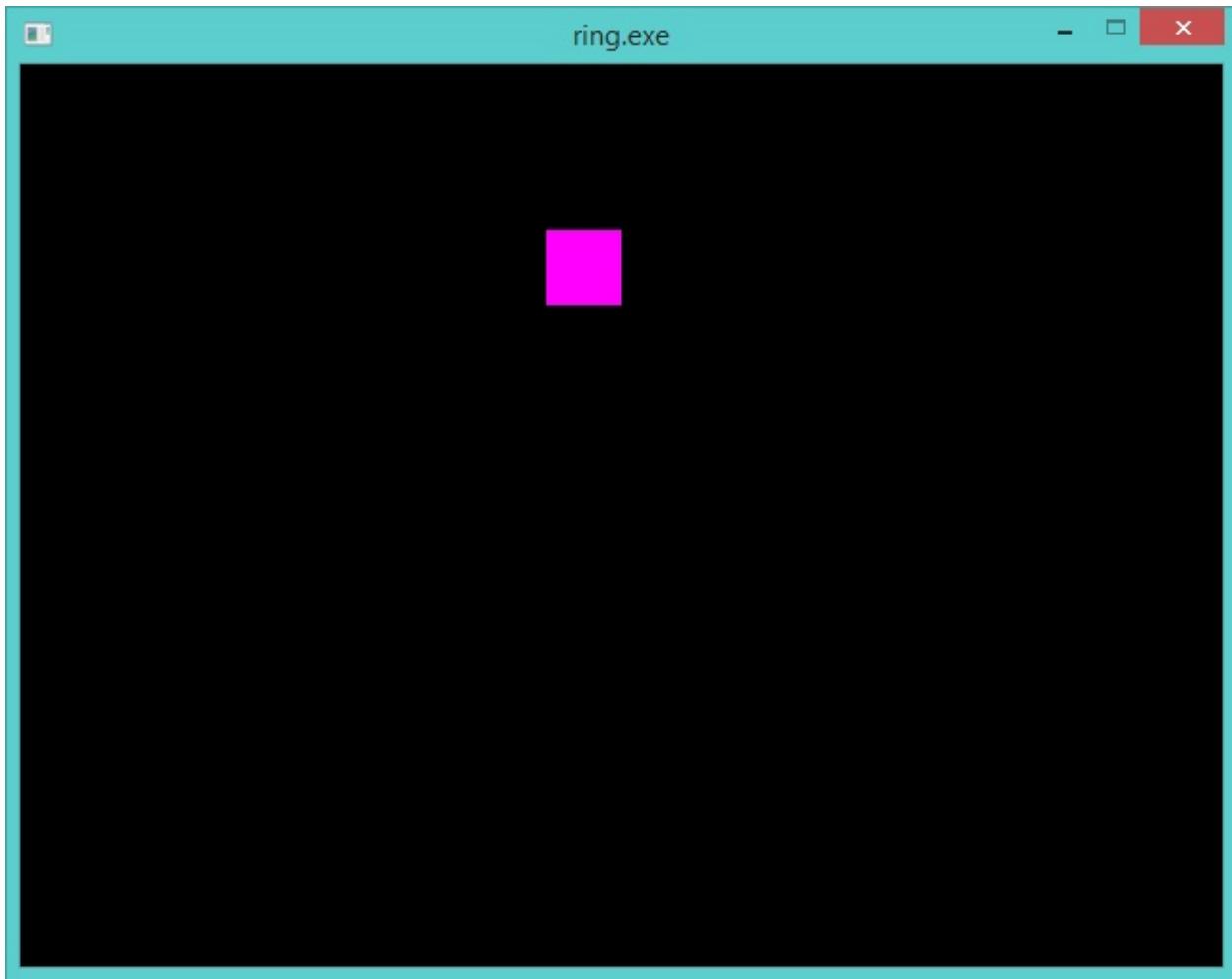
Then we see two rectangles are moving on the screen



Then we see an image displayed on the screen



Finally we have one rectangle, and we see it moving all of the time on the screen but we can control it using the Mouse and/or the Keyboard



54.2 Using TrueType Fonts

In this example we will see how to use TrueType Fonts *.ttf in our Games using Allegro

```
Load "gamelib.ring"

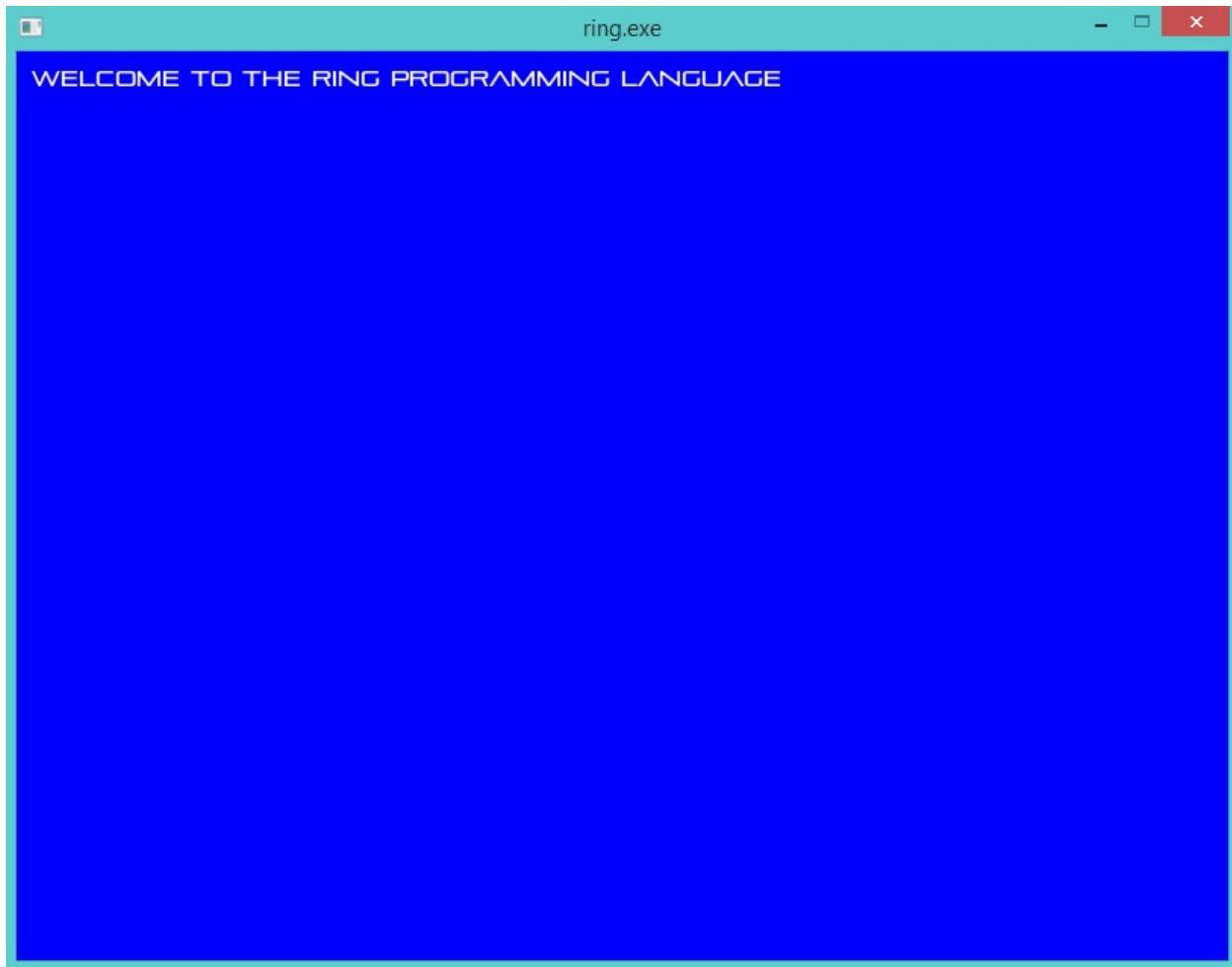
al_init()
al_init_font_addon()
al_init_ttf_addon()

display = al_create_display(800,600)

al_clear_to_color(al_map_rgb(0,0,255))
font = al_load_ttf_font("pirulen.ttf",14,0 )
al_draw_text(font, al_map_rgb(255,255,255), 10, 10,ALLEGRO_ALIGN_LEFT,
            "Welcome to the Ring programming language")
al_flip_display()
al_rest(2)

al_destroy_display(display)
```

Screen Shot:



54.3 Playing Sound Files

The next example play a sound file

```
Load "gamelib.ring"

al_init()
al_install_audio()
al_init_acodec_addon()
al_reserve_samples(1)

sample = al_load_sample( "footstep.wav" )

sampleid = al_new_allegro_sample_id()
al_play_sample(sample, 1.0, 0.0, 1.0, ALLEGRO_PLAYMODE_LOOP, sampleid)

display = al_create_display(640, 480)
al_clear_to_color(al_map_rgb(0, 0, 255))
al_flip_display()
al_rest(10)
```

(continues on next page)

(continued from previous page)

```
al_destroy_allegro_sample_id(sampleid)
al_destroy_sample(sample)
al_destroy_display(display)

al_exit()
```

54.4 Scaling and Rotating Images

The next example display and rotate an image

```
Load "gamelib.ring"

al_init()
al_init_image_addon()

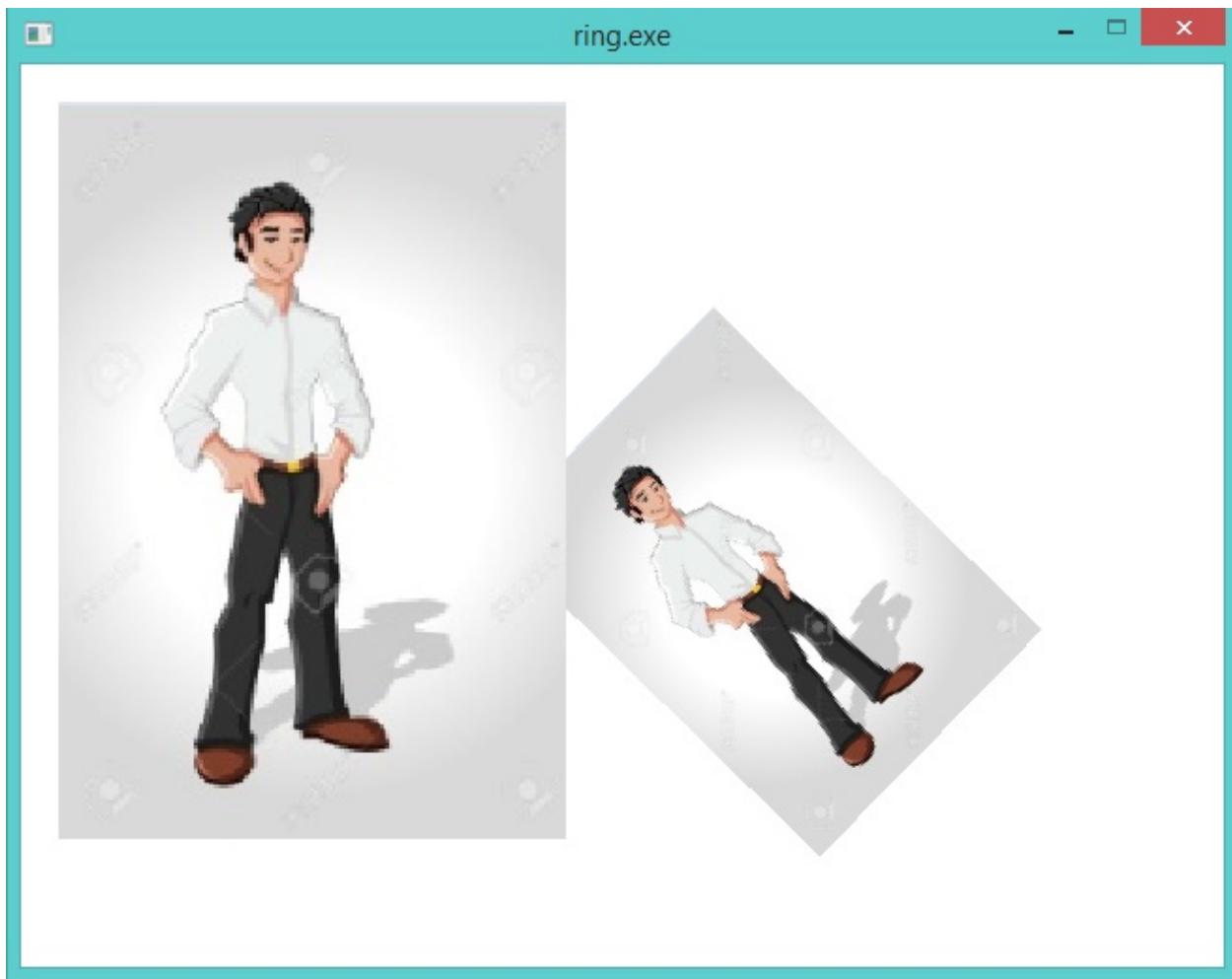
display = al_create_display(640,480)
al_set_target_bitmap(al_get_backbuffer(display))
al_clear_to_color(al_map_rgb(255,255,255))

image = al_load_bitmap("man2.jpg")
al_draw_rotated_bitmap(image,0,0,250,250,150,0)
al_draw_scaled_bitmap(image,0,0,250,250,20,20,400,400,0)

al_flip_display()
al_rest(2)

al_destroy_bitmap(image)
al_destroy_display(display)
```

Screen Shot:



54.5 Display Transparent Image

The next example display image with white background on another image

```
Load "gamelib.ring"

al_init()
al_init_image_addon()

display = al_create_display(640, 480)
imageback = al_load_bitmap("palace.jpg")
al_draw_bitmap(imageback, 0, 0, 0)

image = al_load_bitmap("man4.png")
al_convert_mask_to_alpha(image, al_map_rgb(255, 255, 255))
al_draw_bitmap(image, 0, 0, 0)
al_flip_display()
al_rest(10)

al_destroy_bitmap(image)
al_destroy_display(display)
```

Screen Shot:



54.6 Using Threads

In this example we will learn how to use threads from the Allegro library

```
Load "gamelib.ring"

o1 = new mythreads

Func Main
    al_init()
    for k = 1 to 5
        al_create_thread("o1.thread1()")
        al_create_thread("o1.thread2()")
        al_create_thread("o1.thread3()")
    next
    al_rest(2)

Class Mythreads
```

(continues on next page)

(continued from previous page)

```
cAppName = "Threads Application"

Func Thread1
    for x = 1 to 5
        see x + nl
    next
    See 'Thread(1) : Application Name : ' + cAppName + nl

Func Thread2
    for x = 1 to 5
        see '*****' + x + nl
    next
    See 'Thread(2) : Application Name : ' + cAppName + nl

Func Thread3
    for x = 1 to 5
        see '!!!!' + x + nl
    next
    See 'Thread(3) : Application Name : ' + cAppName + nl
```

Output:

```
1
2
3
4
5
Thread(1) : Application Name : Threads Application
*****1
*****2
*****3
*****4
*****5
Thread(2) : Application Name : Threads Application
!!!!1
!!!!2
!!!!3
!!!!4
!!!!5
Thread(3) : Application Name : Threads Application
1
2
3
4
5
Thread(1) : Application Name : Threads Application
!!!!1
!!!!2
!!!!3
!!!!4
!!!!5
Thread(2) : Application Name : Threads Application
*****1
*****2
*****3
*****4
*****5
```

(continues on next page)

(continued from previous page)

```
Thread(2) : Application Name : Threads Application
*****1
*****2
*****3
*****4
*****5
Thread(2) : Application Name : Threads Application
!!!!1
!!!!2
!!!!3
!!!!4
!!!!5
Thread(3) : Application Name : Threads Application
1
2
3
4
5
Thread(1) : Application Name : Threads Application
*****1
*****2
*****3
*****1
*****4
*****2
!!!!1
*****5
*****3
1
!!!!2
Thread(2) : Application Name : Threads Application
1
*****4
!!!!1
2
!!!!3
!!!!4
*****5
!!!!2
3
2
!!!!5
Thread(2) : Application Name : Threads Application
!!!!3
4
3
Thread(3) : Application Name : Threads Application
!!!!4
5
4
!!!!5
Thread(1) : Application Name : Threads Application
5
Thread(3) : Application Name : Threads Application
Thread(1) : Application Name : Threads Application
```

DEMO PROJECT - GAME ENGINE FOR 2D GAMES

In this chapter we will learn about using the different programming paradigms in the same project.

We will create a simple Game Engine for 2D Games.

You can use the Engine directly to create 2D Games for Desktop or Mobile.

55.1 Project Layers

The project contains the next layers

- Games Layer (Here we will use declarative programming)
- Game Engine Classes (Here we will use the Object-Oriented Programming paradigm)
- Interface to graphics library (Here we will use procedural programming)
- Graphics Library bindings (Here we have RingAllegro and RingLibSDL)

55.2 Graphics Library bindings

We already have RingAllegro to use the Allegro game programming library and we have RingLibSDL to use the LibSDL game programming library.

Both of RingAllegro and RingLibSDL are created using the C language with the help of the Ring code generator for extensions.

Each of them is over 10,000 lines of C code which is generated after writing simple configuration files (That are processed by the code generator).

Each configuration file determines the functions names, structures information and constants then the generator process this configuration file to produce the C code and the library that can be loaded from Ring code.

Using RingAllegro and RingLibSDL is very similar to using Allegro and LibSDL from C code where you have the same functions but we can build on that using the Ring language features

- RingAllegro Source Code : <https://github.com/ring-lang/ring/tree/master/extensions/ringallegro>
- RingLibSDL Source Code : <https://github.com/ring-lang/ring/tree/master/extensions/ringsdl>

55.3 Interface to graphics library

In this layer we have gl_allegro.ring and gl_libsdl.ring

Each library provides the same functions to be used with interacting with the Graphics Library.

This layer hides the details and the difference between RingAllegro and RingLibSDL.

You have the same functions, Just use it and you can switch between Allegro and LibSDL at anytime.

Why ?

Allegro is very simple, we can use it to quickly create 2D games for Windows, Linux and MacOS X.

In Ring 1.0 we started by supporting Allegro.

Also LibSDL is very powerful and popular, very easy to use for Mobile Development.

Ring 1.1 comes with support for LibSDL so we can quickly create games for Mobile.

Note: We can use just one library for Desktop and Mobile development.

- gl_allegro.ring source code : https://github.com/ring-lang/ring/blob/master/libraries/gameengine/gl_allegro.ring
- gl_libsdl.ring source code : https://github.com/ring-lang/ring/blob/master/libraries/gameengine/gl_libsdl.ring

55.4 Game Engine Classes

The Engine comes with the next classes

- GameBase class
- Resources class
- Game class
- GameObject class
- Sprite class
- Text class
- Animate class
- Sound class
- Map class
- Source Code : <https://github.com/ring-lang/ring/blob/master/libraries/gameengine/gameengine.ring>

55.5 Games Layer

In this layer we create our games using the Game Engine classes

The classes are designed to be used through Declarative Programming.

In our games we will use the next classes

- Game class
- Sprite class
- Text class
- Animate class
- Sound class
- Map class

Note: Other classes in the engine are for internal use by the engine.

We will introduce some examples and three simple games :-

- Stars Fighter Game
- Flappy Bird 3000 Game
- Super Man 2016 Game

55.6 Game Class

The next table present the class attributes.

Attributes	Description
FPS	Number determines how many times the draw() method will be called per second.
FixedFPS	Number determines how many times the animate() method will be called per second.
Title	String determines the window title of the game.
Icon	String determines the window icon (file name)
aObjects	List contains all objects in the game
shutdown	True/False value to end the game loop

The next table present the class methods.

Method	Description
refresh()	Delete objects.
settitle(cTitle)	Set the window title using a string parameter.
shutdown()	Close the application.
find(cName)	Find an object using the object name
remove(nID)	Remove an object using the object ID

The next table present a group of keywords defined by the class.

Keyword	Description
sprite	Create new Sprite object and add it to the game objects.
text	Create new Text object and add it to the game objects.
animate	Create new Animate object and add it to the game objects.
sound	Create new Sound object and add it to the game objects.
map	Create new Map object and add it to the game objects.

55.7 GameObject Class

The next table present the class attributes.

Attributes	Description
enabled	True/False determine the state of the object (Active/Not Active)
x	Number determine the x position of the object.
y	Number determine the y position of the object.
width	Number determine the width of the object.
height	Number determine the height of the object.
nIndex	Number determine the ID of the object.
name	String represent the object name.
animate	True/False to animate the object or not.
move	True/False to move the object using the keyboard or not.
Scaled	True/False to scale the object image or not.
draw	Function to be called when drawing the object.
state	Function to be called for object animation.
keypress	Function to be called when a key is pressed.
mouse	Function to be called when a mouse event happens.

The next table present the class methods.

Method	Description
keyboard(oGame,nkey)	Check Keyboard Events
mouse(oGame,nType,aMouseList)	Check Mouse Events
rgb(r,g,b)	Return new color using the RGB (Red, Green and Blue) Values.

55.8 Sprite Class

Parent Class : GameObject Class

The next table present the class attributes.

Attributes	Description
image	String determine the image file name.
point	Number determine the limit of automatic movement of the object.
direction	Number determine the direction of movement.
nstep	Number determine the increment/decrement during movement.
type	Number determine the object type in the game (Optional).
transparent	True/False value determine if the image is transparent.

The next table present the class methods.

Method	Description
Draw(oGame)	Draw the object

55.9 Text Class

Parent Class : Sprite Class

The next table present the class attributes.

Attributes	Description
size	Number determine the font size
font	String determine the font file name
text	String determine the text to be displayed
color	Number determine the color

The next table present the class methods.

Method	Description
Draw(oGame)	Draw the object

55.10 Animate Class

Parent Class : Sprite Class

The next table present the class attributes.

Attributes	Description
frames	Number determine the number of frames
frame	Number determine the active frame
framewidth	Number determine the frame width.
animate	True/False determine using animate or not.
scaled	True/False determine scaling image or not.

The next table present the class methods.

Method	Description
Draw(oGame)	Draw the object

55.11 Sound Class

Parent Class : GameObject Class

The next table present the class attributes.

Attributes	Description
file	String determine the sound file name.
once	True/False determine to play the file one time or not (loop).

The next table present the class methods.

Method	Description
playsound()	Play the sound file

55.12 Map Class

Parent Class : Sprite Class

The next table present the class attributes.

Attributes	Description
aMap	List determine the map content using numbers.
aImages	List determine the image used for each number in the map.
BlockWidth	Number determine the block width (default = 32).
BlockHeight	Number determine the block height (default = 32).
Animate	True/False determine the animation status.

The next table present the class methods.

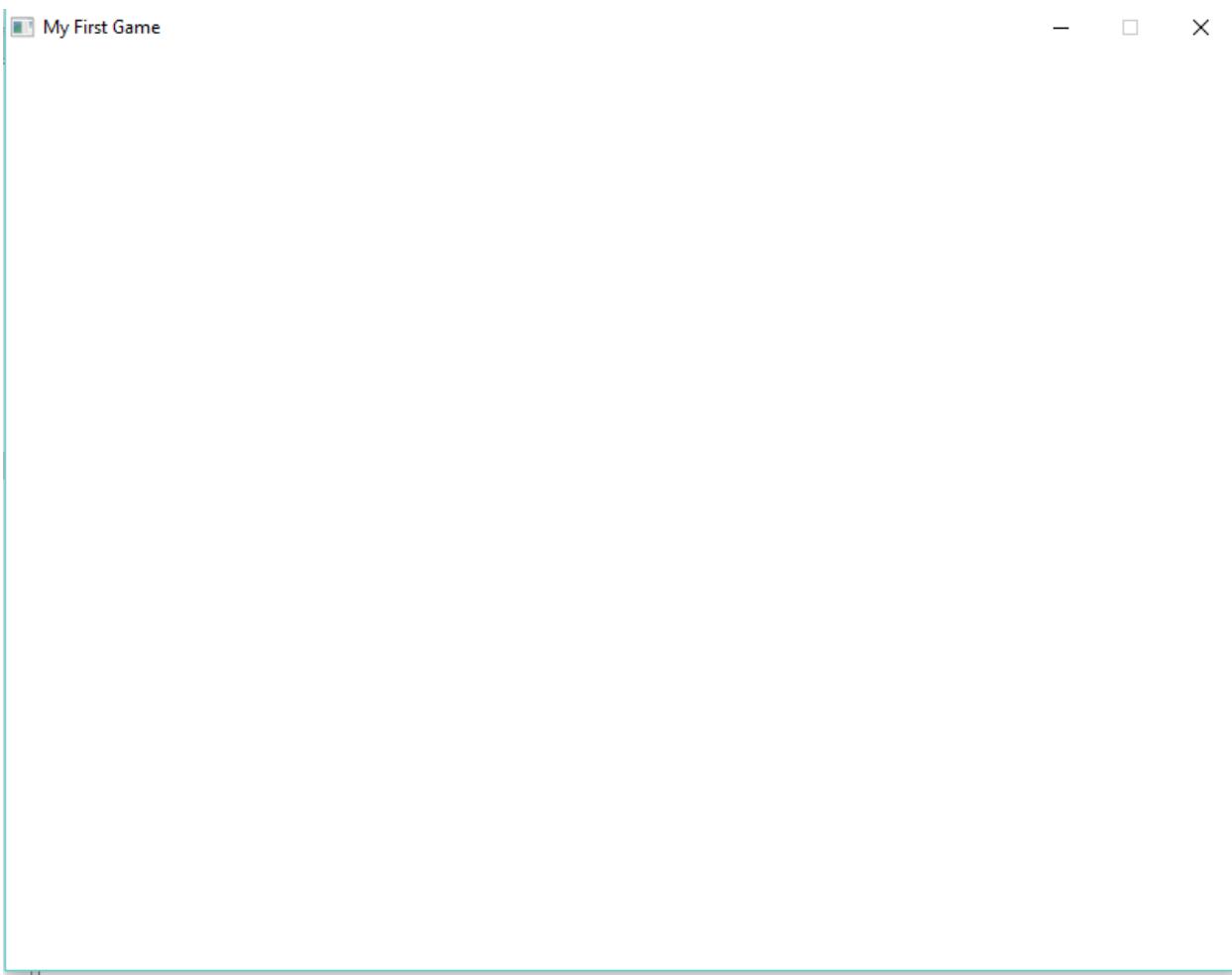
Method	Description
getvalue(x,y)	Return the item value in the Map according to the visible part

55.13 Using the Game Engine - Creating the Game Window

```
Load "gameengine.ring" # Give Control to the Game Engine
func main # Called by the Game Engine
    oGame = New Game # Create the Game Object
    {
        title = "My First Game"
    } # Start the Events Loop
```

Note: if you want to define global variables, this must be before load “gameengine.ring” because this instruction will give the control to the game engine.

Screen Shot:



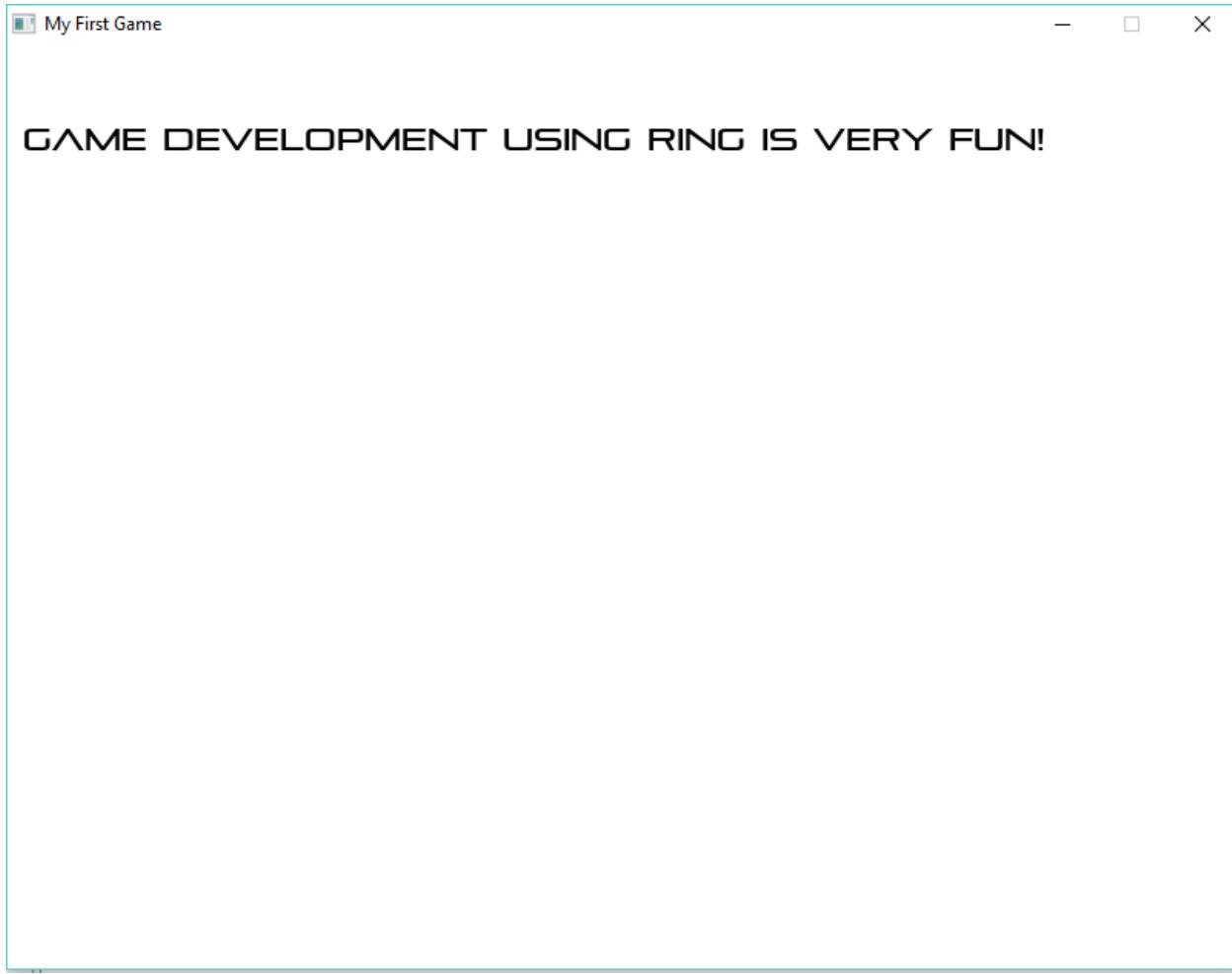
55.14 Using the Game Engine - Drawing Text

```
Load "gameengine.ring" # Give Control to the Game Engine

func main                # Called by the Game Engine

    oGame = New Game      # Create the Game Object
    {
        title = "My First Game"
        text {
            x = 10  y=50
            animate = false
            size = 20
            file = "fonts/pirulen.ttf"
            text = "game development using ring is very fun!"
            color = rgb(0,0,0)
        }
    }                      # Start the Events Loop
```

Screen Shot:



55.15 Using the Game Engine - Moving Text

```

Load "gameengine.ring"    # Give Control to the Game Engine

func main                  # Called by the Game Engine

    oGame = New Game          # Create the Game Object
    {
        title = "My First Game"
        text {
            x = 10  y=50
            animate = false
            size = 20
            file = "fonts/pirulen.ttf"
            text = "game development using ring is very fun!"
            color = rgb(0,0,0)      # Color = black
        }
        text {
            x = 10  y=150
            # Animation Part =====
            animate = true           # Use Animation
        }
    }
}

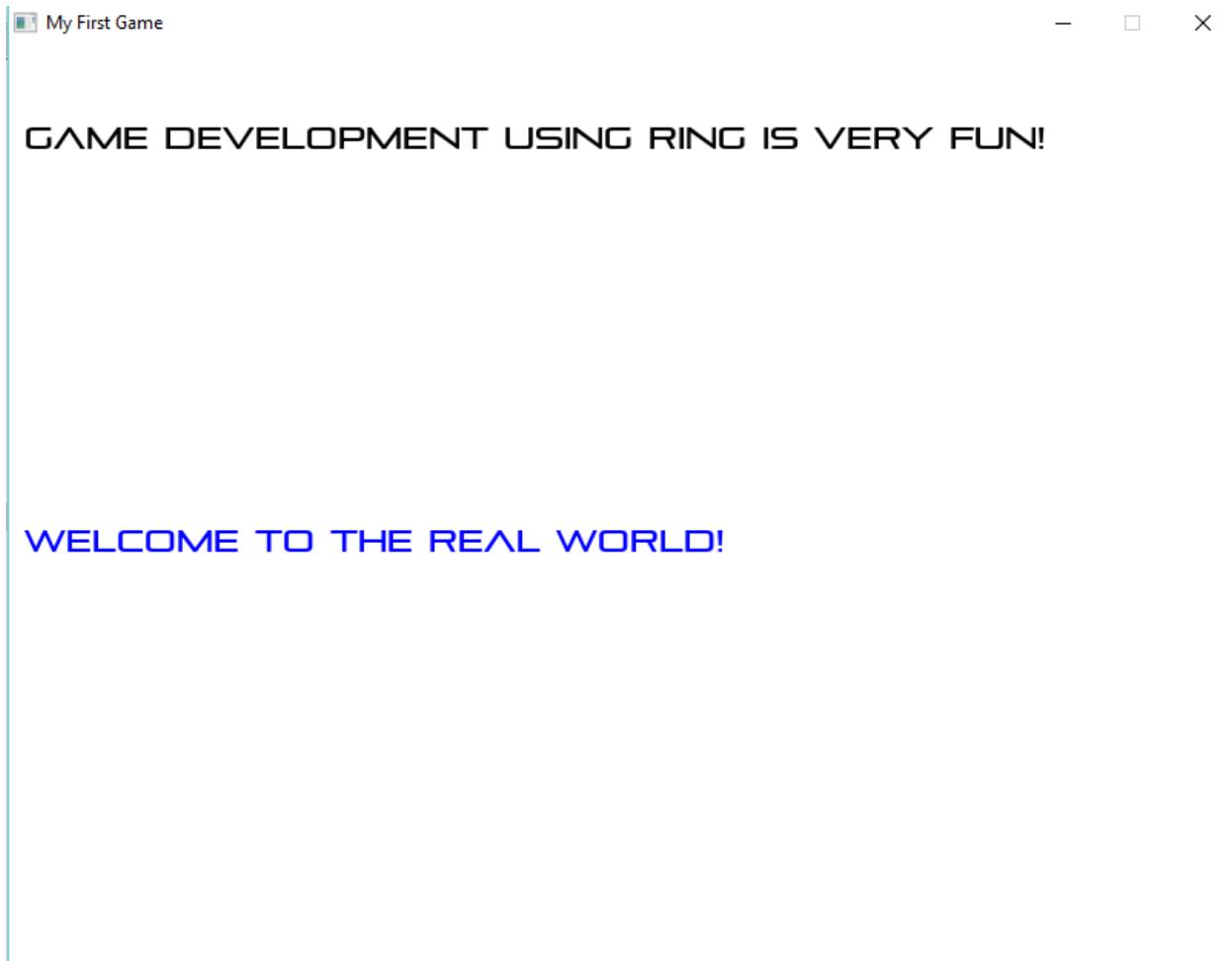
```

(continues on next page)

(continued from previous page)

```
direction = GE_DIRECTION_INCVERTICAL      # Increase y
point = 400                                # Continue until y=400
nStep = 3                                    # Each time y+= 3
#=====
size = 20
file = "fonts/pirulen.ttf"
text = "welcome to the real world!"
color = rgb(0,0,255)                         # Color = Blue
}
}                                                 # Start the Events Loop
```

Screen Shot:



55.16 Using the Game Engine - Playing Sound

```

Load "gameengine.ring" # Give Control to the Game Engine

func main # Called by the Game Engine

    oGame = New Game # Create the Game Object
    {
        title = "My First Game"
        text {
            x = 10 y=50
            animate = false
            size = 20
            file = "fonts/pirulen.ttf"
            text = "game development using ring is very fun!"
            color = rgb(0,0,0) # Color = black
        }
        text {
            x = 10 y=150
            # Animation Part =====
            animate = true # Use Animation
            direction = GE_DIRECTION_INCVERTICAL # Increase y
            point = 400 # Continue until y=400
            nStep = 3 # Each time y+= 3
            =====
            size = 20
            file = "fonts/pirulen.ttf"
            text = "welcome to the real world!"
            color = rgb(0,0,255) # Color = Blue
        }
        Sound {
            # Play Sound
            file = "sound/music1.wav" # Sound File Name
        }
    } # Start the Events Loop
}

```

55.17 Using the Game Engine - Animation

```

Load "gameengine.ring" # Give Control to the Game Engine

func main # Called by the Game Engine

    oGame = New Game # Create the Game Object
    {
        title = "My First Game"

        animate {
            file = "images/fire.png"
            x = 100
            y = 200
            framewidth = 40
            height = 42
            nStep = 3 # Used for delay
            transparent = true
            state = func oGame,oSelf { # Called by engine each frame
}
}

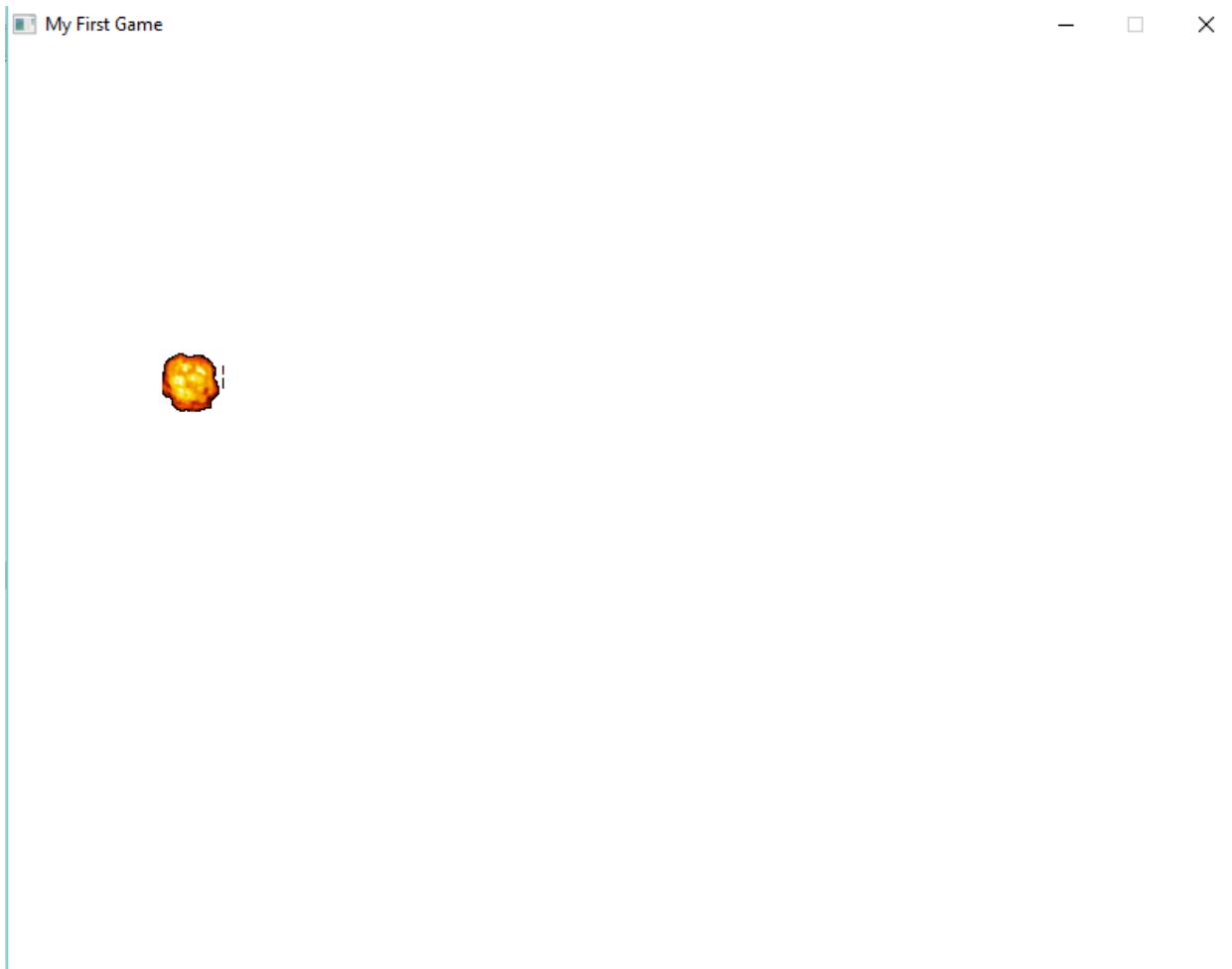
```

(continues on next page)

(continued from previous page)

```
oSelf {
    nStep--
    if nStep = 0
        nStep = 3
    if frame < 13      # we have 13 frames in animation
        frame++    # move to next frame
    else
        oGame.remove(oself nIndex)    # remove object
    ok
}
}
}

# Start the Events Loop
```



55.18 Using the Game Engine - Animation and Functions

```

Load "gameengine.ring" # Give Control to the Game Engine

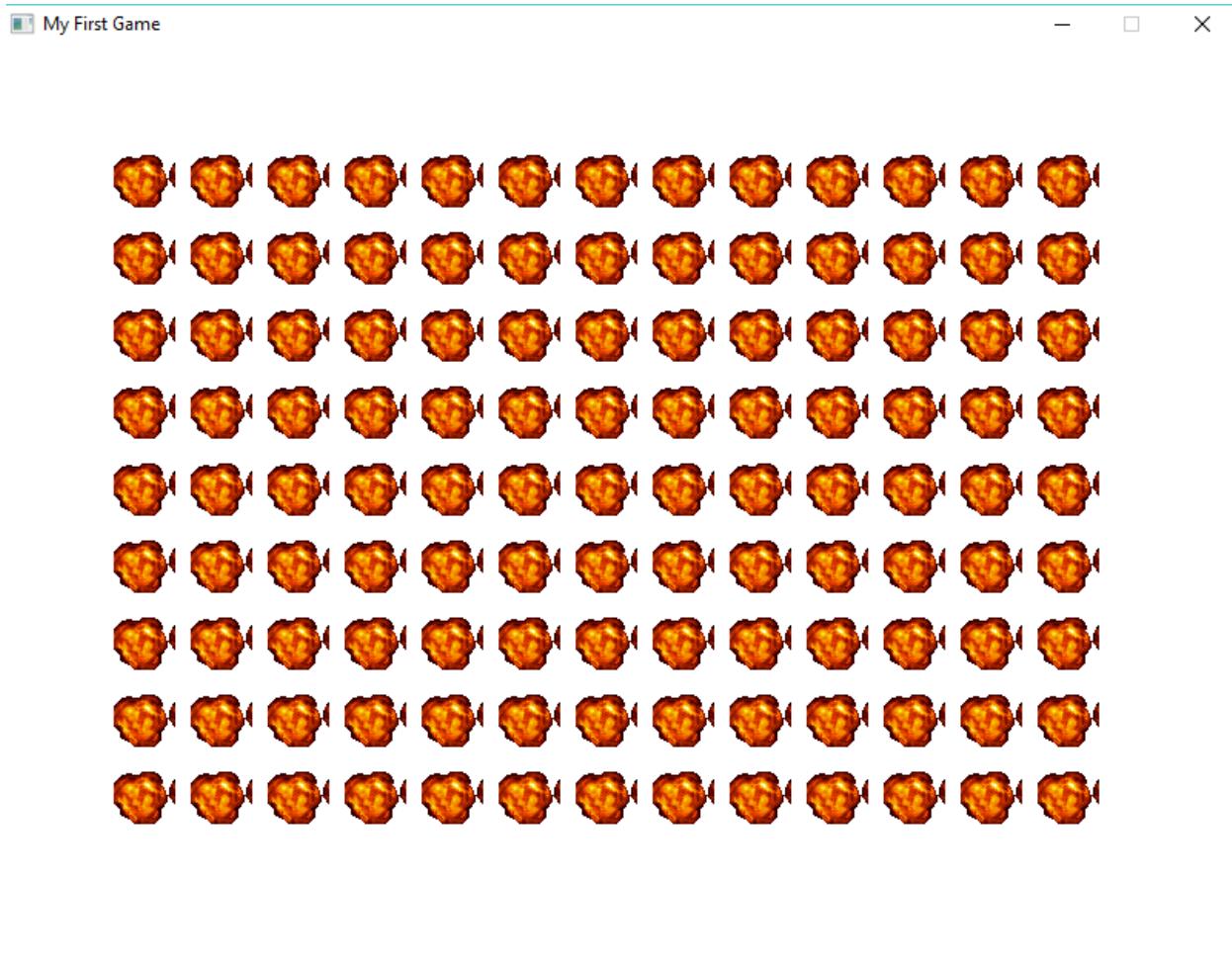
func main # Called by the Game Engine

oGame = New Game # Create the Game Object
{
    title = "My First Game"
    for x = 70 to 700 step 50
        for y = 70 to 500 step 50
            showfire(oGame,x,y)
    next
    next

} # Start the Events Loop

func showfire oGame,nX,nY
oGame {
    animate {
        file = "images/fire.png"
        x = nX
        y = nY
        framewidth = 40
        height = 42
        nStep = 3 # Used for delay
        transparent = true
        state = func oGame,oSelf { # Called by engine each frame
            oSelf {
                nStep--
                if nStep = 0
                    nStep = 3
                    if frame < 13 # we have 13 frames in animation
                        frame++ # move to next frame
                    else
                        frame=1
                ok
            }
        }
    }
}

```



55.19 Using the Game Engine - Sprite - Automatic Movement using Keyboard

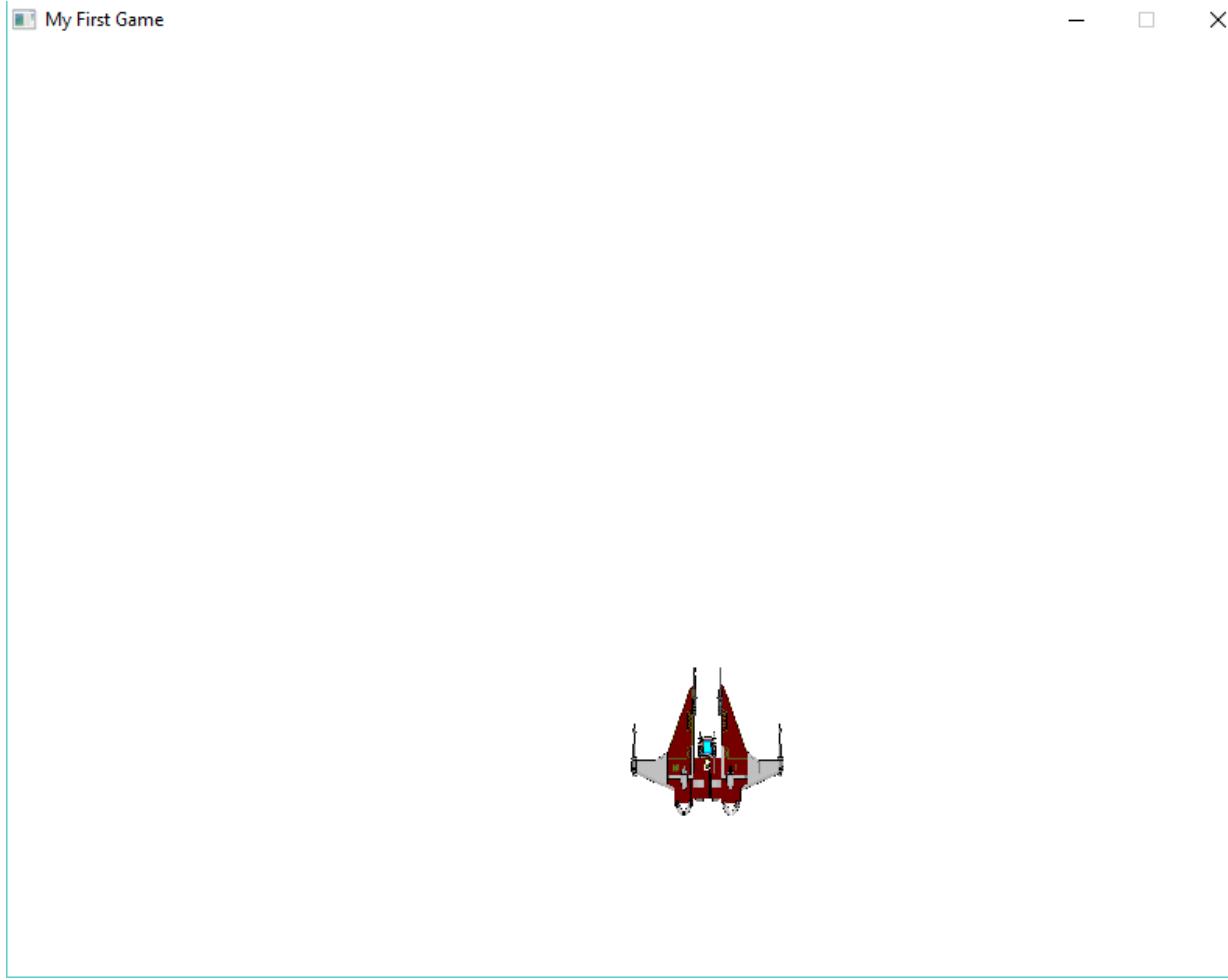
```

Load "gameengine.ring"                                # Give control to the game engine

func main                                         # Called by the Game Engine

    oGame = New Game                               # Create the Game Object
    {
        title = "My First Game"
        sprite
        {
            type = GE_TYPE_PLAYER                  # Just for our usage
            x=400 y=400 width=100 height=100
            file = "images/player.png"
            transparent = true
            Animate=false
            Move=true                         # we can move it using keyboard arrows
            Scaled=true
        }
    }                                              # Start the Events Loop

```



55.20 Using the Game Engine - Sprite - Keypress event

```

Load "gameengine.ring"                                # Give control to the game engine

func main                                         # Called by the Game Engine

    oGame = New Game                               # Create the Game Object
    {
        title = "My First Game"
        sprite
        {
            type = GE_TYPE_PLAYER           # Just for our usage
            x=400 y=400 width=100 height=100
            file = "images/player.png"
            transparent = true
            Animate=false
            Move=false                      # Custom Movement
            Scaled=true
            keypress = func oGame,oSelf,nKey {
                oSelf {
                    Switch nKey

```

(continues on next page)

(continued from previous page)

```

        on KEY_LEFT
            x -= 10
        on KEY_RIGHT
            x += 10
        on KEY_UP
            y -= 10
        on KEY_DOWN
            y += 10
    off
}
}
}

# Start the Events Loop

```

55.21 Using the Game Engine - Sprite - Mouse event

```

Load "gameengine.ring"                                # Give control to the game engine

func main                                            # Called by the Game Engine

    oGame = New Game                                    # Create the Game Object
    {
        title = "My First Game"
        sprite
        {
            type = GE_TYPE_PLAYER                      # Just for our usage
            x=400 y=400 width=100 height=100
            file = "images/player.png"
            transparent = true
            Animate=false
            Move=false                                     # Custom Movement
            Scaled=true
            keypress = func oGame,oSelf,nKey {
                oSelf {
                    switch nKey
                    on KEY_LEFT
                        x -= 10
                    on KEY_RIGHT
                        x += 10
                    on KEY_UP
                        y -= 10
                    on KEY_DOWN
                        y += 10
                off
            }
        }
        mouse = func oGame,oSelf,nType,aMouseList {
            if nType = GE_MOUSE_UP
                oSelf {
                    x = aMouseList[GE_MOUSE_X]
                    y = aMouseList[GE_MOUSE_Y]
                }
            ok
        }
    }
}

```

(continues on next page)

(continued from previous page)

```

        }
    }                                # Start the Events Loop
}

```

55.22 Using the Game Engine - Sprite - State event

```

Load "gameengine.ring"                      # Give control to the game engine

func main                                     # Called by the Game Engine

oGame = New Game                             # Create the Game Object
{
    title = "My First Game"
    sprite
    {
        type = GE_TYPE_PLAYER             # Just for our usage
        x=400 y=400 width=100 height=100
        file = "images/player.png"
        transparent = true
        Animate=false
        Move=false                         # Custom Movement
        Scaled=true
        keypress = func oGame,oSelf,nKey {
            oSelf {
                Switch nKey
                on KEY_LEFT
                    x -= 10
                on KEY_RIGHT
                    x += 10
                on KEY_UP
                    y -= 10
                on KEY_DOWN
                    y += 10
                off
            }
        }
        mouse = func oGame,oSelf,nType,aMouseList {
            if nType = GE_MOUSE_UP
                oSelf {
                    x = aMouseList[GE_MOUSE_X]
                    y = aMouseList[GE_MOUSE_Y]
                }
            ok
        }
        state = func oGame,oSelf {
            oself {
                if x < 0 x = 0 ok
                if y < 0 y = 0 ok
                if x > ogame.width-width
                    x= ogame.width - width ok
                if y > ogame.height-height
                    y=ogame.height - height ok
            }
        }
    }
}

```

(continues on next page)

(continued from previous page)

}	<i># Start the Events Loop</i>
---	--------------------------------

55.23 Using the Game Engine - Animate - Events

```

Load "gameengine.ring"                                # Give control to the game engine

func main                                         # Called by the Game Engine

    oGame = New Game                               # Create the Game Object
    {
        title = "My First Game"

        animate {

            file = "images/fbbird.png"
            x = 10
            y = 10
            framewidth = 20
            scaled = true
            height = 50
            width = 50
            nStep = 3
            transparent = true

            state = func oGame,oSelf {
                oSelf {

                    # Animation
                    nStep--
                    if nStep = 0
                        nStep = 3
                        if frame < 3
                            frame++
                    else
                        frame=1
                    ok
                    ok

                    # Move Down
                    y += 3
                    if y > 550 y=550 ok

                }
            }

            keypress = func ogame,oself,nKey {
                oself {
                    if nkey = key_space
                        y -= 55
                        if y<=0 y=0 ok
                    ok
                }
            }
        }
    }
}

```

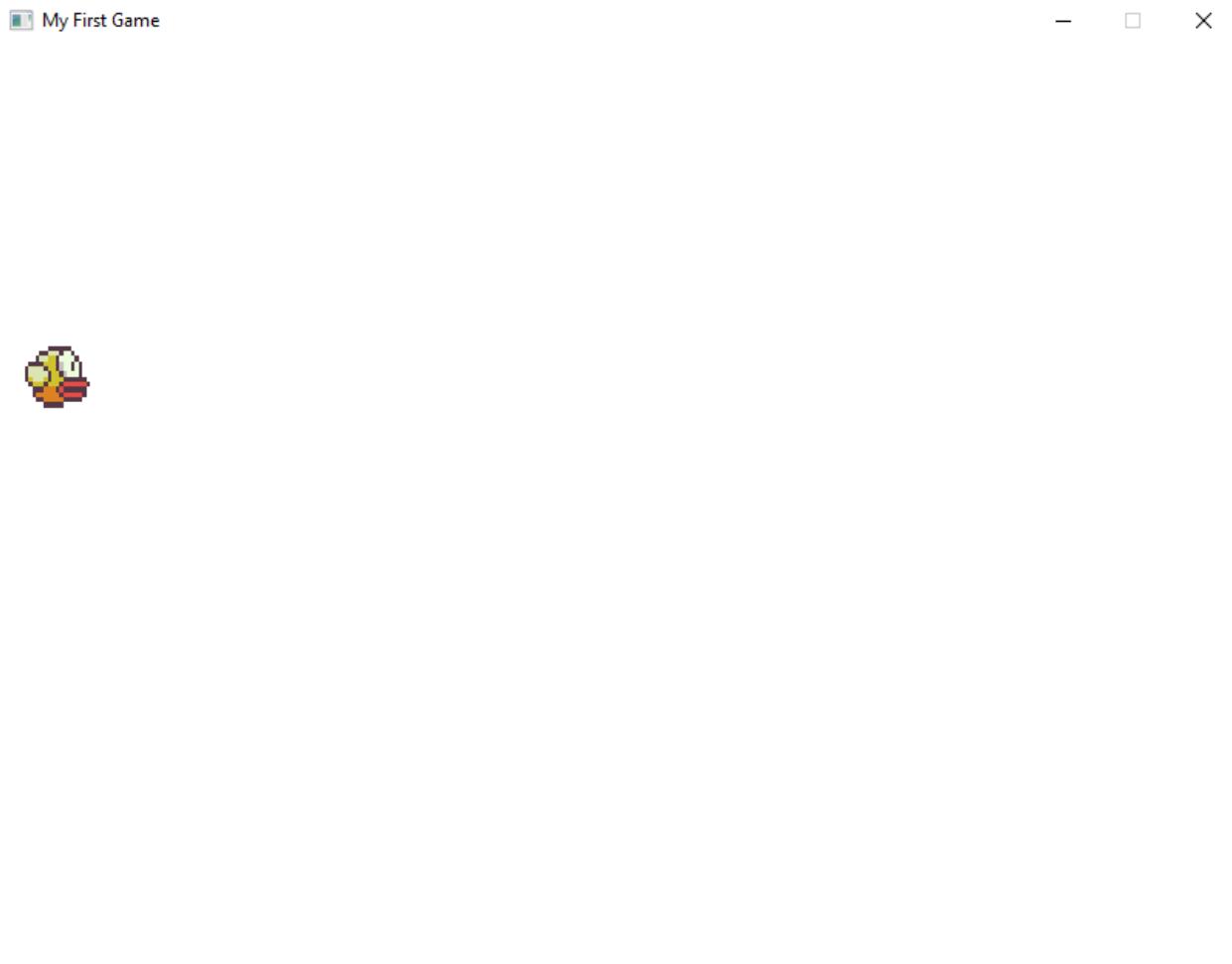
(continues on next page)

(continued from previous page)

```
mouse = func ogame,oSelf,nType,aMouseList {
    if nType = GE_MOUSE_UP
        cFunc = oSelf.keypress
        call cFunc(ogame,oSelf,Key_Space)
    ok
}
}

# Start the Events Loop
```

Screen Shot:



55.24 Using the Game Engine - Map

```

Load "gameengine.ring"           # Give control to the game engine

func main                      # Called by the Game Engine

oGame = New Game             # Create the Game Object
{
    title = "My First Game"

    Map {

        blockwidth = 80
        blockheight = 80

        aMap = [
            [0,0,0,0,0,0,0,0,1,0,0,0,3,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0],
            [0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0],
            [0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,1,0,0,0,2,0,0,0,1,0,0,0],
            [0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0,3,0,0,0,1,0,0,0],
            [0,0,0,0,0,0,0,0,0,1,0,0,0,2,0,0,0,3,0,0,0,1,0,0,0,1,0,0,0],
            [0,0,0,0,0,0,0,0,0,3,0,0,0,1,0,0,0,0,0,0,1,0,0,0,3,0,0,0],
            [0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,1,0,0,0,0,0,0,0,0],
            [0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,1,0,0,0,0,0,0,0,0],
            [0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,1,0,0,0,0,0,0,0,0]
        ]
    }

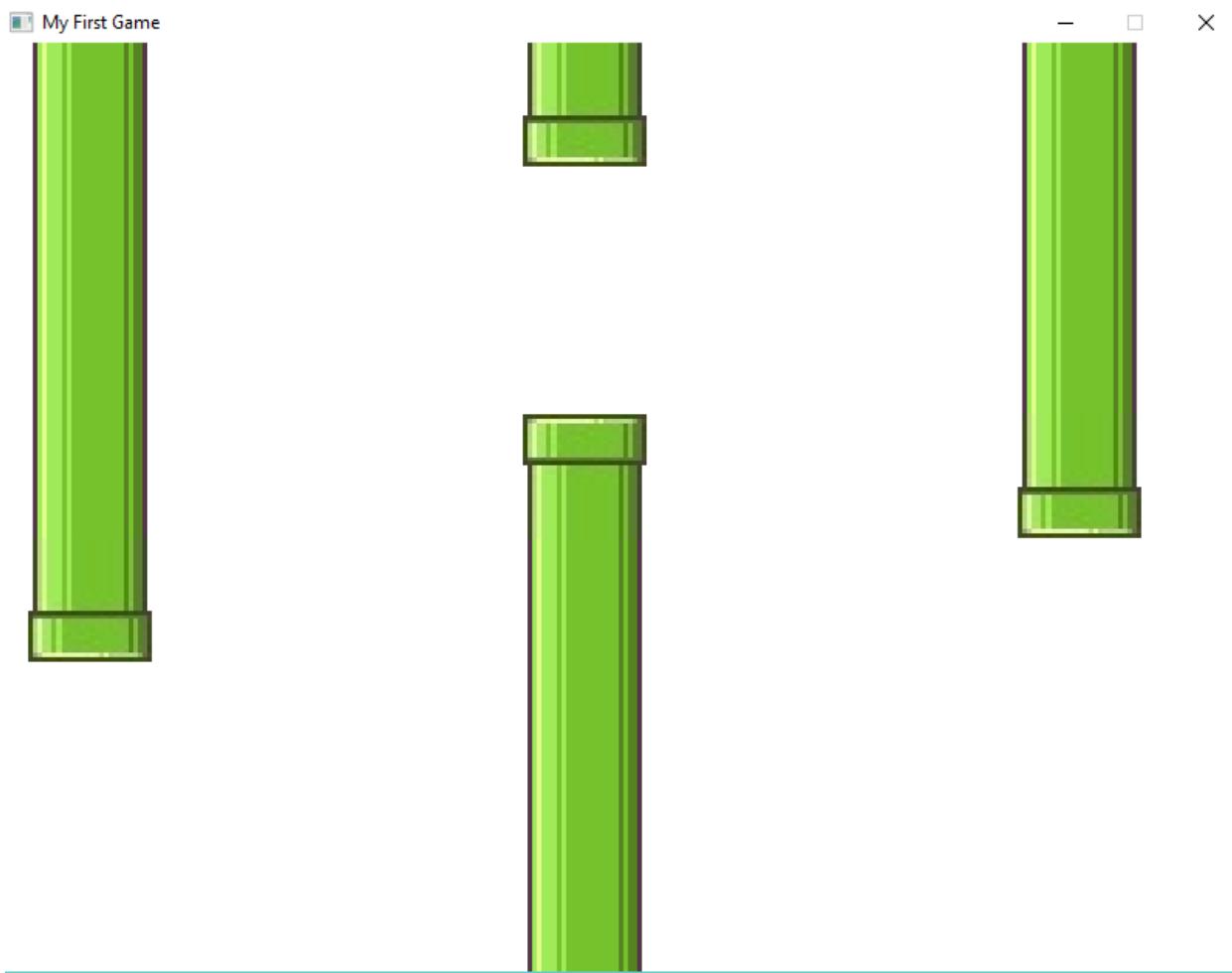
    aImages = ["images/fbwall.png",
               "images/fbwallup.png",
               "images/fbwalldown.png"]

    state = func oGame,oSelf {
        oSelf {
            x -= 3
            if x < - 2100   x = 0   ok
        }
    }
}

}                                # Start the Events Loop

```

Screen Shot:



55.25 Using the Game Engine - Map Events

```

Load "gameengine.ring"           # Give control to the game engine

func main                      # Called by the Game Engine

oGame = New Game             # Create the Game Object
{
    title = "My First Game"

    Map {

        blockwidth = 80
        blockheight = 80

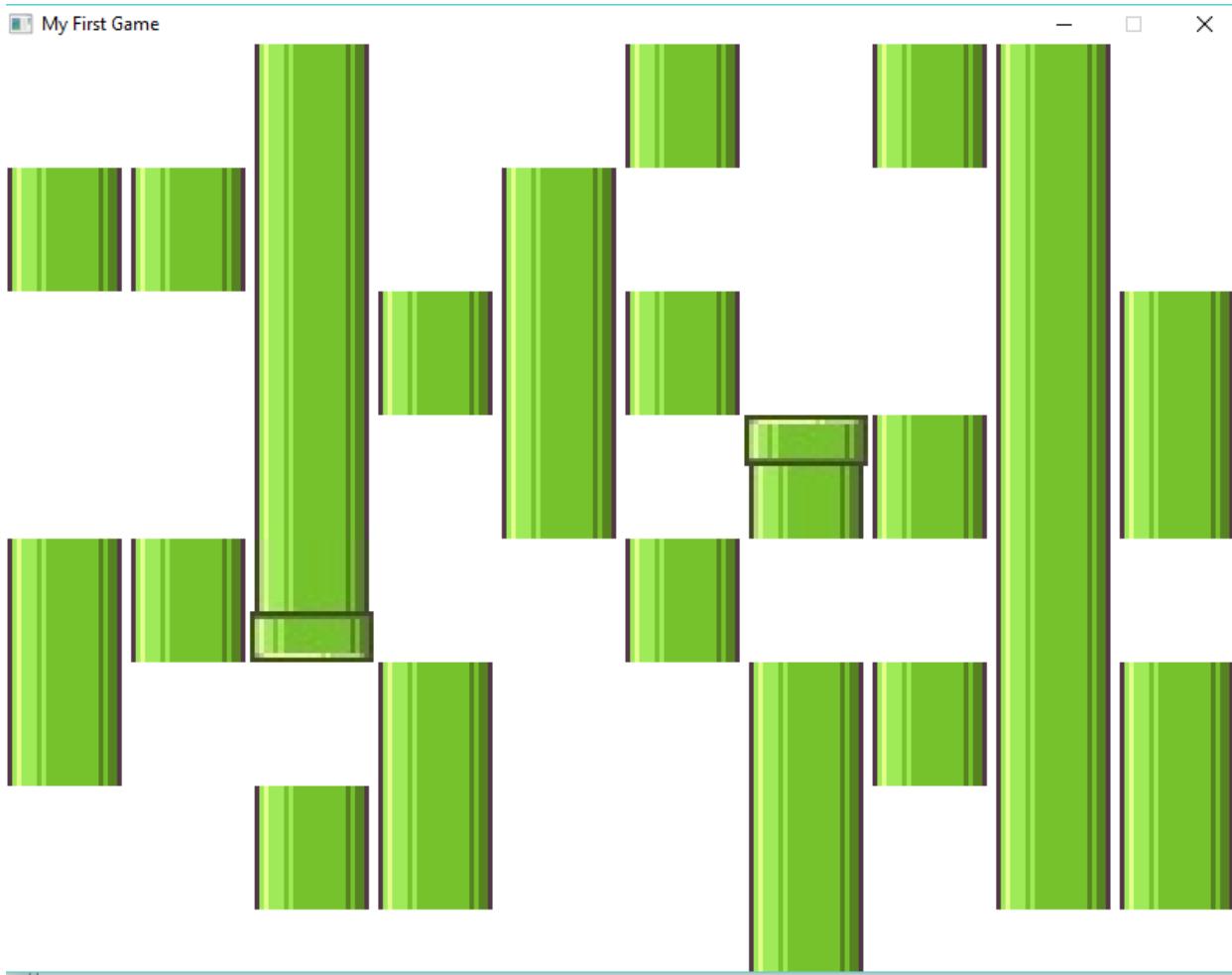
        aMap = [
            [0,0,0,0,0,0,0,0,1,0,0,0,3,0,0,0,0,1,0,0,0,0,0,0,0,0,1,0,0,0],
            [0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,0,1,0,0,0],
            [0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0,2,0,0,0,1,0,0,0],
            [0,0,0,0,0,0,0,0,1,0,0,0,2,0,0,3,0,0,0,1,0,0,0,1,0,0,0],
            [0,0,0,0,0,0,0,3,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0,3,0,0,0]
        ]
    }
}

```

(continues on next page)

(continued from previous page)

Screen Shot:



55.26 Using the Game Engine - Object and Drawing

We can use the Object keyword (defined by the game engine) to create objects from the GameObject class.

Example:

```
Load "gameengine.ring"                                # Give control to the game engine

func main                                         # Called by the Game Engine

    oGame = New Game                               # Create the Game Object
    {
        title = "My First Game"
        Object {
            x = 0 y=300 width = 200 height=200
            draw = func oGame,oSelf {
                oSelf {
                    for t = 1 to 210
                        gl_draw_circle(x,y,t,
                            gl_map_rgb(t*random(255),
                            t*2,t*3),1)
                }
            }
            next
        }
    }
}
```

(continues on next page)

(continued from previous page)

```
        }
    }
state = func oGame,oSelf {
    oSelf {
        if x <= 800
            x+= 3
        else
            x=0
        ok
    }
}
keypress = func oGame,oSelf,nKey {
    oSelf {
        switch nKey
        on KEY_LEFT
            x -= 10
        on KEY_RIGHT
            x += 10
        on KEY_UP
            y -= 10
        on KEY_DOWN
            y += 10
        off
    }
}
}

# Start the Events Loop
```

Screen Shot:



Example:

```

Load "gameengine.ring"                                # Give control to the game engine

func main                                         # Called by the Game Engine

    oGame = New Game                               # Create the Game Object
    {
        title = "My First Game"
        Object {
            x = 400 y=300 width = 200 height=200
            draw = func oGame,oSelf {
                oSelf {
                    for t = 1 to 210
                        gl_draw_rectangle(x+t,y+t,
                            x+t*2,y+t*2,
                            gl_map_rgb(t*random(255),
                            t*2,t*3),1)
                        gl_draw_rectangle(x+t*2,y+t*2,
                            x-t*2,y-t*2,
                            gl_map_rgb(t*random(255),
                            t*2,t*3),1)
                }
            }
        }
    }
}

```

(continues on next page)

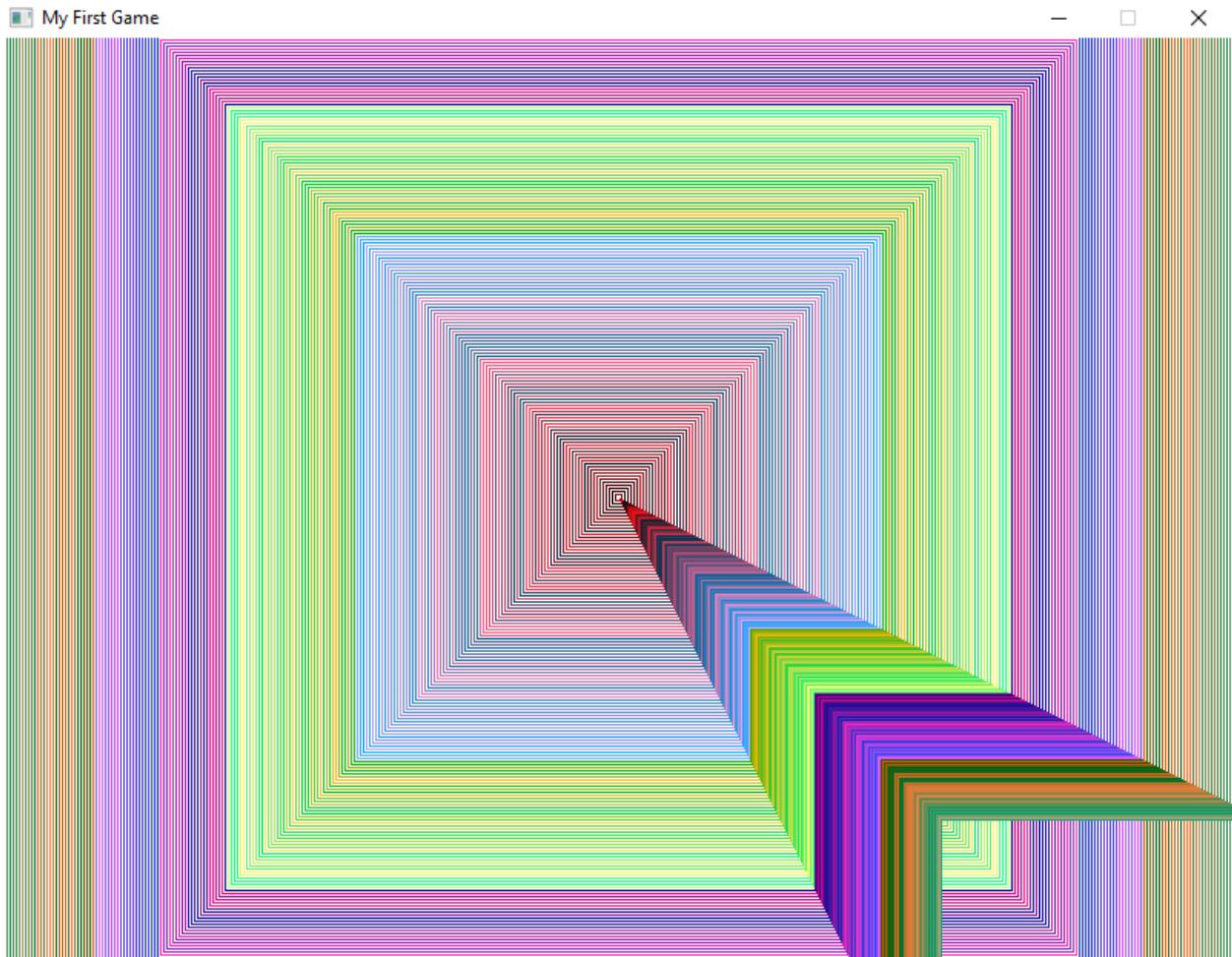
(continued from previous page)

```
        }
    keypress = func oGame, oSelf, nKey {
        oSelf {
            switch nKey
            on KEY_LEFT
                x -= 10
            on KEY_RIGHT
                x += 10
            on KEY_UP
                y -= 10
            on KEY_DOWN
                y += 10
            off
        }
    }

}

# Start the Events Loop
```

Screen Shot:



55.27 Stars Fighter Game

The Stars Fighter source code

```
# The Ring Standard Library
# Game Engine for 2D Games
# 2016, Mahmoud Fayed <msfclipper@yahoo.com>

oGameState = NULL

load "gameengine.ring"

func main

oGame = New Game

while true

    oGameState = new GameState

    oGame {
        title = "Stars Fighter!"
        sprite
        {
            file = "images/menu1.jpg"
            x = 0 y=0 width=800 height = 600 scaled = true animate = false
            keypress = func ogame,oself,nKey {
                if nkey = key_esc or nKey = GE_AC_BACK
                    ogame.shutdown()
                but nKey = key_space
                    oGameState.startplay=true
                    ogame.shutdown=true
                ok
            }
            mouse = func ogame,oself,nType,aMouseList {
                if nType = GE_MOUSE_UP
                    oGameState.startplay=true
                    ogame.shutdown=true
                ok
            }
        }
        text {
            animate = false
            size = 35
            file = "fonts/pirulen.ttf"
            text = "Stars Fighter"
            x = 10 y=50
        }
        text {
            animate = false
            size = 25
            file = "fonts/pirulen.ttf"
            text = "Version 1.0"
            x = 80 y=100
        }
        text {
            animate = false
        }
    }
}
```

(continues on next page)

(continued from previous page)

```

        size = 16
        file = "fonts/pirulen.ttf"
        text = "(C) 2016, Mahmoud Fayed"
        x = 45  y=140
    }

    text {
        animate = false
        size = 25
        file = "fonts/pirulen.ttf"
        text = "Press Space to start"
        x = 190  y=470
    }
    text {
        animate = false
        size = 20
        file = "fonts/pirulen.ttf"
        text = "Press Esc to Exit"
        x = 260  y=510
    }
    Sound {
        file = "sound/music1.wav"
    }
}

if oGameState.startplay
    oGame.refresh()
    playstart(oGame)
    oGame.refresh()
ok

end

func playstart oGame

oSound = New Sound {
    file = "sound/music2.wav"
}

while true
    play(oGame)
    if ogame.shutdown = true and oGameState.value = 0
        exit
    ok
    ogame.refresh()
end

oSound.Delete()

func play oGame

oGame
{
    FPS = 60
    FixedFPS = 120
    title = "Stars Fighter!"
    sprite
}

```

(continues on next page)

(continued from previous page)

```

{
    file = "images/stars.jpg"
    x = 0
    y = 0
    point = -370
    direction = ge_direction_dec
    type = ge_type_background
    state = func ogame,oself {
        oself {
            if x < -350
                direction = ge_direction_inc
                point = 370
            but x = 0 and direction = ge_direction_inc
                direction = ge_direction_dec
                point = -370
            ok
        }
    }
}
sprite
{
    file = "images/player.png"
    transparent = true
    type = ge_type_player
    x = 400 y =400 width=100 height=100
    animate=false move=true Scaled=true
    mouse = func ogame,oself,nType,aMouseList {

        if not ( aMouseList[GE_MOUSE_X] >= oSelf.x and
                  aMouseList[GE_MOUSE_X] <= oSelf.x+oSelf.width and
                  aMouseList[GE_MOUSE_Y] >= oself.y and
                  aMouseList[GE_MOUSE_Y] <= oSelf.y+oSelf.height )

        if nType = GE_MOUSE_DOWN
            if aMouseList[1] < oSelf.X # left
                oSelf.X -= 100
            else
                oSelf.X += 100
            ok
            if aMouseList[2] < oSelf.Y # up
                oSelf.Y -= 100
            else
                oSelf.Y += 100
            ok
        ok

        else
            if nType = GE_MOUSE_UP
                cFunc = oself.keypress
                call cFunc(ogame,oSelf,Key_Space)
            ok
        ok
    }
    keypress = func oGame,oself,nkey {
        if nkey = key_space
            ogame {
                sprite {

```

(continues on next page)

(continued from previous page)

```

        type = ge_type_fire
        file = "images/rocket.png"
        transparent = true
            x = oself.x + 30
            y = oself.y - 30
            width = 30
            height = 30
            point = -30
            nstep = 20
            direction = ge_direction_decvertical
            state = func oGame,oSelf {
                for x in oGame.aObjects
                    if x.type = ge_type_enemy
                        if oself.x >= x.x and oself.y >= x.y and
                            oself.x <= x.x + x.width and
                            oself.y <= x.y + x.height
                            showfire(oGame,x.x+40,x.y+40)
                            ogame.remove(x.nindex)
                            oGameState.score+=10
                            oGameState.enemies--
                            checkwin(oGame)
                            exit
                        ok
                    next
                }
            }
        }
    but nkey = key_esc or nKey = GE_AC_BACK ogame.shutdown()
    ok
}
state = func oGame,oSelf {
    oself {
        if x < 0 x = 0 ok
        if y < 0 y = 0 ok
        if x > ogame.screen_w-width x= ogame.screen_w - width ok
        if y > ogame.screen_h-height y=ogame.screen_h-height ok
    }
}
for g = 1 to oGameState.enemies
    sprite
    {
        type = ge_type_enemy
        file = "images/enemy.png"
        transparent = true
        x = g*random(50) y =g width=100 height=100
        animate=true Scaled=true
        direction = ge_direction_random
        state = func oGame,oSelf {
            oself {
                if x < 0 x = 0 ok
                if y < 0 y = 0 ok
                if x > ogame.screen_w-width x= ogame.screen_w - width ok
                if y > ogame.screen_h-height y=ogame.screen_h-height ok
            }
        if random(100) = 1
    }
}

```

(continues on next page)

(continued from previous page)

```

        ogame {
            sprite {
                type = ge_type_fire
                file = "images/rocket2.png"
                transparent = true
                x = oself.x + 30
                y = oself.y + oself.height+ 30
                width = 30
                height = 30
                point = ogame.screen_h+30
                nstep = 10
                direction = ge_direction_incvertical
                state = func oGame,oSelf {
                    x = oGame.aObjects[oGameState.playerindex]
                    if oself.x >= x.x and oself.y >= x.y and
                        oself.x <= x.x + x.width and
                        oself.y <= x.y + x.height
                    if oGameState.value > 0
                        oGameState.value-=10
                    ok
                    ogame.remove(oself.nindex)
                    checkgameover(oGame)
                }
                ok
            }
        }
    }
    next
    text {
        size = 30
        file = "fonts/pirulen.ttf"
        text = "Destroy All Enemies!"
        nstep = 3
        color = GE_COLOR_GREEN
        x = 100 y=50
        direction = ge_direction_incvertical
        point = 500
    }
    text {
        animate = false
        point = 400
        size = 30
        file = "fonts/pirulen.ttf"
        text = "Score : " + oGameState.score
        x = 500 y=10
        state = func oGame,oSelf { oSelf { text = "Score : " + oGameState.score } }
    }
    text {
        animate = false
        point = 400
        size = 30
        file = "fonts/pirulen.ttf"
        text = "Energy : " + oGameState.value
        x = 500 y=50
        state = func oGame,oSelf { oSelf { text = "Energy : " + oGameState.value } }
    }
}

```

(continues on next page)

(continued from previous page)

```

        }
    text {
        animate = false
        point = 400
        size = 30
        file = "fonts/pirulen.ttf"
        text = "Level : " + oGameState.level
        x = 500 y=90
    }
}

func checkwin ogame
if oGameState.gameresult return ok
if oGameState.enemies = 0
    oGameState.gameresult = true
    oGame {
        if oGameState.level < 30
        text {
            point = 400
            size = 30
            file = "fonts/pirulen.ttf"
            text = "Level Completed!"
            nStep = 3
            x = 500 y=10
            state = func ogame,oself {
                if oself.y >= 400
                    ogame.shutdown = true
                    oGameState.level++
                    oGameState.enemies = oGameState.level
                    oGameState.gameresult = false
                ok
            }
        }
        else
        text {
            point = 400
            size = 30
            nStep = 3
            file = "fonts/pirulen.ttf"
            text = "You Win !!!"
            x = 500 y=10
            state = func ogame,oself {
                if oself.y >= 400
                    ogame.shutdown = true
                    oGameState.value = 0
                ok
            }
        }
    ok
}
ok

func checkgameover ogame
if oGameState.gameresult return ok
if oGameState.value <= 0
    oGameState.gameresult = true

```

(continues on next page)

(continued from previous page)

```

oGame {
    text {
        point = 400
        size = 30
        nStep = 3
        file = "fonts/pirulen.ttf"
        text = "Game Over !!!"
        x = 500 y=10
        state = func ogame,oself {
            if oself.y >= 400
                ogame.shutdown = true
            ok
        }
    }
}
showfire(oGame,oGame.aObjects[oGameState.PlayerIndex].x+40,
         oGame.aObjects[oGameState.PlayerIndex].y+40)
oGame.aObjects[oGameState.PlayerIndex].enabled = false
oGame.remove(oGameState.PlayerIndex)
ok

func showfire oGame,nX,nY
oGame {
    animate {
        file = "images/fire.png"
        x = nX
        y = nY
        framewidth = 40
        height = 42
        nStep = 3
        transparent = true
        state = func oGame,oSelf {
            oSelf {
                nStep--
                if nStep = 0
                    nStep = 3
                    if frame < 13
                        frame++
                    else
                        frame=1
                        oGame.remove(oself.nIndex)
                ok
            }
        }
    }
}

class gamestate
score = 0
level = 1
enemies = 1
value = 100
playerindex = 2
gameresult = false

```

(continues on next page)

(continued from previous page)

```
startplay=false
```

Screen Shot:



55.28 Flappy Bird 3000 Game

The Flappy Bird 3000 Game source code

```
# The Ring Standard Library
# Game Engine for 2D Games
# 2016, Mahmoud Fayed <msfclipper@yahoo.com>

oGameState = NULL

Load "gameengine.ring"

func main

oGame = New Game
```

(continues on next page)

(continued from previous page)

```

while true

    oGameState = New GameState

    oGame {
        title = "Flappy Bird 3000"
        sprite
        {
            file = "images/fbbback.png"
            x = 0 y=0 width=800 height = 600 scaled = true animate = false
            keypress = func ogame,oself,nKey {
                if nkey = key_esc or nKey = GE_AC_BACK
                    ogame.shutdown()
                but nKey = key_space
                    oGameState.startplay=true
                    ogame.shutdown=true
                ok
            }
            mouse = func ogame,oself,nType,aMouseList {
                if nType = GE_MOUSE_UP
                    cFunc = oself.keypress
                    call cFunc(oGame,oSelf,Key_Space)
                ok
            }
        }
        text {
            animate = false
            size = 35
            file = "fonts/pirulen.ttf"
            text = "Flappy Bird 3000"
            x = 150 y=50
        }
        text {
            animate = false
            size = 25
            file = "fonts/pirulen.ttf"
            text = "Version 1.0"
            x = 280 y=100
        }
        text {
            animate = false
            size = 16
            file = "fonts/pirulen.ttf"
            text = "(C) 2016, Mahmoud Fayed"
            x = 245 y=140
        }
        text {
            animate = false
            size = 25
            file = "fonts/pirulen.ttf"
            text = "To Win Get Score = 3000"
            x = 150 y=270
        }
    }

    text {

```

(continues on next page)

(continued from previous page)

```

        animate = false
        size = 25
        file = "fonts/pirulen.ttf"
        text = "Press Space to start"
        x = 190  y=470
    }
    text {
        animate = false
        size = 20
        file = "fonts/pirulen.ttf"
        text = "Press Esc to Exit"
        x = 260  y=510
    }

    animate {
        file = "images/fbbird.png"
        x = 200
        y = 200
        framewidth = 20
        scaled = true
        height = 50
        width = 50
        nStep = 3
        transparent = true
        animate = true
        direction = ge_direction_random
        state = func oGame,oSelf {
            oSelf {
                nStep--
                if nStep = 0
                nStep = 3
                if frame < 3
                    frame++
                else
                    frame=1
                ok
                ok
                if x <= 0 x=0 ok
                if y <= 0 y=0 ok
                if x >= 750 x= 750 ok
                if y > 550 y=550 ok
            }
        }
    }

    Sound {
        file = "sound/music2.wav"
    }
}
if oGameState.startplay
oGame.refresh()
playstart(oGame)
oGame.refresh()
ok

end

```

(continues on next page)

(continued from previous page)

```

func playstart oGame

oGame {
    FPS = 60
    FixedFPS = 120
    Title = "Flappy Bird 3000"
    Sprite {
        file = "images/fbback.png"
        x = 0 y=0 width=800 height = 600 scaled = true animate = false
        keypress = func ogame,oself,nKey {
            if nkey = key_esc or nKey = GE_AC_BACK
                ogame.shutdown()
            ok
        }
    }

Map {
    blockwidth = 80
    blockheight = 80
    aMap = [
        [0,0,0,0,0,0,0,0,0,1,0,0,0,3,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0],
        [0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0],
        [0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0,2,0,0,0,1,0,0,0],
        [0,0,0,0,0,0,0,0,0,1,0,0,0,2,0,0,0,3,0,0,0,1,0,0,0,1,0,0,0],
        [0,0,0,0,0,0,0,0,0,3,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0,3,0,0,0],
        [0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0],
        [0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0],
        [0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0]
    ]
    newmap(aMap)
    aImages = ["images/fbwall.png","images/fbwallup.png",
               "images/fbwalldown.png"]
    state = func oGame,oSelf {
        if oGameState.gameresult = false
            px = oGame.aObjects[3].x
            py = oGame.aObjects[3].y
            oSelf {
                x -= 3
                if x < - 2100
                    x = 0
                    newmap(aMap)
                ok
                nCol = getcol(px,0)
                if nCol=11 or nCol=15 or nCol=19 or nCol=23 or nCol=27
                    if nCol != oGameState.lastcol
                        oGameState.lastcol = nCol
                        oGameState.Score += 100
                        oGame { Sound {
                            once = true
                            file = "sound/sfx_point.wav"
                        } }
                        checkwin(oGame)
                    ok
                ok
            }
        if oSelf.getvalue(px+40,py) != 0 or

```

(continues on next page)

(continued from previous page)

```

oSelf.getvalue(px+40,py+40) != 0 or
oSelf.getvalue(px,py) != 0 or
oSelf.getvalue(px,py+40) != 0
oGameState.gameresult = true
oGame {
    text {
        point = 550
        size = 30
        nStep = 3
        file = "fonts/pirulen.ttf"
        text = "Game Over !!!"
        x = 500 y=10
        state = func ogame,oSelf {
            if oSelf.y >= 550
                ogame.shutdown = true
            ok
            if oSelf.y = 90
                ogame {
                    Sound {
                        once = true
                        file = "sound/sfx_die.wav"
                    }
                }
            ok
        }
    }
    Sound {
        once = true
        file = "sound/sfx_hit.wav"
    }
}
ok
ok
}

animate {
    file = "images/fbbird.png"
    x = 10
    y = 10
    framewidth = 20
    scaled = true
    height = 50
    width = 50
    nStep = 3
    transparent = true
    state = func oGame,oSelf {
        oSelf {
            nStep--
            if nStep = 0
                nStep = 3
                if frame < 3
                    frame++
            else
                frame=1
            ok
        }
    }
}

```

(continues on next page)

(continued from previous page)

```

        }

    if not oGameState.playerwin
        oGameState.down --
    if oGameState.down = 0
        oGameState.down = 3
        oself {
            y += 25
            if y > 550 y=550 ok
        }
    ok
    ok

}

keypress = func ogame,oself,nKey {
    if oGameState.gameresult = false
        oself {
            if nkey = key_space
                y -= 55
                oGameState.down = 60
                if y<=0 y=0 ok
            }
        }
    ok
}

mouse = func ogame,oself,nType,aMouseList {
    if nType = GE_MOUSE_UP
        cFunc = oself.keypress
        call cFunc(ogame,oSelf,Key_Space)
    }
}

text {
    animate = false
    point = 400
    size = 30
    file = "fonts/pirulen.ttf"
    text = "Score : " + oGameState.score
    x = 500 y=10
    state = func oGame,oSelf {
        oSelf { text = "Score : " + oGameState.score }
    }
}

func newmap aMap
    aV = [
        [1,1,3,0,0,2,1,1],
        [1,3,0,0,0,2,1,1],
        [1,1,1,3,0,2,1,1],
        [1,1,1,3,0,0,0,0],
        [0,0,0,0,2,1,1,1],
        [0,0,2,1,1,1,1,1],
        [0,0,0,2,1,1,1,1],
        [1,1,1,3,0,2,1,1],
    ]
}

```

(continues on next page)

(continued from previous page)

```

[1,1,1,1,1,3,0,0],
[3,0,0,2,1,1,1,1],
[3,0,0,2,3,0,0,2]
]
for x = 10 to 24 step 4
    aVar = aV[ (random(10)+1) ]
    for y = 1 to 8
        aMap[y][x] = aVar[y]
    next
next

func checkwin ogame
    if oGameState.score = 3000
        oGameState.gameresult = true
        oGameState.playerwin = true
        oGame {
            text {
                point = 400
                size = 30
                nStep = 3
                file = "fonts/pirulen.ttf"
                text = "You Win !!!"
                x = 500 y=10
                state = func ogame,oself {
                    if oself.y >= 400
                        ogame.shutdown = true
                        oGameState.value = 0
                    ok
                }
            }
        }
    ok

Class GameState
    down = 3
    gameresult = false
    Score = 0
    startplay=false
    lastcol = 0
    playerwin = false

```

Screen Shot:



55.29 Super Man 2016 Game

The Super Man 2016 Game source code

```
# The Ring Standard Library
# Game Engine for 2D Games
# 2016, Mahmoud Fayed <msfclipper@yahoo.com>

oGameState = NULL

Load "gameengine.ring"

func main

    oGame = New Game

    while true

        oGameState = new GameState

        oGame {
```

(continues on next page)

(continued from previous page)

```

title = "Super Man 2016"
sprite {
    file = "images/superman.jpg"
    x = 0 y=0 width=800 height = 600 scaled = true animate = false
    keypress = func ogame,oself,nKey {
        if nkey = key_esc or nKey = GE_AC_BACK
            ogame.shutdown()
        but nKey = key_space
            oGameState.startplay=true
            ogame.shutdown=true
        ok
    }
    mouse = func ogame,oself,nType,aMouseList {
        if nType = GE_MOUSE_UP
            oGameState.startplay=true
            ogame.shutdown=true
        ok
    }
    state = func ogame,oself {
        oself {
            if x > -500
                x-=1
                y-=1
                width +=1
                height +=4
            ok
        }
    }
}
text {
    animate = false
    size = 35
    file = "fonts/pirulen.ttf"
    text = "Super Man 2016"
    x = 20 y=30
}
text {
    animate = false
    size = 25
    file = "fonts/pirulen.ttf"
    text = "Version 1.0"
    x = 20 y=80
}
text {
    animate = false
    size = 16
    file = "fonts/pirulen.ttf"
    text = "(C) 2016, Mahmoud Fayed"
    x = 20 y=120
}

text {
    animate = false
    size = 25
    file = "fonts/pirulen.ttf"
    text = "Press Space to start"
}

```

(continues on next page)

(continued from previous page)

```

        x = 190  y=470
    }
    text {
        animate = false
        size = 20
        file = "fonts/pirulen.ttf"
        text = "Press Esc to Exit"
        x = 260  y=510
    }

    animate {
        file = "images/superman.png"
        x = 200
        y = 200
        framewidth = 68
        scaled = true
        height = 86
        width = 60
        nStep = 10
        transparent = true
        animate = true
        direction = ge_direction_random
        state = func oGame,oSelf {
            oSelf {
                nStep--
                if nStep = 0
                nStep = 10
                if frame < 1
                    frame++
                else
                    frame=1
                ok
                ok
                if x <= 0 x=0 ok
                if y <= 0 y=0 ok
                if x >= 750 x= 750 ok
                if y > 550 y=550 ok
            }
        }
    }

    Sound {
        file = "sound/music2.wav"
    }
}
if oGameState.startplay
    oGame.refresh()
    playstart(oGame)
    oGame.refresh()
ok

end

func playstart oGame
    oGame {

```

(continues on next page)

(continued from previous page)

```

FPS = 60
FixedFPS = 15
Title = "Super Man 2016"
Sprite {
    file = "images/supermancity.jpg"
    x = 0 y=0 width=800 height = 600 scaled = true animate = false
}
Map {
    blockwidth = 80
    blockheight = 80
    aMap = [
        [0,0,0,4,4,4,0,0,0,1,0,0,0,1,4,4,0,1,0,0,0,0,4,4,0,1,4,
4,4,0,0,0,0,0,0,0,0,0,0,0,0,2,0,1,0,0,0,1,0,0,1,0,3,3,3,5,3,3,3,3,0],
        [0,0,4,0,4,0,4,0,0,1,0,0,0,3,4,4,4,1,0,0,0,0,4,4,0,1,4,
4,4,0,0,4,4,4,4,4,4,4,4,4,1,4,1,0,0,0,1,0,0,0,1,0,4,4,4,4,4,4,0],
        [0,0,0,4,4,4,0,0,0,1,0,0,0,4,4,4,4,1,0,0,0,0,0,0,0,0,0,0,3,4,
4,4,0,0,4,0,0,0,0,0,4,2,0,0,4,1,4,1,4,2,4,1,0,2,0,1,0,4,4,4,4,4,4,0],
        [0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,4,4,4,4,4,4,4,1,0,0,4,1,4,1,4,1,0,1,0,1,0,2,2,2,2,2,2,2,0],
        [0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,2,0,0,0,0,0,2,0,3,0,0,0,1,4,1,4,1,4,1,0,1,0,1,0,0,0,0,0,0,0,0,0],
        [0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,0,2,0,0,0,0,1,0,0,0,0,0,2,0,0,0,0,0,
0,0,0,0,1,0,0,0,0,0,1,0,0,0,0,1,4,3,4,1,4,3,0,1,0,3,0,1,0,0,0,0,0,0,0,0],
        [0,0,2,0,0,2,0,0,2,1,0,0,0,1,0,0,0,1,0,0,0,1,0,0,0,1,0,0,0,0,1,0,0,0,0,0,
0,0,0,0,1,0,0,0,0,0,3,0,0,0,0,0,1,0,0,0,1,0,0,0,1,0,0,0,0,1,0,0,0,0,0,0,0],
        [0,0,1,0,0,1,0,0,1,3,0,0,0,1,0,0,0,0,3,0,0,0,0,1,0,0,0,1,0,0,0,0,0,0,0,0,0,
0,0,0,0,1,0,0,0,0,0,0,0,1,0,0,0,1,0,0,0,1,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0],
        ],
    aImages = ["images/smwall.png", "images/smwallup.png",
               "images/smwalldown.png", "images/smstar.png",
               "images/smkey.png", "images/smstar2.png"]
}
sprite {
    type = ge_type_enemy
    animate = false
    file = "images/smhome.png"
    x = 5000
    y = 400
    width = 290
    height = 200
    transparent = true

    state = func oGame, oSelf {
        oself {
            x = 5000 + oGame.aObjects[2].x
            if x < 0 or x > SCREEN_W return ok
        }
        if oGameState.gameresult or oGameState.DoorKey = false return ok
        if oGame.aObjects[oGameState.playerindex].x > oself.x + 100 and
            oGame.aObjects[oGameState.playerindex].y > oself.y + 50
            oGameState.gameresult = true
        oGame {
            sprite {
                file = "images/smwin.jpg"
                x=0 y=0 width=800 height=600
                scaled = true animate=false
            }
        }
    }
}

```

(continues on next page)

(continued from previous page)

```

state = func ogame,oself {
    oself {
        x-=5
        y-=5
        width +=10
        height +=10
        if x = -300
            ogame.shutdown = true
        ok
    }
}
ok
}

animate {
    file = "images/superman.png"
    x = 0
    y = 0
    framewidth = 60
    scaled = true
    height = 86
    width = 60
    nStep = 3
    transparent = true
    state = func oGame,oSelf {
        checkstarskeycol(oGame,oSelf)

        if not oGameState.playerwin
            oself {
                file = "images/superman.png"
                height = 86
                width = 60
                for t=1 to 8
                    if checkwall2(oGame,oSelf,0,5,[2,1])
                        y += 5
                    else
                        exit
                    ok
                next
                if y > 500 y=500 ok
            }
        ok
    }
    keypress = func ogame,oself,nKey {
        if oGameState.gameresult = false

        oself {
            if nkey = key_up and checkwall(oGame,oSelf,0,-40)
                oGameState.value -= 1
                checkgameover(oGame)
                file = "images/supermanup.png"
        }
    }
}

```

(continues on next page)

(continued from previous page)

```

height = 123
dotransparent()
y -= 40
oGameState.down = 10
if y<=0 y=0 ok
but nkey = key_down and checkwall(oGame,oSelf,0,40)
file = "images/supermandown.png"
dotransparent()
y += 40
if y>=500 y=500 ok
but nKey = key_right and checkwall(oGame,oSelf,10,0)
file = "images/supermanright.png"
dotransparent()
x += 10
if x >= 440
    if oGame.aObjects[2].x > -4500
        oGame.aObjects[2].x -= 50
        callenemystate(oGame)
else
    if x <= 750
        if checkwall(oGame,oSelf,10,0)
            x += 10
        ok
    else
        if checkwall(oGame,oSelf,-10,0)
            x -= 10
        ok
    ok
return
ok
x=400
ok
but nKey = key_left and checkwall(oGame,oSelf,-10,0)
file = "images/supermanleft.png"
dotransparent()
x -= 10
if x <= 0
    x += 10
    if oGame.aObjects[2].x != 0
        oGame.aObjects[2].x += 50
        callenemystate(oGame)
        x += 50
    ok
ok
but nkey = key_esc or nKey = GE_AC_BACK
ogame.shutdown()
ok
}
ok
}
mouse = func ogame,oself,nType,aMouseList {
if nType = GE_MOUSE_DOWN
    oGameState.moveplayer = TRUE
But nType = GE_MOUSE_UP
    oGameState.moveplayer = FALSE
ok
if oGameState.moveplayer = TRUE

```

(continues on next page)

(continued from previous page)

```

if aMouseList[GE_MOUSE_X] < oSelf.X # left
    cFunc = oself.keypress
    call cFunc(oGame,oSelf,Key_left)
else
    cFunc = oself.keypress
    call cFunc(oGame,oSelf,Key_right)
ok
if aMouseList[GE_MOUSE_Y] < oSelf.Y # up
    cFunc = oself.keypress
    call cFunc(oGame,oSelf,Key_up)
else
    cFunc = oself.keypress
    call cFunc(oGame,oSelf,Key_down)
ok
ok
}

}

addenemy(oGame,600)
addenemy(oGame,900)
addenemy(oGame,1550)
addenemy(oGame,2350)
addenemy(oGame,3350)
addenemy(oGame,3500)
addenemy(oGame,3670)
addenemy(oGame,3840)

text {
    animate = false
    point = 400
    size = 30
    file = "fonts/pirulen.ttf"
    text = "Score : " + oGameState.score
    x = 500 y=0
    state = func oGame,oSelf {
        oSelf { text = "Score : " + oGameState.score }
    }
}

text {
    animate = false
    point = 400
    size = 30
    file = "fonts/pirulen.ttf"
    text = "Energy : " + oGameState.value
    x = 10 y=0
    state = func oGame,oSelf { oSelf { text = "Energy : " + oGameState.value } }
}
}

func inlist nValue,aList
for x in aList
    if x = nValue
        return true
    ok
next

```

(continues on next page)

(continued from previous page)

```

return false

func checkwall oGame,oSelf,diffx,diffy
    aList = [1,2,3]
    return checkwall2(oGame,oSelf,diffx,diffy,aList)

func checkwall2 oGame,oSelf,diffx,diffy,aList
    xPos = oSelf.x + diffx
    yPos = oSelf.y + diffy
    nValue = oGame.aObjects[2].getvalue(xPos,yPos)
    nValue = inlist(nValue,aList)
    nValue = not nValue
    if nValue = 0 return nValue ok

    xPos = oSelf.x + diffx
    yPos = oSelf.y + diffy + oSelf.height
    nValue = oGame.aObjects[2].getvalue(xPos,yPos)
    nValue = inlist(nValue,aList)
    nValue = not nValue
    if nValue = 0 return nValue ok

    xPos = oSelf.x + diffx + oSelf.width
    yPos = oSelf.y + diffy
    nValue = oGame.aObjects[2].getvalue(xPos,yPos)
    nValue = inlist(nValue,aList)
    nValue = not nValue
    if nValue = 0 return nValue ok

    xPos = oSelf.x + diffx + oSelf.width
    yPos = oSelf.y + diffy + oSelf.height
    nValue = oGame.aObjects[2].getvalue(xPos,yPos)
    nValue = inlist(nValue,aList)
    nValue = not nValue
    if nValue = 0 return nValue ok

return nValue

func checkopenwall oGame
    if oGameState.score = 900
        oGame.aObjects[2].aMap[3][10] = 3
        oGame.aObjects[2].aMap[4][10] = 0
        oGame.aObjects[2].aMap[5][10] = 0
        oGame.aObjects[2].aMap[6][10] = 0
        oGame.aObjects[2].aMap[7][10] = 0
        oGame.aObjects[2].aMap[8][10] = 0
    but oGameState.score = 1800
        oGame.aObjects[2].aMap[3][18] = 3
        oGame.aObjects[2].aMap[4][18] = 0
        oGame.aObjects[2].aMap[5][18] = 0
        oGame.aObjects[2].aMap[6][18] = 0
        oGame.aObjects[2].aMap[7][18] = 0
        oGame.aObjects[2].aMap[8][18] = 0
    but oGameState.score = 5500
        oGame.aObjects[2].aMap[1][44] = 0
        oGame.aObjects[2].aMap[2][44] = 0
        oGame.aObjects[2].aMap[3][44] = 2
    ok
```

(continues on next page)

(continued from previous page)

```

func checkgameover ogame
    if oGameState.gameresult return ok
    if oGameState.value <= 0
        oGameState.value = 0
        oGameState.gameresult = true
        oGame {
            text {
                point = 400
                size = 30
                nStep = 9
                file = "fonts/pirulen.ttf"
                text = "Game Over !!!"
                x = 500 y=10
                state = func ogame,oself {
                    if oself.y >= 400
                        ogame.shutdown = true
                    ok
                }
            }
        }
        showfire(oGame,oGame.aObjects[oGameState.PlayerIndex].x+40,
                 oGame.aObjects[oGameState.PlayerIndex].y+40)
        oGame.aObjects[oGameState.PlayerIndex].enabled = false
        oGame.remove(oGameState.PlayerIndex)
    ok

func showfire oGame,nX,nY
    oGame {
        animate {
            file = "images/fire.png"
            x = nX
            y = nY
            framewidth = 40
            height = 42
            nStep = 3
            transparent = true
            state = func oGame,oSelf {
                oSelf {
                    nStep--
                    if nStep = 0
                        nStep = 3
                        if frame < 13
                            frame++
                        else
                            frame=1
                            oGame.remove(oself.nIndex)
                    ok
                ok
            }
        }
    }

func addenemy oGame,xPos

```

(continues on next page)

(continued from previous page)

```

oGame {
    lbraceend = false
    sprite {
        type = ge_type_enemy
        file = "images/smenemy.png"
        transparent = true
        x = xPos y =10 width=100 height=100
        animate=true Scaled=true
        direction = GE_DIRECTION_NOMOVE
        temp = xPos
        state = func oGame,oSelf {
            oself {
                x = oSelf.temp + oGame.aObjects[2].x
                if y < 0 y = 0 ok
                if y > 100 y=100 ok
                if x > SCREEN_W or x < 0 return ok
            }

            if random(10) = 1
                if oGameState.gameresult return ok
                ogame {
                    sprite {
                        type = ge_type_fire
                        file = "images/smrocket.png"
                        scaled = true
                        transparent = true
                        x = oself.x + 30
                        y = oself.y + oself.height+ 30
                        width = 30
                        height = 30
                        point = ogame.screen_h+30
                        nstep = 30
                        direction = ge_direction_incvertical
                        xvalue = oGame.aObjects[2].x
                        temp = oself.x + 30 - xvalue
                        state = func oGame,oSelf {
                            oself { x = oSelf.temp + oGame.aObjects[2].x }
                            x = oGame.aObjects[oGameState.playerindex]
                            if oself.x >= x.x and oself.y >= x.y and
                                oself.x <= x.x + x.width and
                                oself.y <= x.y + x.height
                                if oGameState.value > 0
                                    oGameState.value-=1000
                                    ok
                                    ogame.remove(oself.nindex)
                                    checkgameover(oGame)
                                    ok
                            }
                        }
                    }
                }
            }
        }
    }
}
ogame.lbraceend = true

```

(continues on next page)

(continued from previous page)

```

func checkstarskey oGame,oSelf,nValue,nRow,nCol
    switch nValue
        on 4
            oGame.aObjects[2].aMap[nRow][nCol] = 6
            oGameState.Score += 100
            checkopenwall(oGame)
            oGame { Sound {
                once = true
                file = "sound/sfx_point.wav"
            } }
        on 5
            oGame.aObjects[2].aMap[nRow][nCol] = 0
            oGameState.DoorKey = true
            oGameState.Score += 500
            checkopenwall(oGame)
            oGame { Sound {
                once = true
                file = "sound/sfx_point.wav"
            } }
    off

func checkstarskeycol oGame,oSelf
    nValue = oGame.aObjects[2].getvalue(oSelf.x,oSelf.y)
    nRow = oGame.aObjects[2].getrow(oSelf.x,oSelf.y)
    nCol = oGame.aObjects[2].getcol(oSelf.x,oSelf.y)
    checkstarskey(oGame,oSelf,nValue,nRow,nCol)

    nValue = oGame.aObjects[2].getvalue(oSelf.x+oSelf.width,oSelf.y+oSelf.height)
    nRow = oGame.aObjects[2].getrow(oSelf.x+oSelf.width,oSelf.y+oSelf.height)
    nCol = oGame.aObjects[2].getcol(oSelf.x+oSelf.width,oSelf.y+oSelf.height)
    checkstarskey(oGame,oSelf,nValue,nRow,nCol)

    nValue = oGame.aObjects[2].getvalue(oSelf.x+oSelf.width,oSelf.y)
    nRow = oGame.aObjects[2].getrow(oSelf.x+oSelf.width,oSelf.y)
    nCol = oGame.aObjects[2].getcol(oSelf.x+oSelf.width,oSelf.y)
    checkstarskey(oGame,oSelf,nValue,nRow,nCol)

    nValue = oGame.aObjects[2].getvalue(oSelf.x,oSelf.y+oSelf.height)
    nRow = oGame.aObjects[2].getrow(oSelf.x,oSelf.y+oSelf.height)
    nCol = oGame.aObjects[2].getcol(oSelf.x,oSelf.y+oSelf.height)
    checkstarskey(oGame,oSelf,nValue,nRow,nCol)

func callenemystate oGame
    for t in oGame.aObjects
        t {
            if type = GE_TYPE_ENEMY
                call state(oGame,t)
            ok
        }
    next

Class GameState

down = 3
gameresult = false
Score = 0
startplay=false

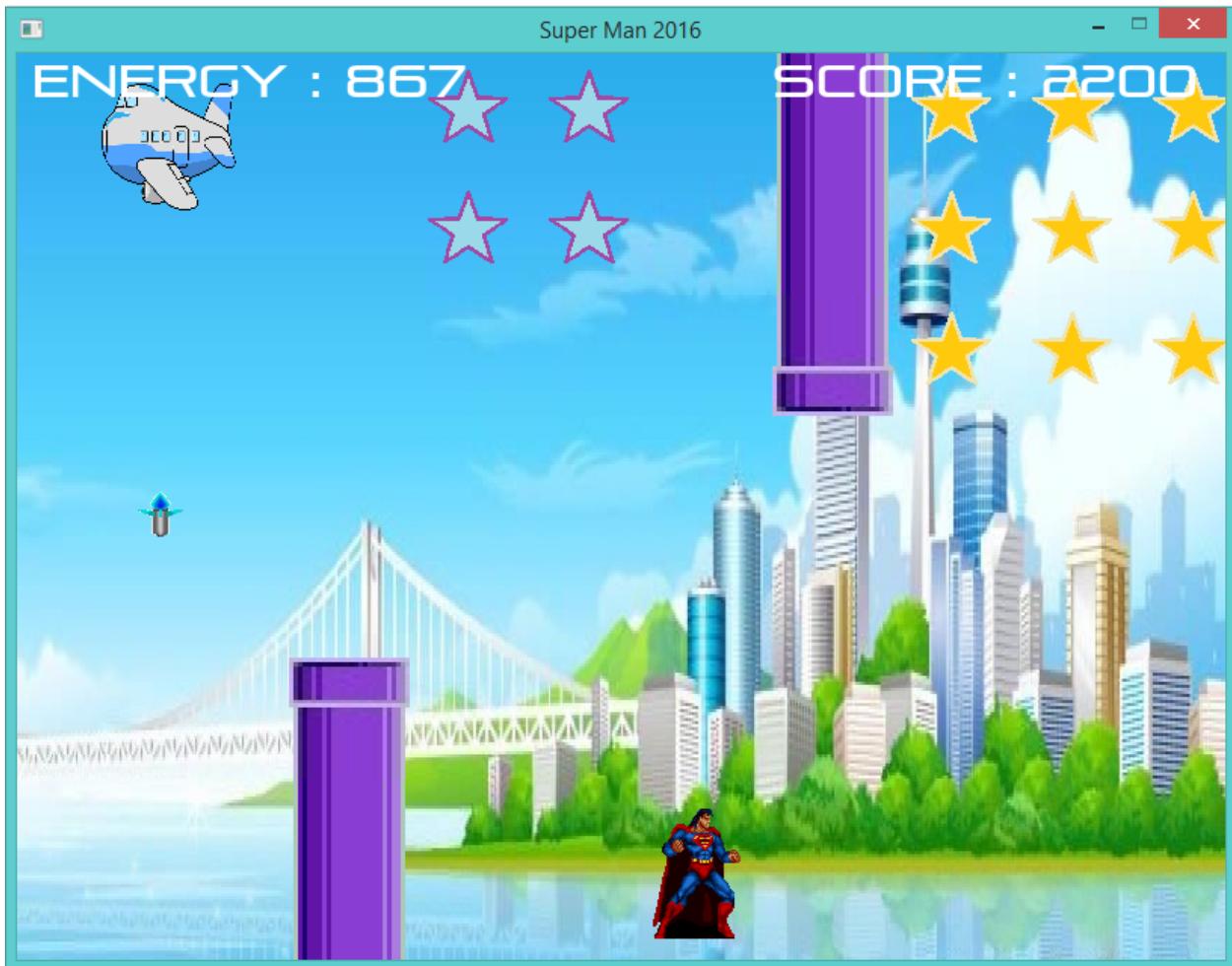
```

(continues on next page)

(continued from previous page)

```
lastcol = 0
playerwin = false
DoorKey = false
playerindex = 4
value = 1000
moveplayer = false
```

Screen Shot:



BUILDING GAMES FOR ANDROID

In this chapter we will learn about Building RingLibSDL Games for Mobile.

So we can create packages (*.apk) for the applications that are developed using Ring Game Engine for 2D Games.

56.1 Download Requirements and Update the Android SDK

- The Android SDK Tools

<https://developer.android.com/studio/index.html>

- The Android NDK (Tested using android-ndk-r10c)

<https://developer.android.com/ndk/index.html>

- Apache Ant v1.8 or later

<http://ant.apache.org/bindownload.cgi>

- Java SE Development Kit (JDK) v6 or later

<http://www.oracle.com/technetwork/java/javase/downloads/jdk7-downloads-1880260.html>

- Update the Android SDK to get the API and tools packages required for development

Tested using Android 4.4.2 (API 19)

- In Windows - Define the next Environment Variables based on your system.

- (1) JAVA_HOME

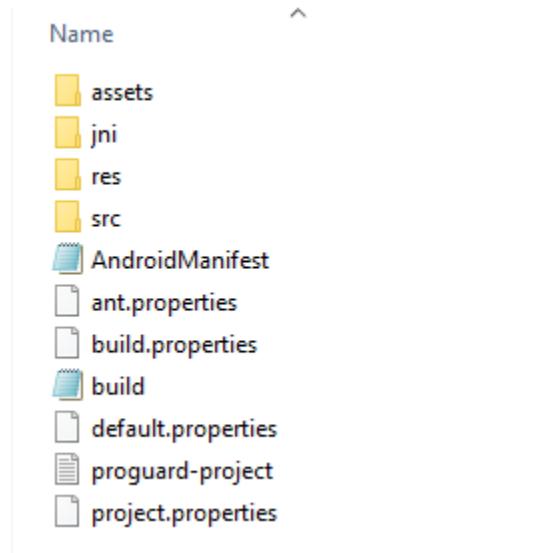
For Example : C:\Program Files (x86)\Java\jdk1.8.0_05

- (2) ANDROID_HOME

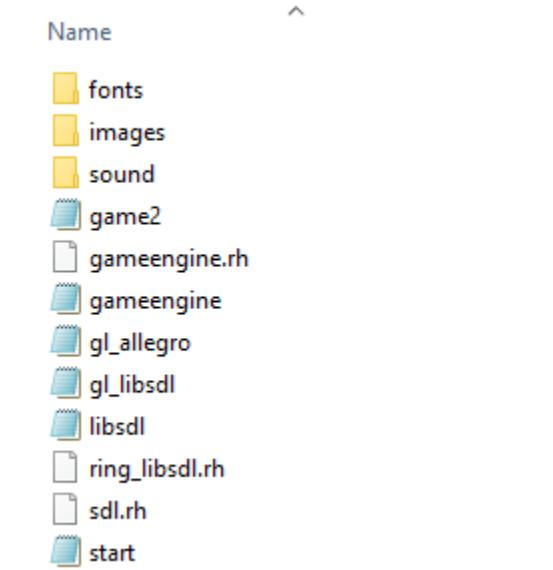
For Example : B:\mahmoud\Tools\Java-Android\adt-bundle-windows-x86-20140702\sdk

56.2 Project Folder

Open the project folder : ring/extensions/android/ringlibsdl/project



You can add the source code (*.ring) and Images/Sound Files to the assets folder.



You will find the Flappy Bird 3000 Game ready for building.

The execution starts from the start.ring file

```
load "game2.ring"
```

56.3 Building the project

Move to the ring/extensions/android/ringlibsdl/project folder

We can build using the next command (We need to do this for one time only).

```
ndk-build
```

Then we can create the package (*.apk) using the next command.

```
ant debug
```

We can write a batch file for building the project (file: build.bat)

```
rem You will need to modify this batch file based on your environment

set JAVA_HOME=C:\Program Files (x86)\Java\jdk1.8.0_05
set ANDROID_HOME=B:\mahmoud\Tools\JavaAndroid\adt-bundle-windows-x86-20140702\sdk
set NDK_ROOT=B:\mahmoud\Tools\JavaAndroid\android-ndk-r10c

set path=%path%;B:\mahmoud\Tools\JavaAndroid\android-ndk-r10c
set path=%path%;B:\mahmoud\Tools\JavaAndroid\apache-ant-1.9.4\bin

ndk-build
```

DEVELOPING GAMES USING RINGRAYLIB

In this chapter we will learn how to use the RingRayLib extension.

57.1 Introduction

RingRayLib is an extension for the RayLib game programming library.

Also RayGUI functions are supported by this extension.

57.2 Basic Window

```
load "raylib.ring"

screenWidth      = 800
screenHeight     = 450

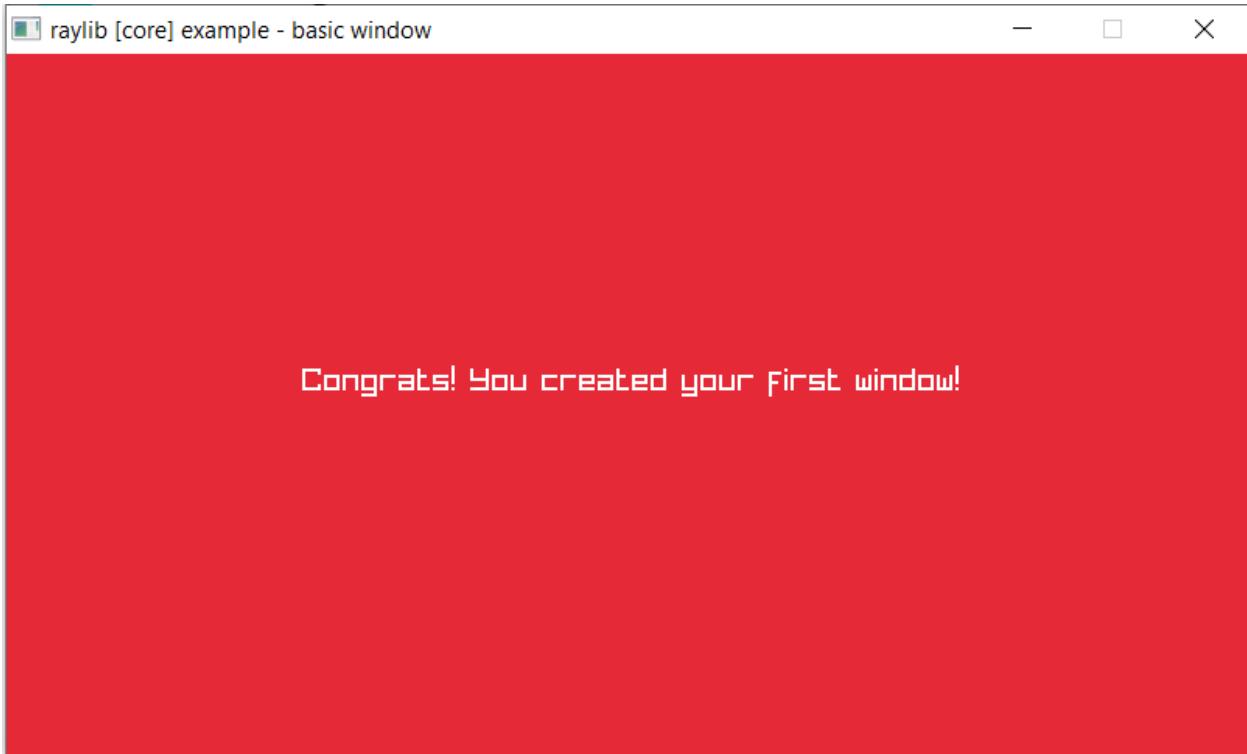
InitWindow(screenWidth, screenHeight, "raylib [core] example - basic window")

SetTargetFPS(60)

while !WindowShouldClose()
    BeginDrawing()
    ClearBackground(RED)
    DrawText("Congrats! You created your first window!", 190, 200, 20, WHITE)
    EndDrawing()
end

CloseWindow()
```

Screen Shot:



57.3 Input Keys

```

load "raylib.ring"

screenWidth  = 800
screenHeight = 450

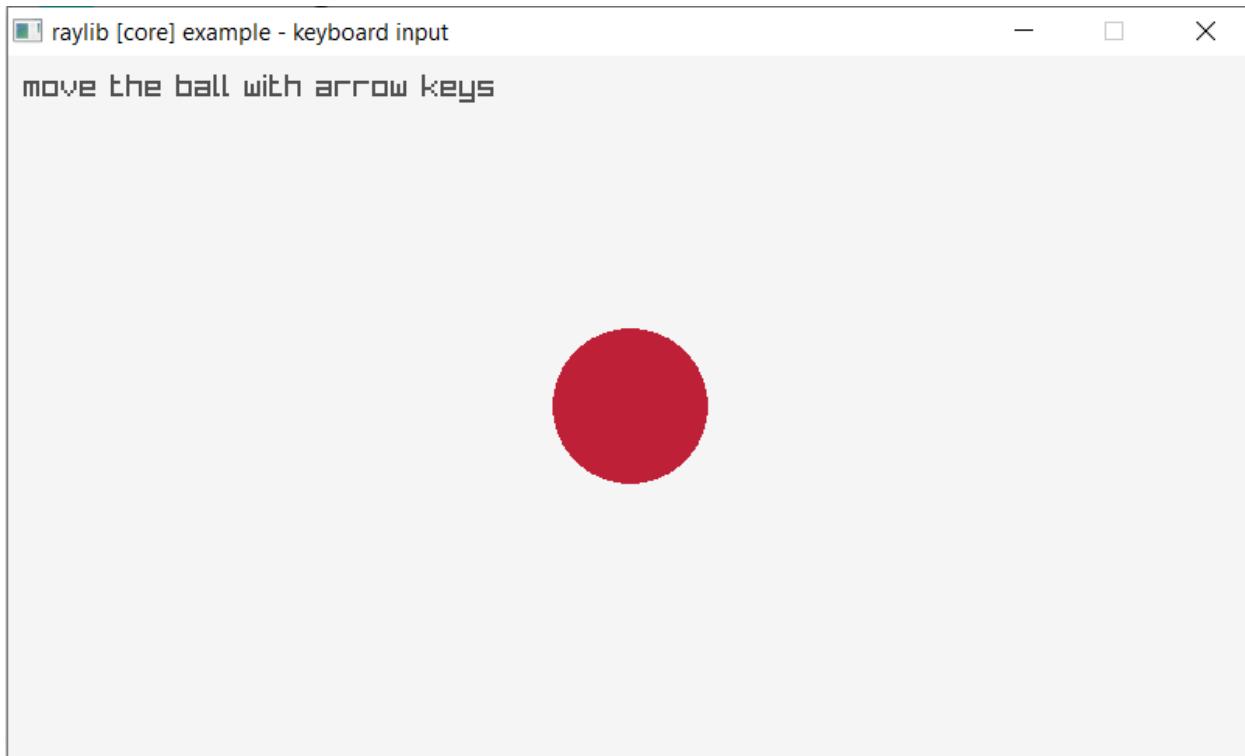
InitWindow(screenWidth, screenHeight, "raylib [core] example - keyboard input")
ballPosition = Vector2(screenWidth/2, screenHeight/2)
SetTargetFPS(60)

while !WindowShouldClose()
    if IsKeyDown(KEY_RIGHT) ballPosition.x += 2 ok
    if IsKeyDown(KEY_LEFT)   ballPosition.x -= 2 ok
    if IsKeyDown(KEY_UP)     ballPosition.y -= 2 ok
    if IsKeyDown(KEY_DOWN)   ballPosition.y += 2 ok
    BeginDrawing()
    ClearBackground(RAYWHITE)
    DrawText("move the ball with arrow keys", 10, 10, 20, DARKGRAY)
    DrawCircleV(ballPosition, 50, MAROON)
    EndDrawing()
end

CloseWindow()

```

Screen Shot:



57.4 Input Mouse

```

load "raylib.ring"

screenWidth  = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight, "raylib [core] example - mouse input")

ballPosition     = Vector2(100, 100)
ballColor       = DARKBLUE

SetTargetFPS(60)

while ! WindowShouldClose()

    ballPosition = GetMousePosition()

    if IsMouseButtonPressed(MOUSE_LEFT_BUTTON)
        ballColor = MAROON
    but IsMouseButtonPressed(MOUSE_MIDDLE_BUTTON)
        ballColor = LIME
    but IsMouseButtonPressed(MOUSE_RIGHT_BUTTON)
        ballColor = DARKBLUE
    ok

    BeginDrawing()
    ClearBackground(BLACK)
    DrawCircleV(ballPosition, 40, ballColor)

```

(continues on next page)

(continued from previous page)

```

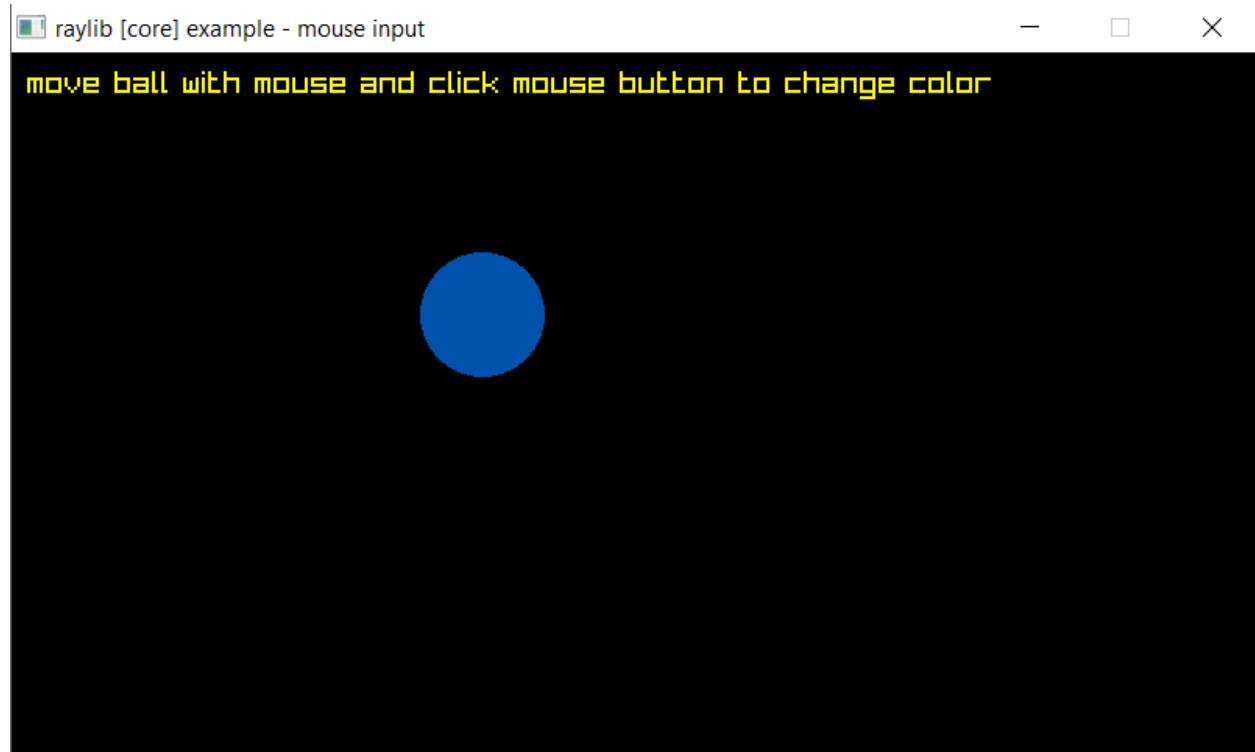
        DrawText("move ball with mouse and click mouse button to change color
        ↵",
                  10, 10, 20, YELLOW)
    EndDrawing()

end

CloseWindow()

```

Screen Shot:



57.5 3D Camera

```

load "raylib.ring"

screenWidth = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight, "raylib [core] example - 3d camera mode")

camera = Camera3D(
    0, 10, 10,           // Camera position
    0, 0, 0,             // Camera looking at point
    0, 1, 0,             // Camera up vector (rotation towards target)
    45,                 // Camera field-of-view Y
    CAMERA_PERSPECTIVE) // Camera mode type

cubePosition = Vector3(0, 0, 0)

```

(continues on next page)

(continued from previous page)

```
SetTargetFPS(60)

while !WindowShouldClose()

    BeginDrawing()

        ClearBackground(RAYWHITE)

        BeginMode3D(camera)

            DrawCube(cubePosition, 2, 2, 2, RED)
            DrawCubeWires(cubePosition, 2, 2, 2, MAROON)

            DrawGrid(10, 1)

        EndMode3D()

        DrawText("Welcome to the third dimension!", 10, 40, 20, DARKGRAY)

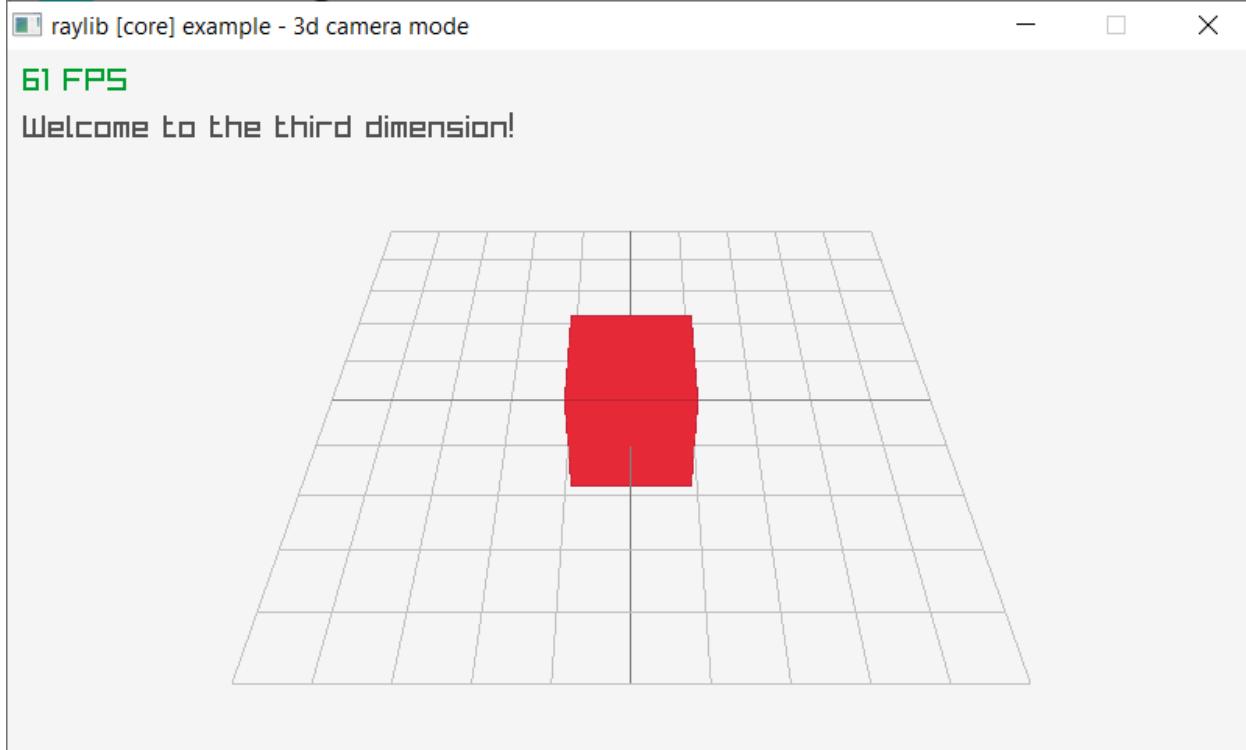
        DrawFPS(10, 10)

    EndDrawing()

end

CloseWindow()
```

Screen Shot:



57.6 3D Camera Free

```

load "raylib.ring"

screenWidth = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight, "raylib [core] example - 3d camera free")

camera = Camera3D(
    10, 10, 10,           // Camera position
    0, 0, 0,               // Camera looking at point
    0, 1, 0,               // Camera up vector (rotation towards target)
    45,                   // Camera field-of-view Y
    CAMERA_PERSPECTIVE)   // Camera mode type

cubePosition = Vector3(0, 0, 0)

SetCameraMode(camera, CAMERA_FREE)           // Set a free camera mode

SetTargetFPS(60)

while !WindowShouldClose()

    UpdateCamera(camera)

    if IsKeyDown("Z") camera.target = Vector3( 0, 0, 0) ok

    BeginDrawing()

    ClearBackground(RAYWHITE)

    BeginMode3D(camera)

    DrawCube(cubePosition, 2, 2, 2, RED)
    DrawCubeWires(cubePosition, 2, 2, 2, MAROON)

    DrawGrid(10, 1)

    EndMode3D()

    DrawRectangle( 10, 10, 320, 133, Fade(SKYBLUE, 0.5))
    DrawRectangleLines( 10, 10, 320, 133, BLUE)

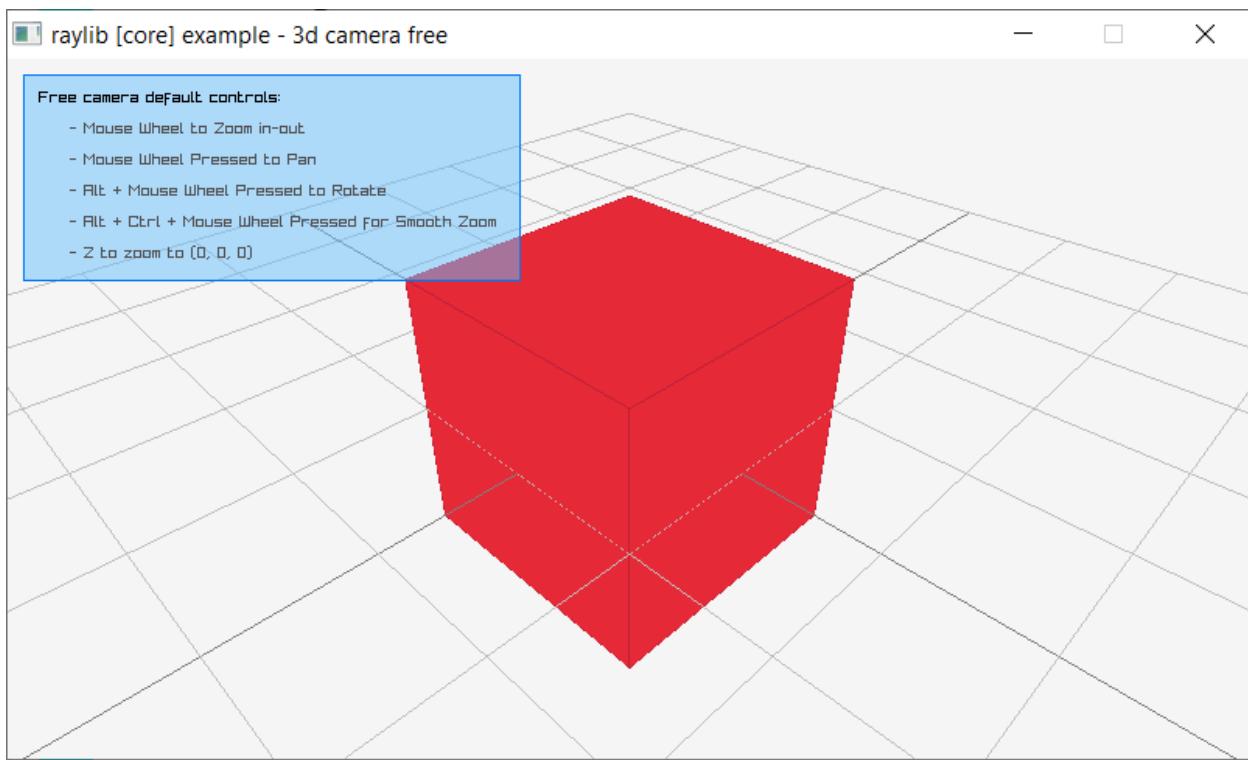
    DrawText("Free camera default controls:", 20, 20, 10, BLACK)
    DrawText("- Mouse Wheel to Zoom in-out", 40, 40, 10, DARKGRAY)
    DrawText("- Mouse Wheel Pressed to Pan", 40, 60, 10, DARKGRAY)
    DrawText("- Alt + Mouse Wheel Pressed to Rotate", 40, 80, 10, DARKGRAY)
    DrawText("- Alt + Ctrl + Mouse Wheel Pressed for Smooth Zoom", 40, 100, 10, DARKGRAY)
    DrawText("- Z to zoom to (0, 0, 0)", 40, 120, 10, DARKGRAY)

    EndDrawing()
end

CloseWindow()

```

Screen Shot:



57.7 Mouse Wheel

```

load "raylib.ring"

screenWidth = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight, "raylib [core] example - input mouse wheel")

boxPositionY = screenHeight/2 - 40
scrollSpeed = 4

SetTargetFPS(60)

while !WindowShouldClose()
    boxPositionY -= (GetMouseWheelMove() * scrollSpeed)

    BeginDrawing()

    ClearBackground(RAYWHITE)

    DrawRectangle(screenWidth/2 - 40, boxPositionY, 80, 80, MAROON)

    DrawText("Use mouse wheel to move the cube up and down!", 10, 10, 20, GRAY)
    DrawText("Box position Y: "+boxPositionY, 10, 40, 20, LIGHTGRAY)

    EndDrawing()

```

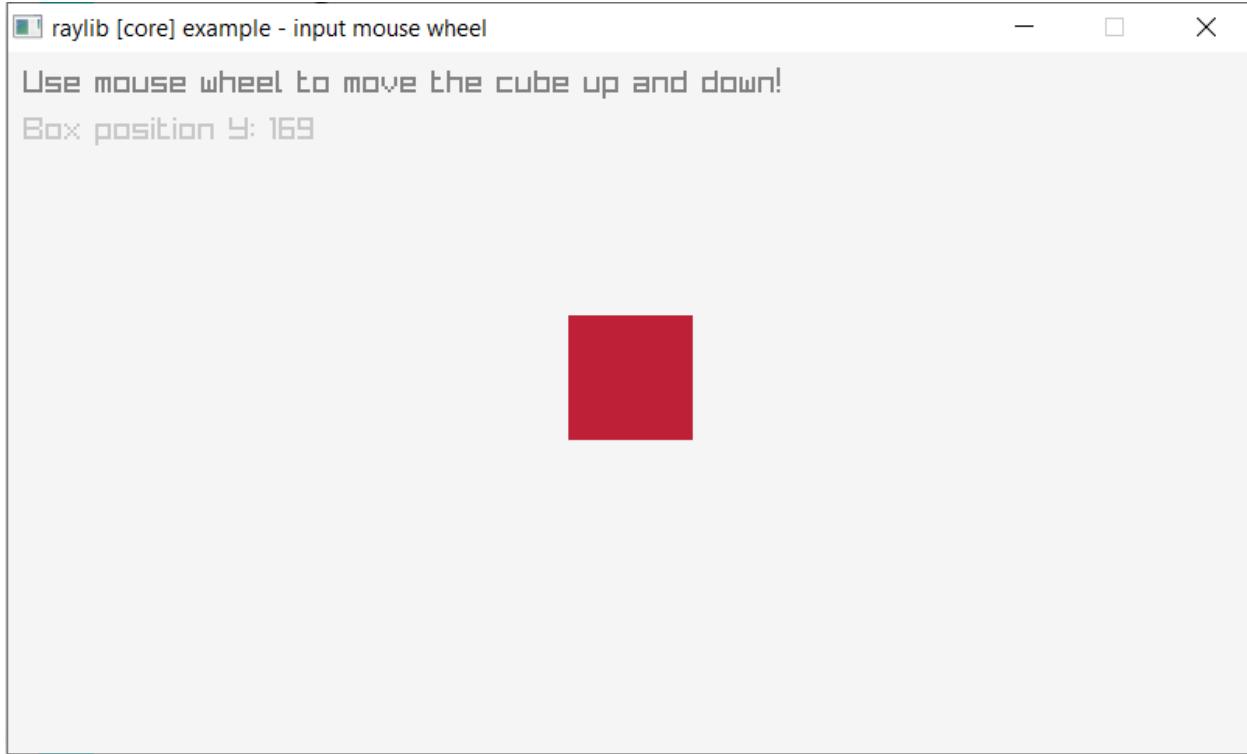
(continues on next page)

(continued from previous page)

```
end

CloseWindow()
```

Screen Shot:



57.8 Input Multi-touch

```
load "raylib.ring"

screenWidth = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight, "raylib [core] example - input multitouch")

ballPosition = Vector2(-100, -100)
ballColor = BEIGE

touchCounter = 0
touchPosition = vector2(0, 0)

MAX_TOUCH_POINTS = 5

SetTargetFPS(60)

while !WindowShouldClose()

    ballPosition = GetMousePosition()
```

(continues on next page)

(continued from previous page)

```

ballColor = BEIGE

if IsMouseButtonDown(MOUSE_LEFT_BUTTON) ballColor = MAROON ok
if IsMouseButtonDown(MOUSE_MIDDLE_BUTTON) ballColor = LIME ok
if IsMouseButtonDown(MOUSE_RIGHT_BUTTON) ballColor = DARKBLUE ok

if IsMouseButtonPressed(MOUSE_LEFT_BUTTON) touchCounter = 10 ok
if IsMouseButtonPressed(MOUSE_MIDDLE_BUTTON) touchCounter = 10 ok
if IsMouseButtonPressed(MOUSE_RIGHT_BUTTON) touchCounter = 10 ok

if touchCounter > 0 touchCounter-- ok

BeginDrawing()

ClearBackground(RAYWHITE)

for i = 0 to MAX_TOUCH_POINTS-1
    touchPosition = GetTouchPosition(i)

    if touchPosition.x >= 0 && touchPosition.y >= 0
        DrawCircleV(touchPosition, 34, ORANGE)
        DrawText("'" + i, touchPosition.x - 10,
                 touchPosition.y - 70, 40, BLACK)
    ok
next

DrawCircleV(ballPosition, 30 + (touchCounter*3), ballColor)

DrawText("move ball with mouse and click mouse button to change color",
        10, 10, 20, DARKGRAY)
DrawText("touch the screen at multiple locations to get multiple balls",
        10, 30, 20, DARKGRAY)

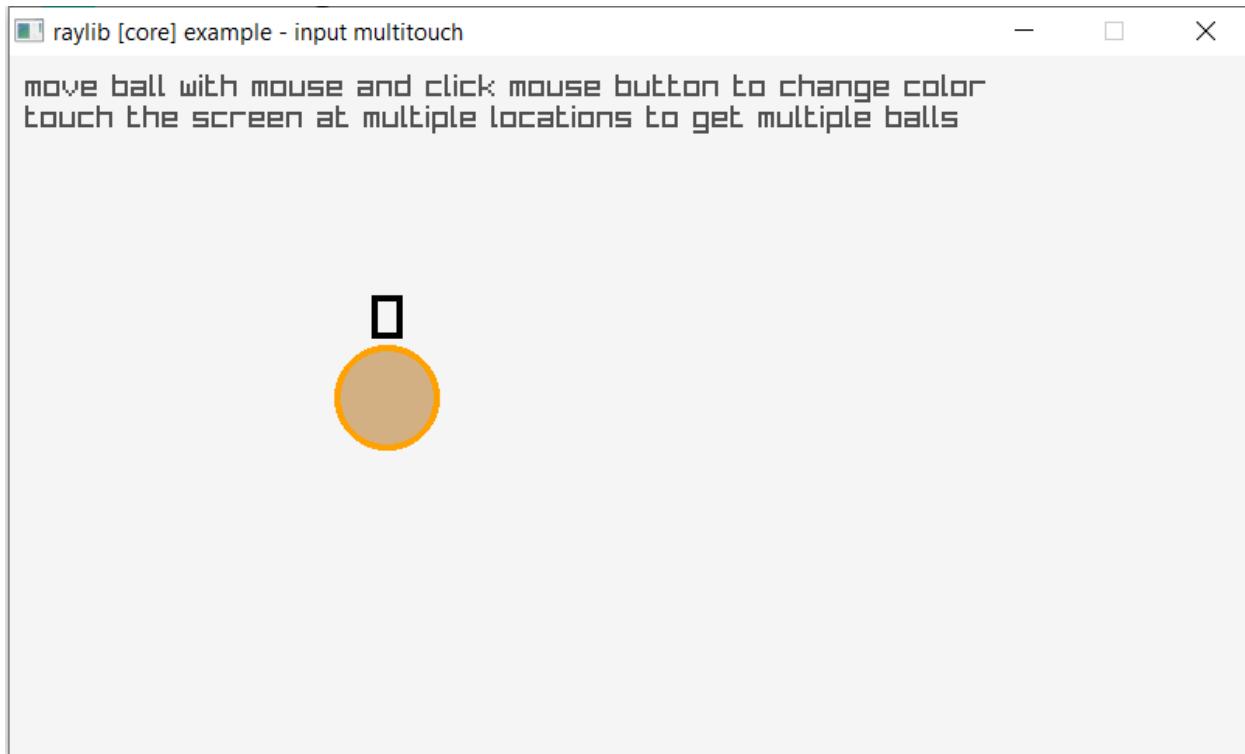
EndDrawing()

end

CloseWindow()

```

Screen Shot:



57.9 Camera First Person

```

load "raylib.ring"

MAX_COLUMNS = 20

screenWidth = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight, "raylib [core] example - 3d camera first person
→")

camera = Camera3d(
    4, 2, 4,
    0, 1, 0,
    0, 1, 0,
    60,
    CAMERA_PERSPECTIVE
)

heights = list(MAX_COLUMNS)
positions = list(MAX_COLUMNS)
for item in positions item = vector3(0,0,0) next
colors = list(MAX_COLUMNS)
for item in colors item = BLACK next

for i = 1 to MAX_COLUMNS
    heights[i] = GetRandomValue(1, 12)
    positions[i] = Vector3(GetRandomValue(-15, 15),

```

(continues on next page)

(continued from previous page)

```

        heights[i]/2, GetRandomValue(-15, 15) )
colors[i] = RAYLibColor(GetRandomValue(20, 255),
                        GetRandomValue(10, 55), 30, 255 )
next

SetCameraMode(camera, CAMERA_FIRST_PERSON)

SetTargetFPS(60)

while !WindowShouldClose()

    UpdateCamera(camera)
    BeginDrawing()

    ClearBackground(RAYWHITE)

    BeginMode3D(camera)

    DrawPlane(Vector3( 0, 0, 0 ), Vector2(32, 32 ), LIGHTGRAY) // Draw ground
    DrawCube(Vector3( -16, 2.5, 0 ), 1, 5, 32, BLUE)           // Draw a blue wall
    DrawCube(Vector3( 16, 2.5, 0 ), 1, 5, 32, LIME)           // Draw a green wall
    DrawCube(Vector3( 0, 2.5, 16 ), 32, 5, 1, GOLD)           // Draw a yellow wall

    for i = 1 to MAX_COLUMNS
        DrawCube(positions[i], 2, heights[i], 2, colors[i])
        DrawCubeWires(positions[i], 2, heights[i], 2, MAROON)
    next

    EndMode3D()

    DrawRectangle( 10, 10, 220, 70, Fade(SKYBLUE, 0.5f) )
    DrawRectangleLines( 10, 10, 220, 70, BLUE)

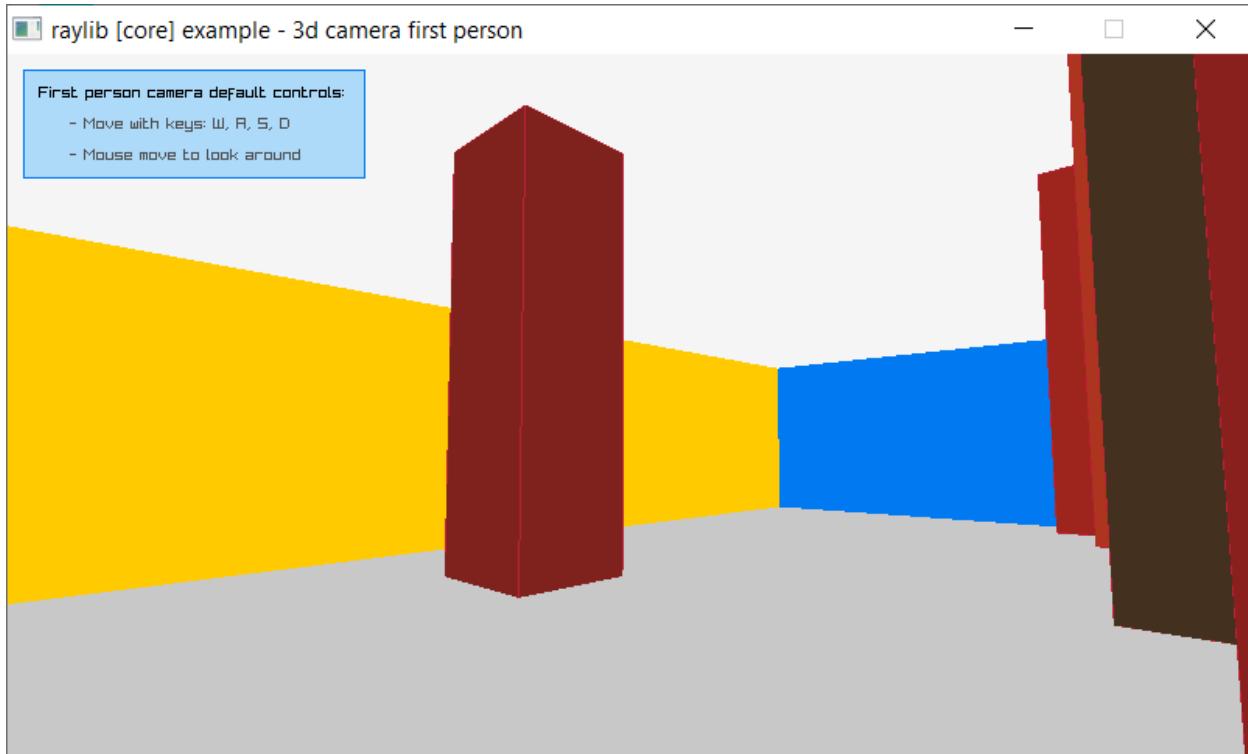
    DrawText("First person camera default controls:", 20, 20, 10, BLACK)
    DrawText("- Move with keys: W, A, S, D", 40, 40, 10, DARKGRAY)
    DrawText("- Mouse move to look around", 40, 60, 10, DARKGRAY)

    EndDrawing()
end

CloseWindow()

```

Screen Shot:



57.10 3D Picking

```

load "raylib.ring"

screenWidth = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight, "raylib [core] example - 3d picking")

camera = Camera3D(
    10, 10, 10,
    0, 0, 0 ,
    0, 1, 0 ,
    45,
    CAMERA_PERSPECTIVE
)

cubePosition = Vector3( 0, 1, 0 )
cubeSize = Vector3( 2, 2, 2 )

ray = Ray(0,0,0,0,0,0)

collision = false

SetCameraMode(camera, CAMERA_FREE)

SetTargetFPS(60)

while !WindowShouldClose()

```

(continues on next page)

(continued from previous page)

```

UpdateCamera(camera)

if IsMouseButtonPressed(MOUSE_LEFT_BUTTON)
    if !collision
        ray = GetMouseRay(Get.mousePosition(), camera)
        collision = CheckCollisionRayBox(ray,
            BoundingBox( cubePosition.x - cubeSize.x/2,
            cubePosition.y - cubeSize.y/2, cubePosition.z - cubeSize.z/2,
            cubePosition.x + cubeSize.x/2, cubePosition.y + cubeSize.y/2,
            cubePosition.z + cubeSize.z/2 ) )
    else collision = false
    ok
ok

BeginDrawing()

ClearBackground(RAYWHITE)

BeginMode3D(camera)

if collision
    DrawCube(cubePosition, cubeSize.x, cubeSize.y, cubeSize.z, RED)
    DrawCubeWires(cubePosition, cubeSize.x, cubeSize.y, cubeSize.z, ↵
    ↵MAROON)

    DrawCubeWires(cubePosition, cubeSize.x + 0.2f,
                  cubeSize.y + 0.2f, cubeSize.z + 0.2f, GREEN)
else
    DrawCube(cubePosition, cubeSize.x, cubeSize.y, cubeSize.z, GRAY)
    DrawCubeWires(cubePosition, cubeSize.x, cubeSize.y, cubeSize.z, ↵
    ↵DARKGRAY)
    ok

DrawRay(ray, MAROON)
DrawGrid(10, 1)

EndMode3D()

DrawText("Try selecting the box with mouse!", 240, 10, 20, DARKGRAY)

if collision DrawText("BOX SELECTED",
                      (screenWidth - MeasureText("BOX SELECTED", 30)) / 2,
                      screenHeight * 0.1f, 30, GREEN) ok

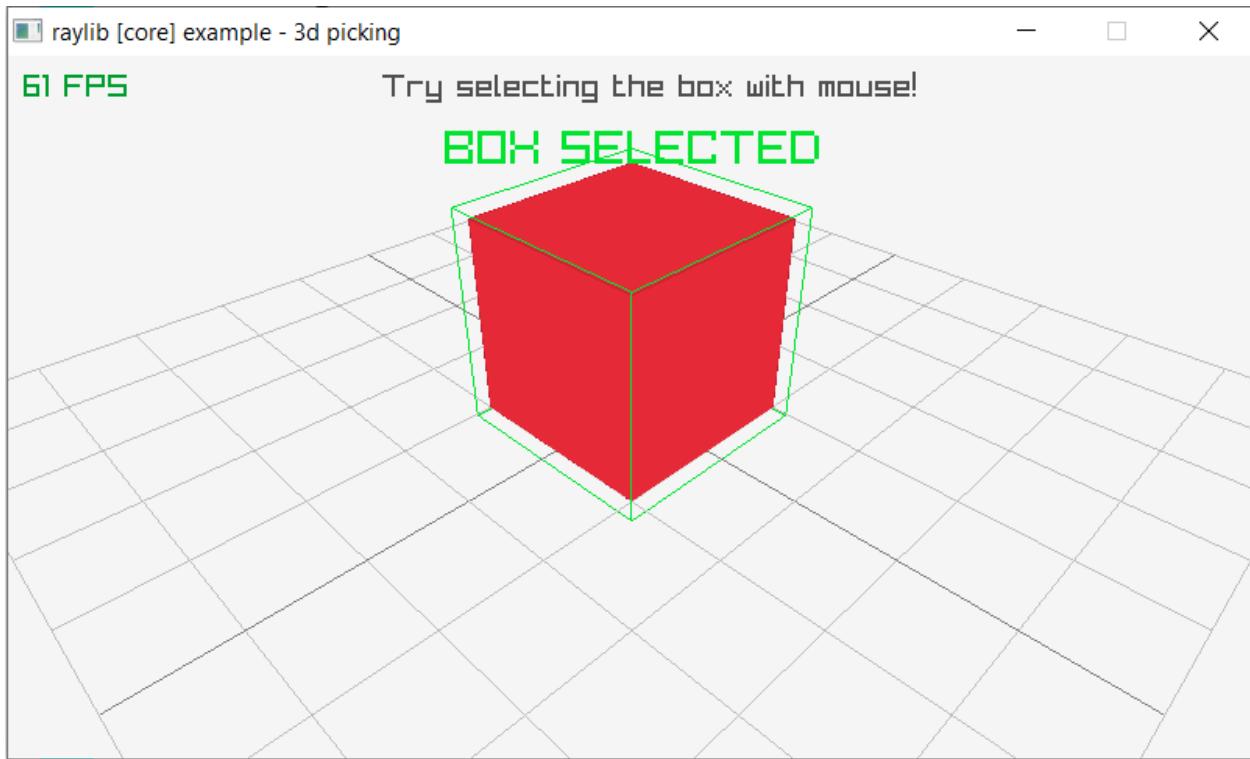
DrawFPS(10, 10)

EndDrawing()
end

CloseWindow()

```

Screen Shot:



57.11 Full Screen

```

load "raylib.ring"

screenWidth      = 1024
screenHeight     = 768

InitWindow(screenWidth, screenHeight, "Full Screen")
ToggleFullScreen()

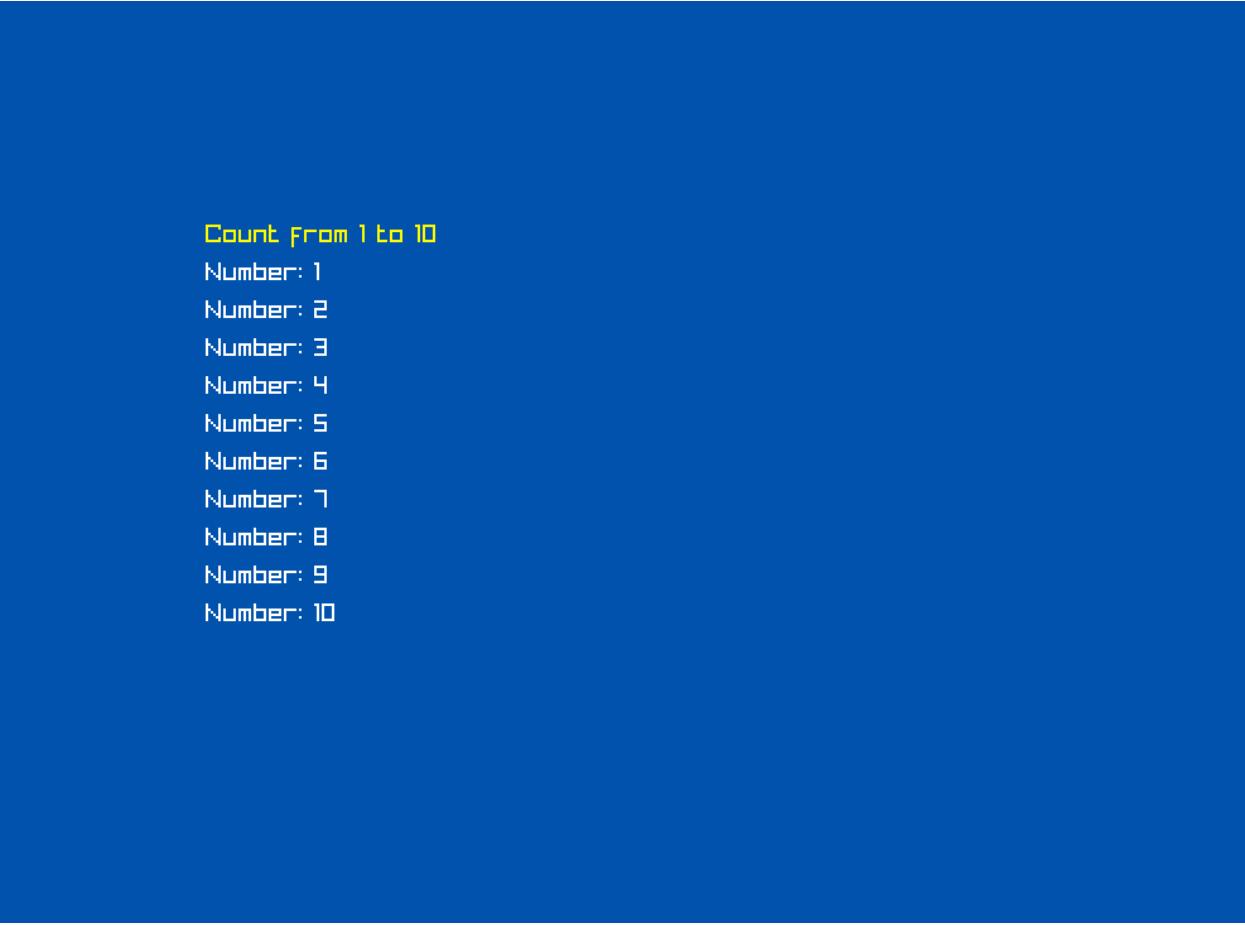
SetTargetFPS(60)

while !WindowShouldClose()
    BeginDrawing()
        ClearBackground(DARKBLUE)
        DrawText("Count from 1 to 10", 190, 200, 20, Yellow)
        for t = 1 to 10
            DrawText("Number: " + t, 190, 200+(30*t), 20, WHITE)
        next
    EndDrawing()
end

CloseWindow()

```

Screen Shot:



Count from 1 to 10

Number: 1
Number: 2
Number: 3
Number: 4
Number: 5
Number: 6
Number: 7
Number: 8
Number: 9
Number: 10

57.12 Two Cubes

```
load "raylib.ring"

screenWidth = 800
screenHeight = 450
InitWindow(screenWidth, screenHeight, "raylib [core] example - Two Cubes")

camera = Camera3D(
    10, 10, 10,
    0, 0, 0 ,
    0, 1, 0 ,
    45,
    CAMERA_PERSPECTIVE
)

cubePosition1 = Vector3( 0, 1, 4 )
cubePosition2 = Vector3( 0, 1, -4 )
cubeSize = Vector3( 2, 2, 2 )

ray = Ray(0,0,0,0,0,0)

collision1 = false
```

(continues on next page)

(continued from previous page)

```

collision2 = false

SetCameraMode(camera, CAMERA_FREE)

SetTargetFPS(60)

while !WindowShouldClose()

    UpdateCamera(camera)

    if IsMouseButtonPressed(MOUSE_LEFT_BUTTON)
        if !collision1
            ray = GetMouseRay(Get.mousePosition(), camera)

            collision1 = CheckCollisionRayBox(ray,
                BoundingBox( cubePosition1.x -
                cubeSize.x/2, cubePosition1.y - cubeSize.y/2,
                cubePosition1.z - cubeSize.z/2,
                cubePosition1.x + cubeSize.x/2,
                cubePosition1.y + cubeSize.y/2,
                cubePosition1.z + cubeSize.z/2 ) )

        else
            collision1 = false
        ok
        if !collision2
            ray = GetMouseRay(Get.mousePosition(), camera)

            collision2 = CheckCollisionRayBox(ray,
                BoundingBox( cubePosition2.x -
                cubeSize.x/2, cubePosition2.y - cubeSize.y/2,
                cubePosition2.z - cubeSize.z/2,
                cubePosition2.x + cubeSize.x/2,
                cubePosition2.y + cubeSize.y/2,
                cubePosition2.z + cubeSize.z/2 ) )

        else
            collision2 = false
        ok
    ok

BeginDrawing()

    ClearBackground(RAYWHITE)

    BeginMode3D(camera)

        if collision1
            DrawCube(cubePosition1, cubeSize.x,
                cubeSize.y, cubeSize.z, RED)
            DrawCubeWires(cubePosition1, cubeSize.x,
                cubeSize.y, cubeSize.z, MAROON)

            DrawCubeWires(cubePosition1, cubeSize.x +
                0.2f, cubeSize.y + 0.2f,
                cubeSize.z + 0.2f, GREEN)
            collision1 = true
        else
            DrawCube(cubePosition1, cubeSize.x,

```

(continues on next page)

(continued from previous page)

```

        cubeSize.y, cubeSize.z, GRAY)
DrawCubeWires(cubePosition1, cubeSize.x,
cubeSize.y, cubeSize.z, DARKGRAY)
collision1 = false
ok

if collision2
    DrawCube(cubePosition2, cubeSize.x,
    cubeSize.y, cubeSize.z, RED)
    DrawCubeWires(cubePosition2, cubeSize.x,
    cubeSize.y, cubeSize.z, MAROON)

    DrawCubeWires(cubePosition2, cubeSize.x +
    0.2f, cubeSize.y + 0.2f,
    cubeSize.z + 0.2f, GREEN)
    collision2 = true
else
    DrawCube(cubePosition2, cubeSize.x,
    cubeSize.y, cubeSize.z, GRAY)
    DrawCubeWires(cubePosition2, cubeSize.x,
    cubeSize.y, cubeSize.z, DARKGRAY)
    collision2 = false
ok

DrawRay(ray, MAROON)
DrawGrid(10, 1)

EndMode3D()

DrawText("Try selecting the box with mouse!", 240, 10,
        20, DARKGRAY)

if collision1 or collision2
    DrawText("BOX SELECTED",
            (screenWidth - MeasureText("BOX SELECTED", 30)) / 2,
            screenHeight * 0.1f, 30, GREEN)
ok

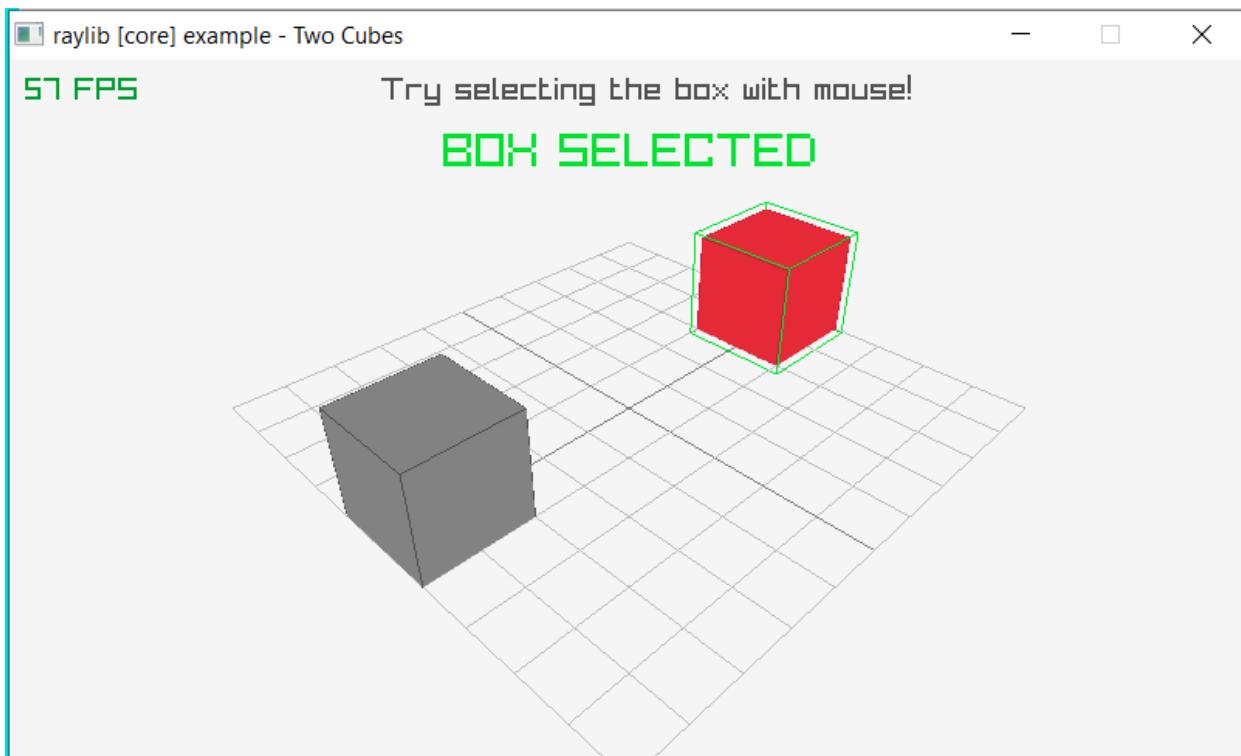
DrawFPS(10, 10)

EndDrawing()
end

CloseWindow()

```

Screen Shot:



57.13 Basic Shapes

```

load "raylib.ring"

screenWidth = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight, "raylib [shapes] example - basic shapes drawing
→")

SetTargetFPS(60)

while !WindowShouldClose()

    BeginDrawing()

    ClearBackground(RAYWHITE)

    DrawText("some basic shapes available on raylib", 20, 20, 20, DARKGRAY)

    DrawCircle(screenWidth/4, 120, 35, DARKBLUE)

    DrawRectangle(screenWidth/4*2 - 60, 100, 120, 60, RED)
    DrawRectangleLines(screenWidth/4*2 - 40, 320, 80, 60, ORANGE)
    DrawRectangleGradientH(screenWidth/4*2 - 90, 170, 180, 130, MAROON, GOLD)

    DrawTriangle(Vector2(screenWidth/4*3, 80),
                Vector2(screenWidth/4*3 - 60, 150),
                Vector2(screenWidth/4*3 + 60, 150), VIOLET)

```

(continues on next page)

(continued from previous page)

```

DrawPoly(Vector2(screenWidth/4*3, 320), 6, 80, 0, BROWN)

DrawCircleGradient(screenWidth/4, 220, 60, GREEN, SKYBLUE)

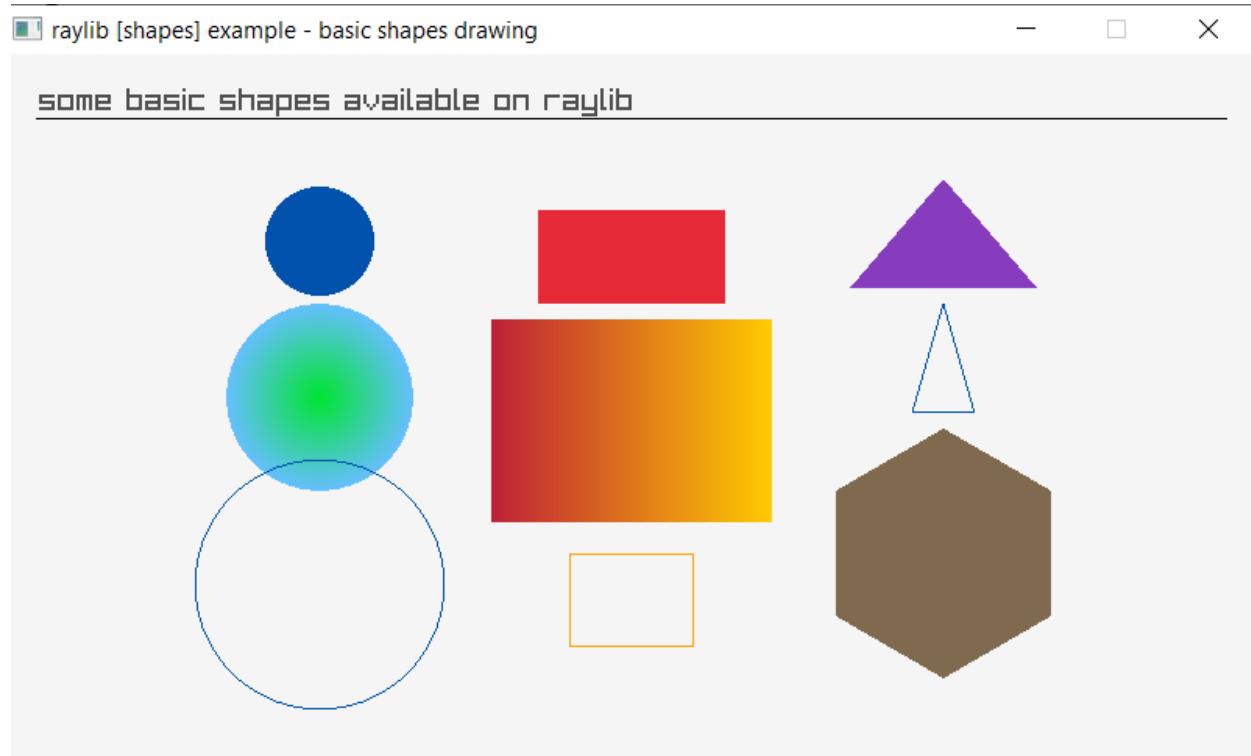
DrawLine(18, 42, screenWidth - 18, 42, BLACK)
DrawCircleLines(screenWidth/4, 340, 80, DARKBLUE)
DrawTriangleLines(Vector2(screenWidth/4*3, 160),
                  Vector2(screenWidth/4*3 - 20, 230),
                  Vector2(screenWidth/4*3 + 20, 230), DARKBLUE)
EndDrawing()

end

CloseWindow()

```

Screen Shot:



57.14 Draw Ring

```

load "raylib.ring"

screenWidth = 800           screenHeight = 450

InitWindow(screenWidth, screenHeight, "raylib [shapes] example - draw ring")

center = Vector2((GetScreenWidth() - 300)/2, GetScreenHeight()/2)

```

(continues on next page)

(continued from previous page)

```

innerRadius = 80          outerRadius = 190
startAngle = 0            endAngle = 360           segments = 0
drawRing = true          drawRingLines = false      drawCircleLines = false

SetTargetFPS(60)

while !WindowShouldClose()

    BeginDrawing()

    ClearBackground(RAYWHITE)

    DrawLine(500, 0, 500, GetScreenHeight(), Fade(LIGHTGRAY, 0.6))
    DrawRectangle(500, 0, GetScreenWidth() - 500,
                  GetScreenHeight(), Fade(LIGHTGRAY, 0.3))

    if drawRing DrawRing(center, innerRadius, outerRadius,
                          startAngle, endAngle, segments, Fade(MAROON, 0.3)) ok
    if drawRingLines DrawRingLines(center, innerRadius,
                                    outerRadius, startAngle, endAngle,
                                    segments, Fade(BLACK, 0.4)) ok
    if drawCircleLines DrawCircleSectorLines(center, outerRadius,
                                              startAngle, endAngle, segments, Fade(BLACK, 0.4)) ok

    startAngle = GuiSliderBar(Rectangle( 600, 40, 120, 20 ),
                             "StartAngle", startAngle, -450, 450, true)
    endAngle = GuiSliderBar(Rectangle( 600, 70, 120, 20 ),
                            "EndAngle", endAngle, -450, 450, true)

    innerRadius = GuiSliderBar(Rectangle( 600, 140, 120, 20 ),
                             "InnerRadius", innerRadius, 0, 100, true)
    outerRadius = GuiSliderBar(Rectangle( 600, 170, 120, 20 ),
                            "OuterRadius", outerRadius, 0, 200, true)

    segments = GuiSliderBar(Rectangle( 600, 240, 120, 20 ),
                           "Segments", segments, 0, 100, true)

    drawRing = GuiCheckBox(Rectangle( 600, 320, 20, 20 ),
                         "Draw Ring", drawRing)
    drawRingLines = GuiCheckBox(Rectangle( 600, 350, 20, 20 ),
                            "Draw RingLines", drawRingLines)
    drawCircleLines = GuiCheckBox(Rectangle( 600, 380, 20, 20 ),
                             "Draw CircleLines", drawCircleLines)

    if segments >= 4
        DrawText("MODE: MANUAL", 600, 270, 10, MAROON)
    else
        DrawText("MODE: AUTO", 600, 270, 10, DARKGRAY)
    ok

    DrawFPS(10, 10)

    EndDrawing()
end

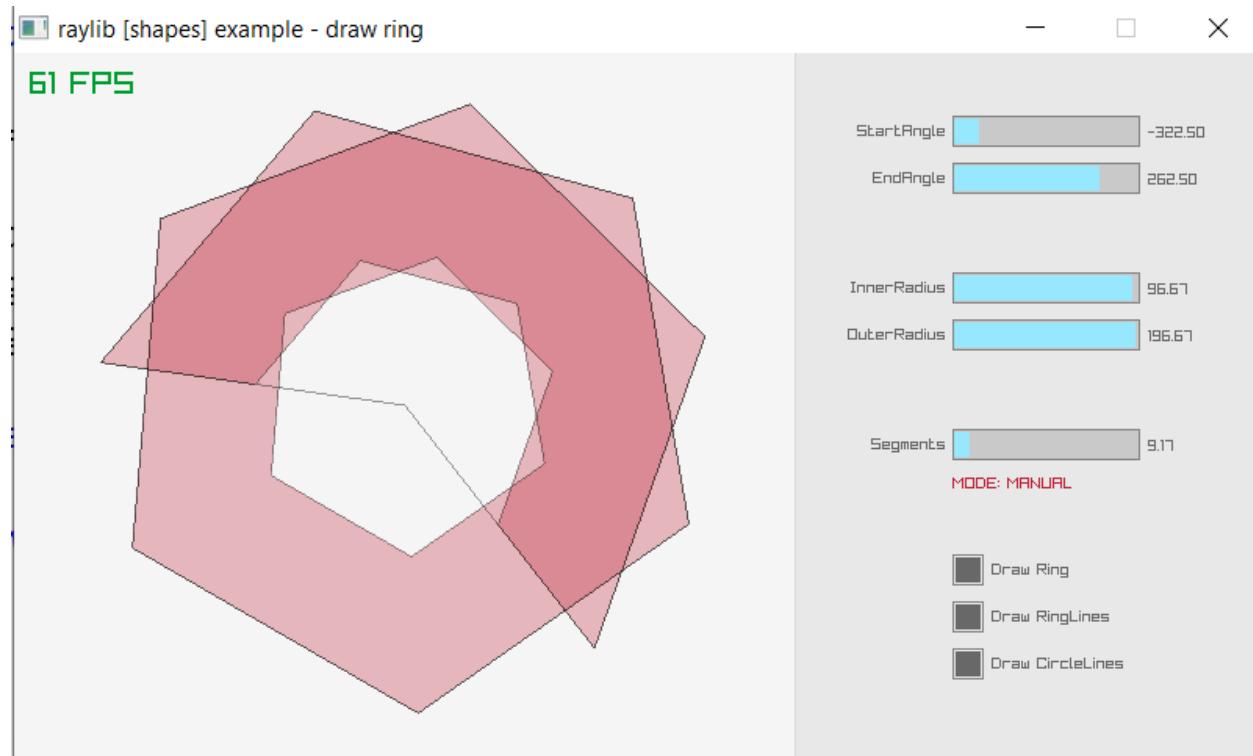
CloseWindow()

```

Screen Shot:



Screen Shot (2):



57.15 Bezier Lines

```

load "raylib.ring"

screenWidth = 800
screenHeight = 450

SetConfigFlags(FLAG_MSAA_4X_HINT)
InitWindow(screenWidth, screenHeight, "raylib [shapes] example - cubic-bezier lines")

start = Vector2(0, 0)
endvec = Vector2(screenWidth, screenHeight)

SetTargetFPS(60)

while (!WindowShouldClose())

    if (IsMouseButtonDown(MOUSE_LEFT_BUTTON))
        start = GetMousePosition()
    else (IsMouseButtonDown(MOUSE_RIGHT_BUTTON))
        endvec = GetMousePosition()
    ok

    BeginDrawing()

    ClearBackground(RAYWHITE)
    DrawText("USE MOUSE LEFT-RIGHT CLICK to DEFINE LINE START and END POINTS",
            15, 20, 20, GRAY)
    DrawLineBezier(start, endvec, 2.0, RED)

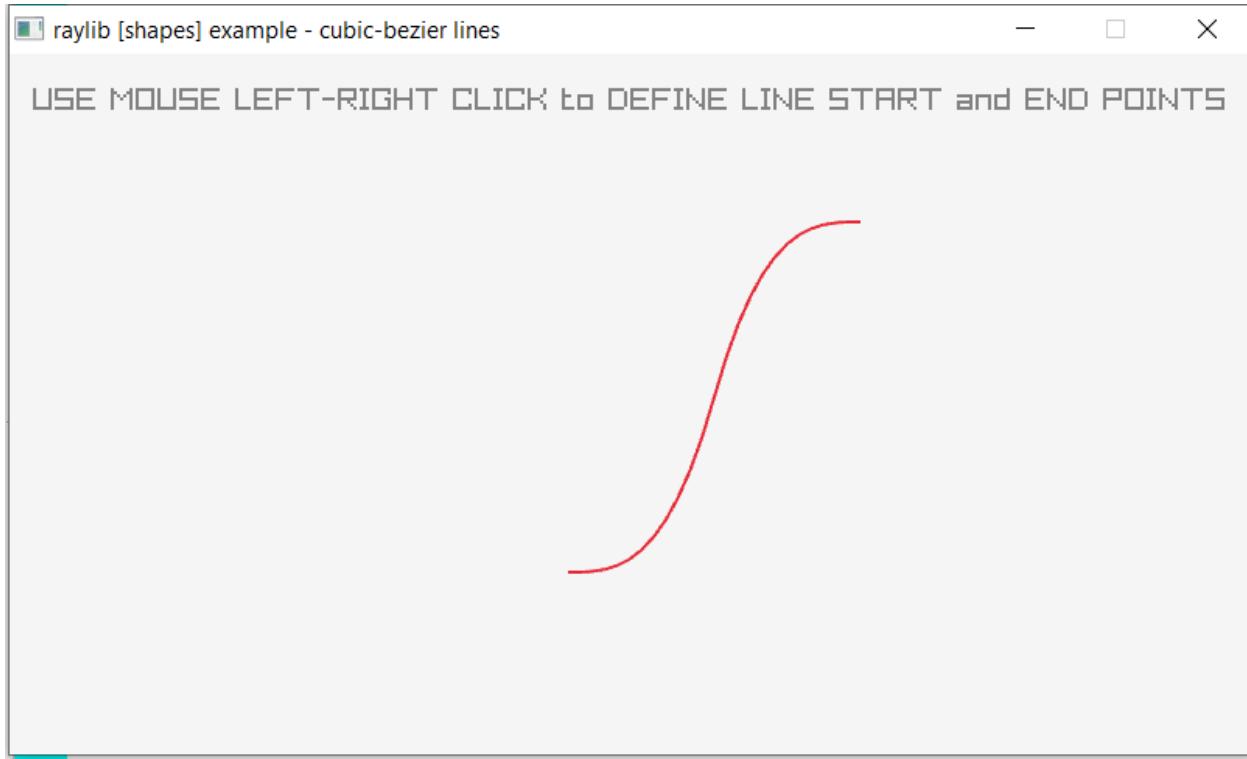
    EndDrawing()

end

CloseWindow()

```

Screen Shot:



57.16 Collision Area

```

load "raylib.ring"

screenWidth = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight, "raylib [shapes] example - collision area")

// Box A: Moving box
boxA = Rectangle( 10, GetScreenHeight()/2 - 50, 200, 100 )
boxASpeedX = 4

// Box B: Mouse moved box
boxB = Rectangle( GetScreenWidth()/2 - 30, GetScreenHeight()/2 - 30, 60, 60 )

boxCollision = GetCollisionRec(boxA, boxB)

boxCollision = Rectangle( 0,0,0,0 ) // Collision rectangle

screenUpperLimit = 40 // Top menu limits

pause = false // Movement pause
collision = false // Collision detection

SetTargetFPS(60)

while !WindowShouldClose()

```

(continues on next page)

(continued from previous page)

```

// Move box if not paused
if (not pause) boxA.x += boxASpeedX ok

// Bounce box on x screen limits
if (((boxA.x + boxA.width) >= GetScreenWidth()) or (boxA.x <= 0))
    boxASpeedX = boxASpeedX*(-1) ok

// Update player-controlled-box (box02)
boxB.x = GetMouseX() - boxB.width/2
boxB.y = GetMouseY() - boxB.height/2

// Make sure Box B does not go out of move area limits
if ((boxB.x + boxB.width) >= GetScreenWidth())
    boxB.x = GetScreenWidth() - boxB.width
else (boxB.x <= 0) boxB.x = 0 ok

if ((boxB.y + boxB.height) >= GetScreenHeight())
    boxB.y = GetScreenHeight() - boxB.height
else (boxB.y <= screenUpperLimit) boxB.y = screenUpperLimit ok

// Check boxes collision
collision = CheckCollisionRecs(boxA, boxB)

// Get collision rectangle (only on collision)
if (collision) boxCollision = GetCollisionRec(boxA, boxB) ok

// Pause Box A movement
if (IsKeyPressed(KEY_SPACE)) pause = not pause ok

BeginDrawing()

    ClearBackground(RAYWHITE)

    if collision = true
        color = RED
    else
        color = BLACK
    ok
    DrawRectangle(0, 0, screenWidth, screenUpperLimit, color)
    DrawRectangleRec(boxA, GOLD)

    boxB.x = GetMouseX() - boxB.width/2
    boxB.y = GetMouseY() - boxB.height/2
    collision = CheckCollisionRecs(boxA, boxB)
    DrawRectangleRec(boxB, BLUE)
    boxCollision = GetCollisionRec(boxA, boxB)

    if (collision) = true

        // Draw collision area
        DrawRectangleRec(boxCollision, LIME)

        // Draw collision message
        DrawText("COLLISION!", GetScreenWidth()/2 -
            MeasureText("COLLISION!", 20)/2,
            screenUpperLimit/2 - 10, 20, BLACK)

```

(continues on next page)

(continued from previous page)

```

    // Draw collision area
    DrawText("Collision Area: " +
        string(boxCollision.width*boxCollision.height),
        GetScreenWidth()/2 - 100,
        screenUpperLimit + 10, 20, BLACK)

ok

DrawFPS(10, 10)

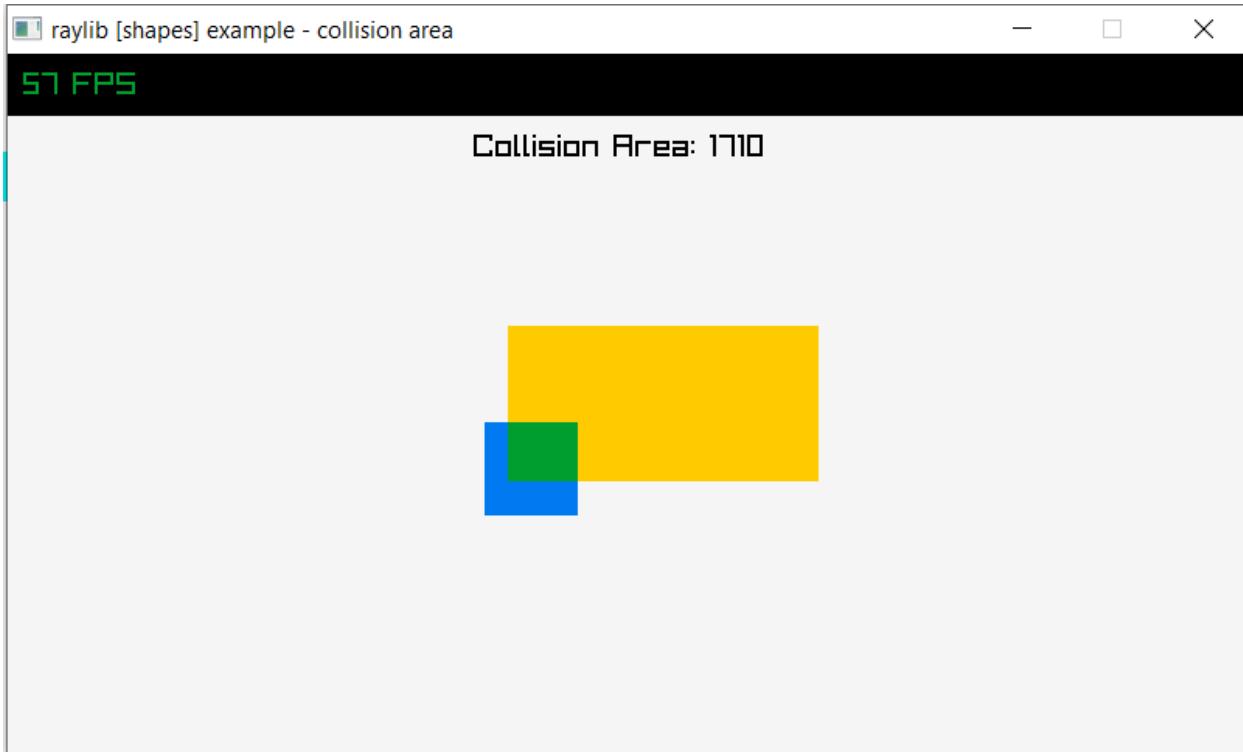
EndDrawing()

end

CloseWindow()

```

Screen Shot:



57.17 Following Eyes

```

load "raylib.ring"

screenWidth = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight, "raylib [shapes] example - following eyes")

scleraLeftPosition = Vector2( GetScreenWidth()/2 - 100, GetScreenHeight()/2 )

```

(continues on next page)

(continued from previous page)

```

scleraRightPosition = Vector2( GetScreenWidth()/2 + 100, GetScreenHeight()/2 )
scleraRadius = 80

irisLeftPosition = Vector2( GetScreenWidth()/2 - 100, GetScreenHeight()/2 )
irisRightPosition = Vector2( GetScreenWidth()/2 + 100, GetScreenHeight()/2 )
irisRadius = 24

angle = 0.0
dx = 0.0 dy = 0.0 dxx = 0.0 dyy = 0.0

SetTargetFPS(60)

while !WindowShouldClose()

    irisLeftPosition = GetMousePosition()
    irisRightPosition = GetMousePosition()

    // Check not inside the left eye sclera
    if !CheckCollisionPointCircle(irisLeftPosition,
        scleraLeftPosition, scleraRadius - 20)
        dx = irisLeftPosition.x - scleraLeftPosition.x
        dy = irisLeftPosition.y - scleraLeftPosition.y

        angle = atan2(dy, dx)

        dxx = (scleraRadius - irisRadius)*cos(angle)
        dyy = (scleraRadius - irisRadius)*sin(angle)

        irisLeftPosition.x = scleraLeftPosition.x + dxx
        irisLeftPosition.y = scleraLeftPosition.y + dyy
    ok

    // Check not inside the right eye sclera
    if !CheckCollisionPointCircle(irisRightPosition,
        scleraRightPosition, scleraRadius - 20)
        dx = irisRightPosition.x - scleraRightPosition.x
        dy = irisRightPosition.y - scleraRightPosition.y

        angle = atan2(dy, dx)

        dxx = (scleraRadius - irisRadius)*cos(angle)
        dyy = (scleraRadius - irisRadius)*sin(angle)

        irisRightPosition.x = scleraRightPosition.x + dxx
        irisRightPosition.y = scleraRightPosition.y + dyy
    ok

BeginDrawing()

    ClearBackground(RAYWHITE)

    DrawCircleV(scleraLeftPosition, scleraRadius, LIGHTGRAY)
    DrawCircleV(irisLeftPosition, irisRadius, BROWN)
    DrawCircleV(irisLeftPosition, 10, BLACK)

    DrawCircleV(scleraRightPosition, scleraRadius, LIGHTGRAY)
    DrawCircleV(irisRightPosition, irisRadius, DARKGREEN)

```

(continues on next page)

(continued from previous page)

```

    DrawCircleV(irisRightPosition, 10, BLACK)

    DrawFPS(10, 10)

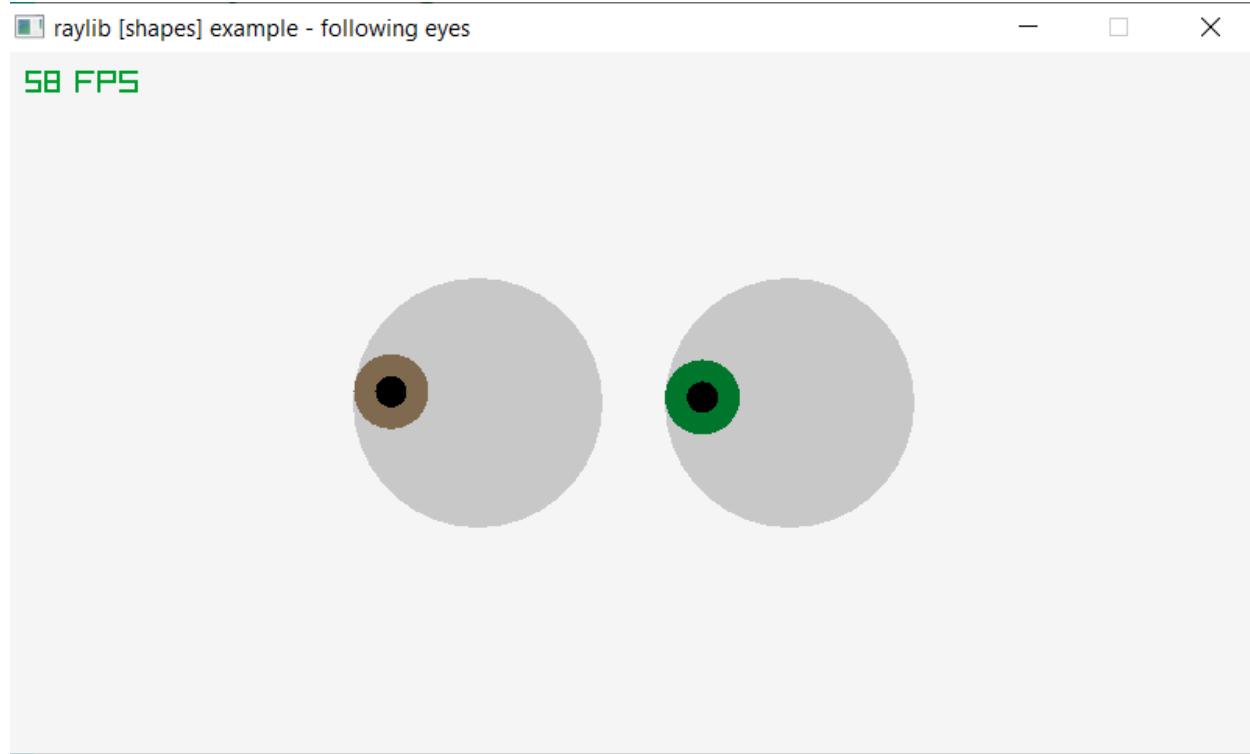
    EndDrawing()

end

CloseWindow()

```

Screen Shot:



57.18 Colors Palette

```

load "raylib.ring"

MAX_COLORS_COUNT = 21           // Number of colors available

screenWidth = 800
screenHeight = 450
colors = list(MAX_COLORS_COUNT)
colorNames = list(MAX_COLORS_COUNT)
colorsRecs = list(MAX_COLORS_COUNT)
colorState = list(MAX_COLORS_COUNT)

InitWindow(screenWidth, screenHeight, "raylib [shapes] example - colors palette")

colors = [

```

(continues on next page)

(continued from previous page)

```

DARKGRAY, MAROON, ORANGE, DARKGREEN, DARKBLUE, DARKPURPLE, DARKBROWN,
GRAY, RED, GOLD, LIME, BLUE, VIOLET, BROWN, LIGHTGRAY, PINK, YELLOW,
GREEN, SKYBLUE, PURPLE, BEIGE ]

colorNames = [
    "DARKGRAY", "MAROON", "ORANGE", "DARKGREEN", "DARKBLUE", "DARKPURPLE",
    "DARKBROWN", "GRAY", "RED", "GOLD", "LIME", "BLUE", "VIOLET", "BROWN",
    "LIGHTGRAY", "PINK", "YELLOW", "GREEN", "SKYBLUE", "PURPLE", "BEIGE" ]

for i = 1 to MAX_COLORS_COUNT
    colorsRecs[i] = new Rectangle(0,0,0,0)
next

for i = 1 to MAX_COLORS_COUNT
    colorState[i] = 0
next

// Fills colorsRecs data (for every rectangle)
for i = 1 to MAX_COLORS_COUNT
    colorsRecs[i].x = 20 + 100*((i-1)%7) + 10*((i-1)%7)
    colorsRecs[i].y = 80 + 100*floor((i-1)/7) + 10*floor((i-1)/7)
    colorsRecs[i].width = 100
    colorsRecs[i].height = 100
next

mousePoint = Vector2( 0.0, 0.0 )

SetTargetFPS(60)

// Main game loop
while !WindowShouldClose()

    mousePoint = GetMousePosition()

    for i = 1 to MAX_COLORS_COUNT
        if (CheckCollisionPointRec(mousePoint,
            colorsRecs[i])) colorState[i] = 1
        else colorState[i] = 0 ok
    next

    BeginDrawing()

    ClearBackground(RAYWHITE)

    DrawText("raylib colors palette", 28, 42, 20, BLACK)
    DrawText("press SPACE to see all colors",
        GetScreenWidth() - 180,
        GetScreenHeight() - 40, 10, GRAY)

    for i = 1 to MAX_COLORS_COUNT      // Draw all rectangles
        if colorState[i]
            cstate = 0.6
        else
            cstate = 1.0
        ok

```

(continues on next page)

(continued from previous page)

```
DrawRectangleRec(colorsRecs[i], Fade(colors[i], cstate))

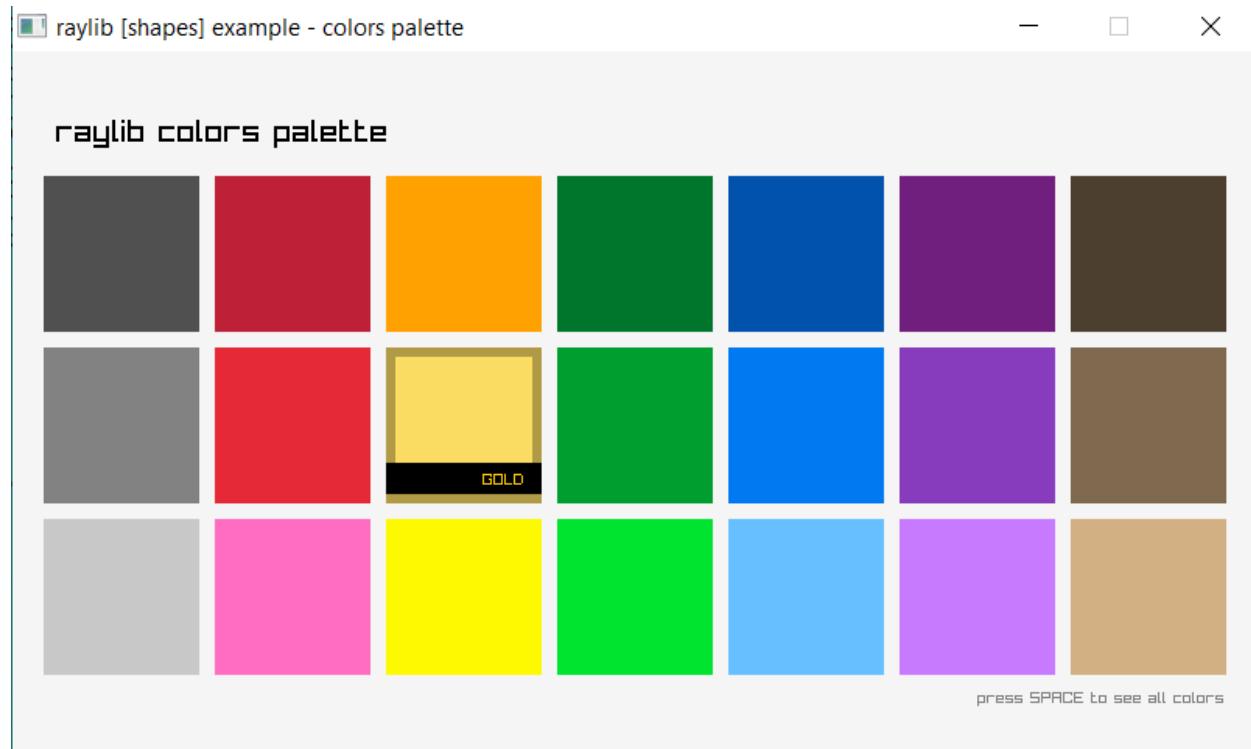
    if (IsKeyDown(KEY_SPACE) || colorState[i])
        DrawRectangle(colorsRecs[i].x,
                    colorsRecs[i].y + colorsRecs[i].height - 26,
                    colorsRecs[i].width, 20, BLACK)
        DrawRectangleLinesEx(colorsRecs[i], 6,
                    Fade(BLACK, 0.3f))
        DrawText(colorNames[i], colorsRecs[i].x +
                    colorsRecs[i].width - MeasureText(colorNames[i],
                    10) - 12, colorsRecs[i].y +
                    colorsRecs[i].height - 20, 10, colors[i])
    ok
next

EndDrawing()

end

CloseWindow()
```

Screen Shot:



57.19 Rectangle Scaling

```

load "raylib.ring"

MOUSE_SCALE_MARK_SIZE = 12

screenWidth = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight,
           "raylib [shapes] example - rectangle scaling mouse")

rec = Rectangle( 100, 100, 200, 80 )

mousePosition = Vector2( 0,0 )

mouseScaleReady = false
mouseScaleMode = false

SetTargetFPS(60)

while !WindowShouldClose()

    mousePosition = GetMousePosition()

    if (CheckCollisionPointRec(mousePosition, rec) and
        CheckCollisionPointRec(mousePosition,
                               Rectangle(rec.x + rec.width - MOUSE_SCALE_MARK_SIZE,
                                         rec.y + rec.height - MOUSE_SCALE_MARK_SIZE,
                                         MOUSE_SCALE_MARK_SIZE, MOUSE_SCALE_MARK_SIZE)))
        mouseScaleReady = true
        if (IsMouseButtonPressed(MOUSE_LEFT_BUTTON))
            mouseScaleMode = true ok
        else mouseScaleReady = false ok

    if (mouseScaleMode)

        mouseScaleReady = true

        rec.width = (mousePosition.x - rec.x)
        rec.height = (mousePosition.y - rec.y)

        if (rec.width < MOUSE_SCALE_MARK_SIZE)
            rec.width = MOUSE_SCALE_MARK_SIZE ok
        if (rec.height < MOUSE_SCALE_MARK_SIZE)
            rec.height = MOUSE_SCALE_MARK_SIZE ok

        if (IsMouseButtonReleased(MOUSE_LEFT_BUTTON))
            mouseScaleMode = false ok
    ok

    BeginDrawing()

    ClearBackground(RAYWHITE)

    DrawText("Scale rectangle dragging from bottom-right corner!",
            10, 10, 20, GRAY)

```

(continues on next page)

(continued from previous page)

```
DrawRectangleRec(rec, Fade(GREEN, 0.5f))

if (mouseScaleReady)

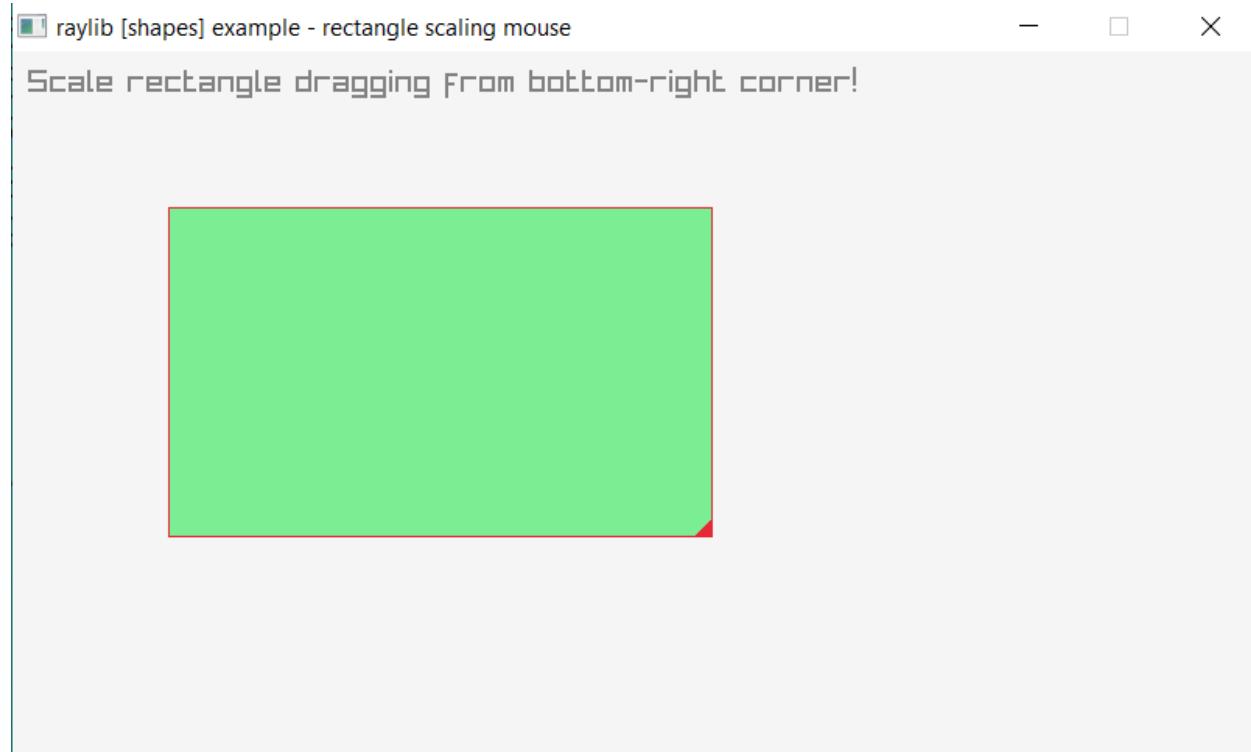
    DrawRectangleLinesEx(rec, 1, RED)
    DrawTriangle(Vector2( rec.x + rec.width -
    MOUSE_SCALE_MARK_SIZE, rec.y + rec.height ),
    Vector2( rec.x + rec.width, rec.y + rec.height ),
    Vector2( rec.x + rec.width, rec.y + rec.height -
    MOUSE_SCALE_MARK_SIZE ), RED)
ok

EndDrawing()

end

CloseWindow()
```

Screen Shot:



57.20 Music Playing

```

load "raylib.ring"

screenWidth = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight,
           "raylib [audio] example - music playing (streaming)")

InitAudioDevice()

music = LoadMusicStream("guitar_noodling.ogg")

PlayMusicStream(music)

timePlayed = 0.0
pause = false

SetTargetFPS(60)

while !WindowShouldClose()

    UpdateMusicStream(music)

    if IsKeyPressed(KEY_SPACE)
        StopMusicStream(music)
        PlayMusicStream(music)
    ok

    if IsKeyPressed(KEY_P)
        pause = !pause

        if pause
            PauseMusicStream(music)
        else
            ResumeMusicStream(music)
        ok
    ok

    timePlayed = GetMusicTimePlayed(music) / GetMusicTimeLength(music) *400

    if timePlayed > 400
        StopMusicStream(music)
    ok

    BeginDrawing()

        ClearBackground(RAYWHITE)

        DrawText("MUSIC SHOULD BE PLAYING!", 255, 150, 20, LIGHTGRAY)

        DrawRectangle(200, 200, 400, 12, LIGHTGRAY)
        DrawRectangle(200, 200, timePlayed, 12, MAROON)
        DrawRectangleLines(200, 200, 400, 12, GRAY)

```

(continues on next page)

(continued from previous page)

```

        DrawText("PRESS SPACE TO RESTART MUSIC", 215, 250, 20, LIGHTGRAY)
        DrawText("PRESS P TO PAUSE/RESUME MUSIC", 208, 280, 20, LIGHTGRAY)

    EndDrawing()

end

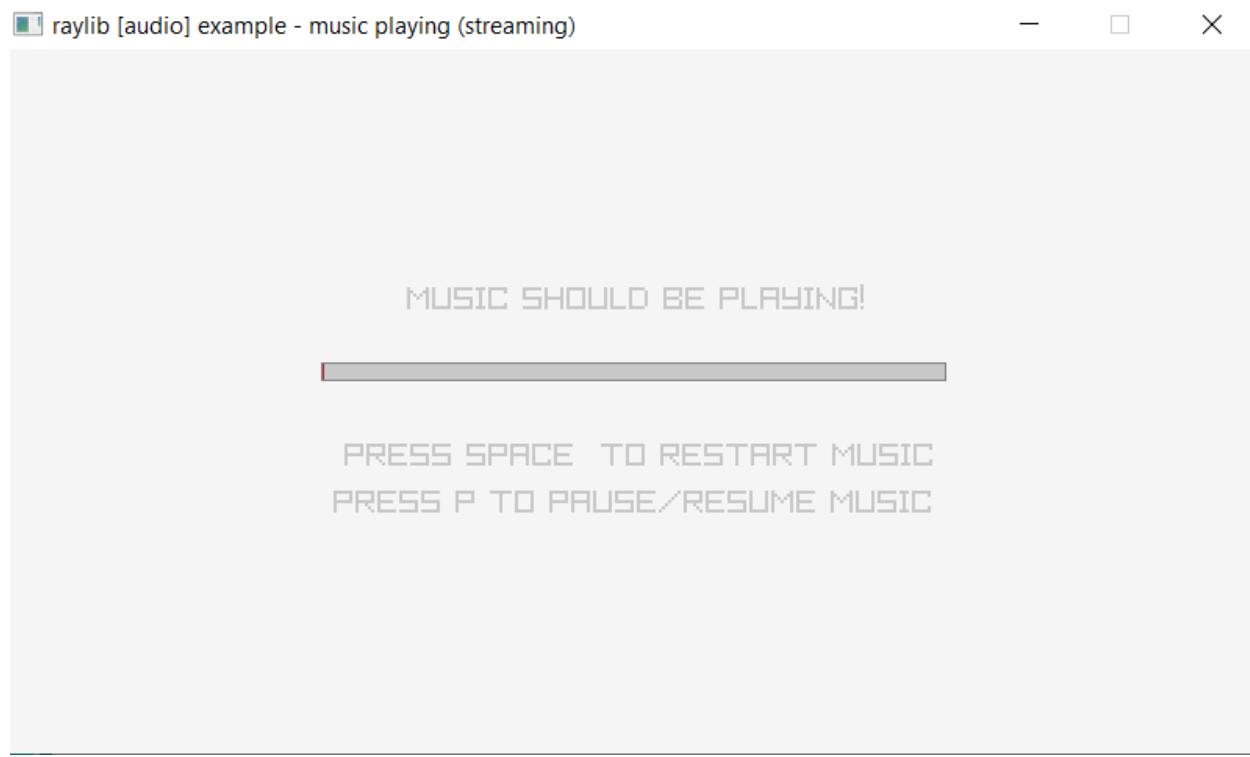
UnloadMusicStream(music)

CloseAudioDevice()

CloseWindow()

```

Screen Shot:



57.21 Sound Loading

```

load "raylib.ring"

screenWidth = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight,
           "raylib [audio] example - sound loading and playing")

InitAudioDevice()

fxWav = LoadSound("sound.wav")

```

(continues on next page)

(continued from previous page)

```
fxOgg = LoadSound("tanatana.ogg")

SetTargetFPS(60)

while !WindowShouldClose()

    if IsKeyPressed(KEY_SPACE) PlaySound(fxWav) ok
    if IsKeyPressed(KEY_ENTER) PlaySound(fxOgg) ok

    BeginDrawing()

        ClearBackground(RAYWHITE)

        DrawText("Press SPACE to PLAY the WAV sound!", 200, 180, 20, LIGHTGRAY)
        DrawText("Press ENTER to PLAY the OGG sound!", 200, 220, 20, LIGHTGRAY)

    EndDrawing()

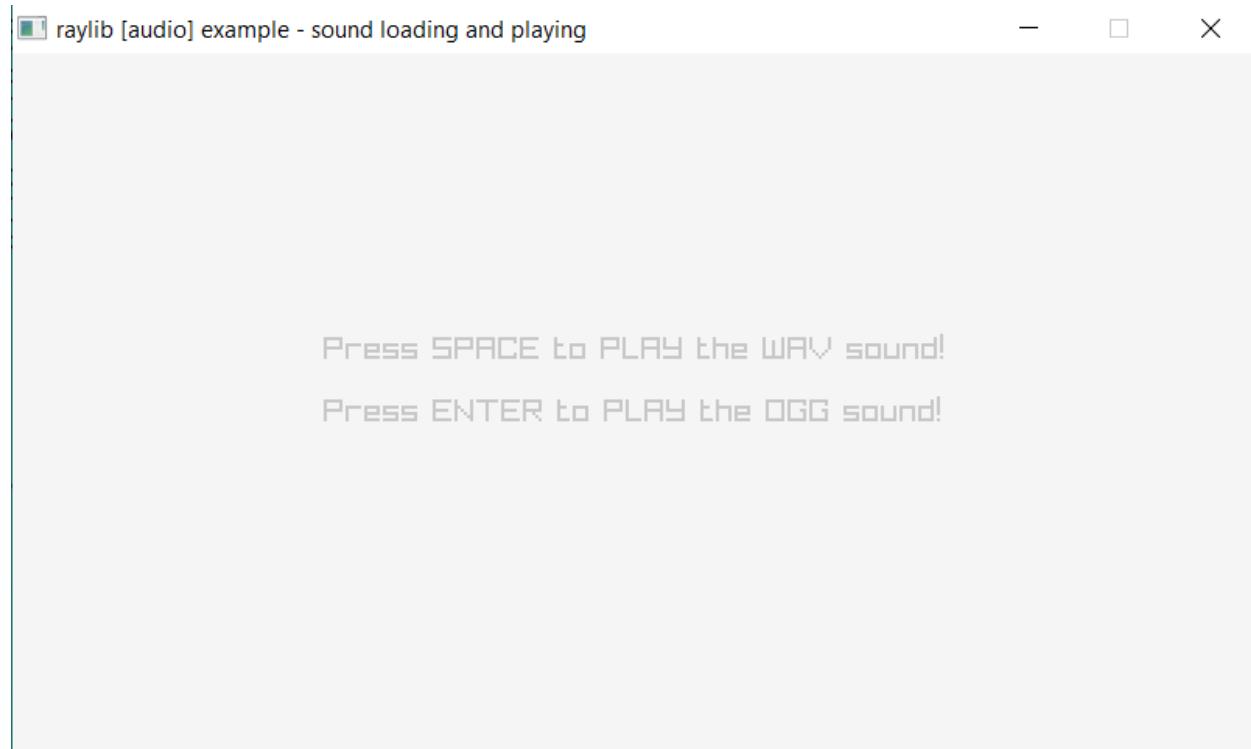
end

UnloadSound(fxWav)
UnloadSound(fxOgg)

CloseAudioDevice()

CloseWindow()
```

Screen Shot:



57.22 Image Drawing

```

load "raylib.ring"

screenWidth = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight,
           "raylib [textures] example - image drawing")

cat = LoadImage("cat.png")

ImageCrop( cat, Rectangle( 100, 10, 280, 380 ))
ImageFlipHorizontal( cat)
ImageResize( cat, 150, 200)

parrots = LoadImage("parrots.png")

ImageDraw( parrots, cat, Rectangle( 0, 0, cat.width, cat.height ),
           Rectangle( 30, 40, cat.width*1.5, cat.height*1.5 ))
ImageCrop( parrots, Rectangle( 0, 50, parrots.width, parrots.height - 100 ))

UnloadImage(cat)

font = LoadFont("custom_jupiter_crash.png")

ImageDrawTextEx(parrots, Vector2( 300, 230 ), font,
                "PARROTS & CAT", font.baseSize, -2, WHITE)
UnloadFont(font);

texture = LoadTextureFromImage(parrots)

UnloadImage(parrots)

SetTargetFPS(60)

while !WindowShouldClose()
    BeginDrawing()

        ClearBackground(RAYWHITE)

        DrawTexture(texture, screenWidth/2 - texture.width/2,
                    screenHeight/2 - texture.height/2 - 40, WHITE)
        DrawRectangleLines(screenWidth/2 - texture.width/2,
                           screenHeight/2 - texture.height/2 - 40,
                           texture.width, texture.height, DARKGRAY)

        DrawText("We are drawing only one texture from various images composed!",
                240, 350, 10, DARKGRAY)
        DrawText("Source images have been cropped, scaled, "+
                "flipped and copied one over the other.",
                190, 370, 10, DARKGRAY)

    EndDrawing()
end

UnloadTexture(texture)

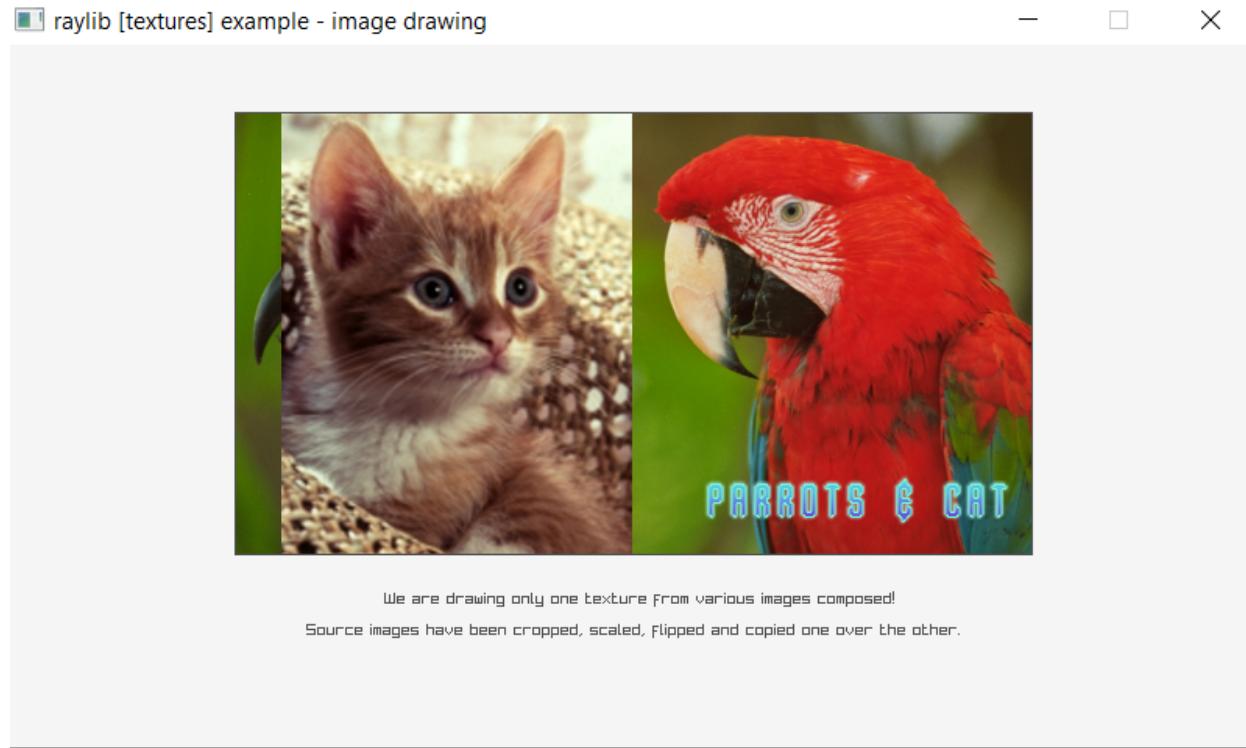
```

(continues on next page)

(continued from previous page)

```
CloseWindow()
```

Screen Shot:



57.23 Image Generation

```
load "raylib.ring"

NUM_TEXTURES = 7
textures      = list(7)

screenWidth  = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight,
           "raylib [textures] example - procedural images generation")

verticalGradient  = GenImageGradientV(screenWidth, screenHeight, RED, BLUE)
horizontalGradient = GenImageGradientH(screenWidth, screenHeight, RED, BLUE)
radialGradient     = GenImageGradientRadial(screenWidth,
                                             screenHeight, 0.0, WHITE, BLACK)
checked           = GenImageChecked(screenWidth, screenHeight,
                                     32, 32, RED, BLUE)
whiteNoise         = GenImageWhiteNoise(screenWidth, screenHeight, 0.5)
perlinNoise        = GenImagePerlinNoise(screenWidth, screenHeight, 50, 50, 4.0)
cellular          = GenImageCellular(screenWidth, screenHeight, 32)
```

(continues on next page)

(continued from previous page)

```

textures[NUM_TEXTURES] = 0

textures[1] = LoadTextureFromImage(verticalGradient)
textures[2] = LoadTextureFromImage(horizontalGradient)
textures[3] = LoadTextureFromImage(radialGradient)
textures[4] = LoadTextureFromImage(checked)
textures[5] = LoadTextureFromImage(whiteNoise)
textures[6] = LoadTextureFromImage(perlinNoise)
textures[7] = LoadTextureFromImage(cellular)

UnloadImage(verticalGradient)
UnloadImage(horizontalGradient)
UnloadImage(radialGradient)
UnloadImage(checked)
UnloadImage(whiteNoise)
UnloadImage(perlinNoise)
UnloadImage(cellular)

currentTexture = 1

SetTargetFPS(10)

while !WindowShouldClose()

    if IsMouseButtonPressed(MOUSE_LEFT_BUTTON) || IsKeyPressed(KEY_RIGHT)
        currentTexture++
        if currentTexture > NUM_TEXTURES currentTexture = 1 ok
    ok

    BeginDrawing()

        ClearBackground(RAYWHITE)

        DrawTexture(textures[currentTexture], 0, 0, WHITE)

        DrawRectangle(30, 400, 325, 30, Fade(SKYBLUE, 0.5))
        DrawRectangleLines(30, 400, 325, 30, Fade(WHITE, 0.5))
        DrawText("MOUSE LEFT BUTTON to CYCLE PROCEDURAL TEXTURES",
            40, 410, 10, WHITE)

        switch(currentTexture)
            on 1 DrawText("VERTICAL GRADIENT", 560, 10, 20, RAYWHITE)
            on 2 DrawText("HORIZONTAL GRADIENT", 540, 10, 20, RAYWHITE)
            on 3 DrawText("RADIAL GRADIENT", 580, 10, 20, LIGHTGRAY)
            on 4 DrawText("CHECKED", 680, 10, 20, RAYWHITE)
            on 5 DrawText("WHITE NOISE", 640, 10, 20, RED)
            on 6 DrawText("PERLIN NOISE", 630, 10, 20, RAYWHITE)
            on 7 DrawText("CELLULAR", 670, 10, 20, RAYWHITE)
        off

        EndDrawing()

    end

    for i = 1 to NUM_TEXTURES
        UnloadTexture( textures[i] )
    next

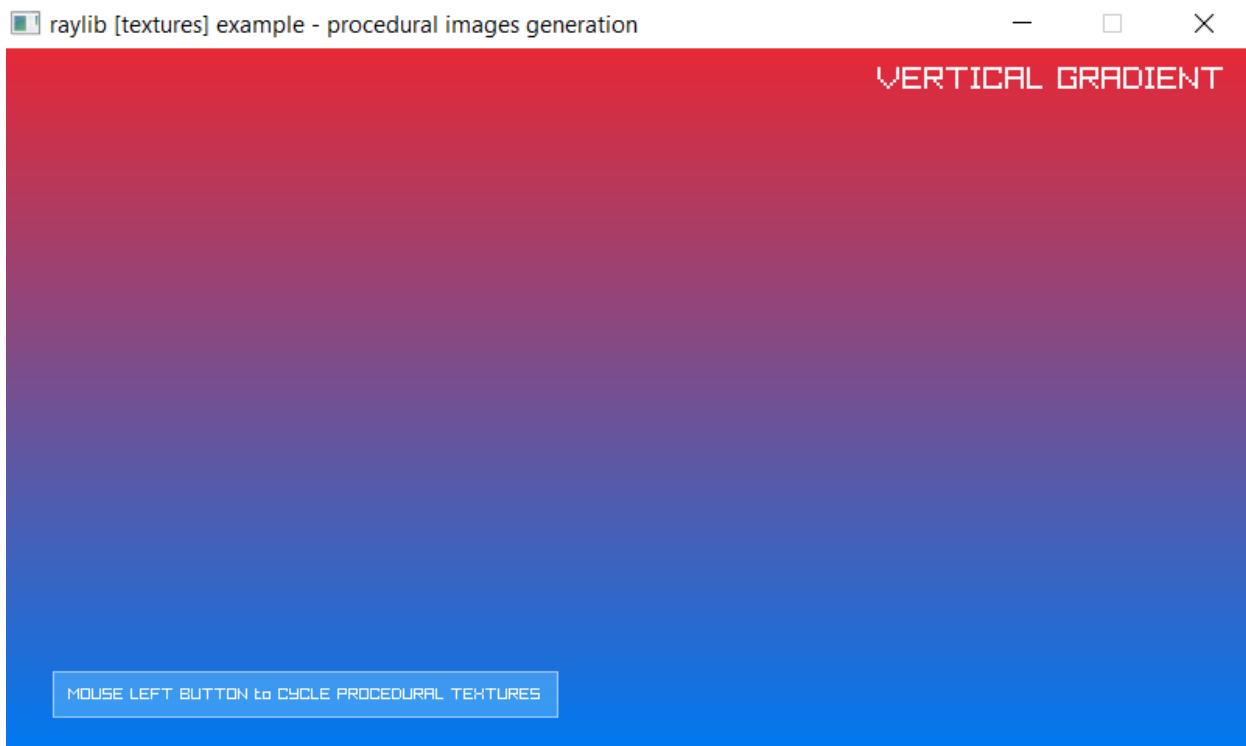
```

(continues on next page)

(continued from previous page)

```
CloseWindow()
```

Screen Shot:



57.24 Texture Source

```
load "raylib.ring"

screenWidth = 800
screenHeight = 800

InitWindow(screenWidth, screenHeight,
           "raylib [textures] examples - texture source and destination rectangles")

// NOTE: Textures MUST be loaded after Window initialization
// (OpenGL context is required)

scarfy = LoadTexture("RingLogo.png")           // Texture loading

frameWidth = scarfy.width
frameHeight = scarfy.height

// Source rectangle (part of the texture to use for drawing)
sourceRec = Rectangle( 0.0, 0.0, frameWidth, frameHeight )

// Destination rectangle (screen rectangle where drawing part of texture)
destRec = Rectangle( screenWidth/2, screenHeight/2, frameWidth*2, frameHeight*2 )
```

(continues on next page)

(continued from previous page)

```
// Origin of the texture (rotation/scale point)
// it's relative to destination rectangle size
origin = Vector2( frameWidth, frameHeight )

rotation = 0

SetTargetFPS(60)

while !WindowShouldClose()

    rotation = rotation+1

    BeginDrawing()

        ClearBackground(RAYWHITE)

        DrawTexturePro(scarfy, sourceRec, destRec,
                      origin, rotation, WHITE)

        DrawLine(destRec.x, 0, destRec.x, screenHeight, GRAY)
        DrawLine(0, destRec.y, screenWidth, destRec.y, GRAY)

        DrawText("(c) Scarfy sprite by Eiden Marsal",
                 screenWidth - 200, screenHeight - 20, 10, GRAY)

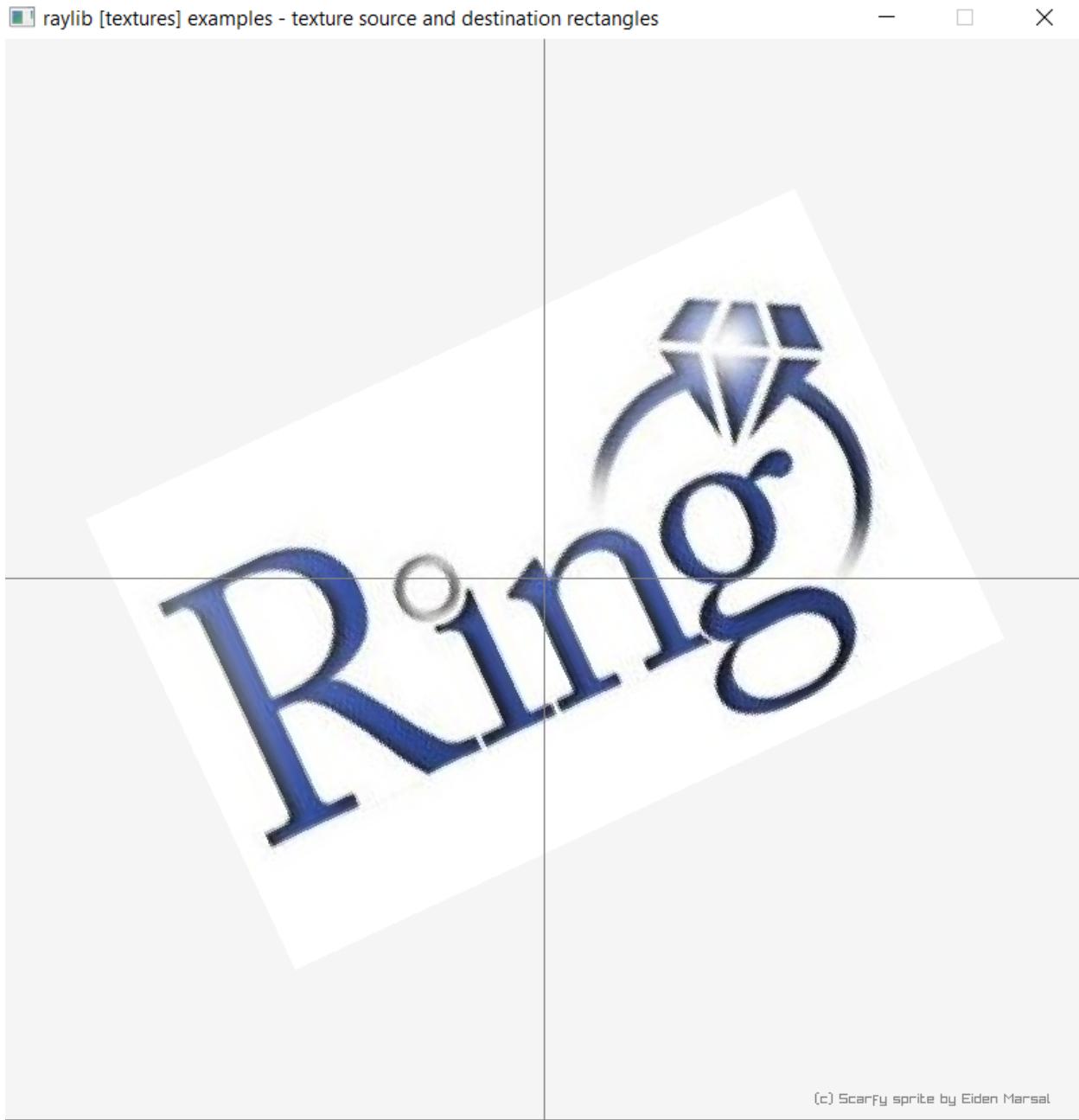
    EndDrawing()

end

UnloadTexture(scarfy)           // Texture unloading

CloseWindow()
```

Screen Shot:



(c) Scarfy sprite by Eiden Marsal

57.25 Geometric Shapes

```
load "raylib.ring"

FOVY_PERSPECTIVE    = 45.0
WIDTH_ORTHOGRAPHIC = 10.0

screenWidth   = 800
screenHeight  = 450
```

(continues on next page)

(continued from previous page)

```

InitWindow(screenWidth, screenHeight,
           "raylib [models] example - geometric shapes")

camera = Camera3D( 0.0, 10.0, 10.0,
                   0.0, 0.0, 0.0,
                   0.0, 1.0, 0.0,
                   FOVY_PERSPECTIVE, CAMERA_PERSPECTIVE
           )

SetTargetFPS(60)

while !WindowShouldClose()

    if IsKeyPressed(KEY_SPACE)

        if camera.type == CAMERA_PERSPECTIVE

            camera.fovy = WIDTH_ORTHOGRAPHIC
            camera.type = CAMERA_ORTHOGRAPHIC

        else

            camera.fovy = FOVY_PERSPECTIVE
            camera.type = CAMERA_PERSPECTIVE
        ok
    ok

    BeginDrawing()

    ClearBackground(RAYWHITE)

    BeginMode3D(camera)

    DrawCube(Vector3(-4.0, 0.0, 2.0), 2.0, 5.0, 2.0, RED)
    DrawCubeWires(Vector3(-4.0, 0.0, 2.0), 2.0, 5.0, 2.0, GOLD)
    DrawCubeWires(Vector3(-4.0, 0.0, -2.0), 3.0, 6.0, 2.0, MAROON)

    DrawSphere(Vector3(-1.0, 0.0, -2.0), 1.0, GREEN)
    DrawSphereWires(Vector3( 1.0, 0.0, 2.0), 2.0, 16, 16, LIME)

    DrawCylinder(Vector3(4.0, 0.0, -2.0), 1.0, 2.0, 3.0, 4, SKYBLUE)
    DrawCylinderWires(Vector3(4.0, 0.0, -2.0), 1.0, 2.0, 3.0, 4, DARKBLUE)
    DrawCylinderWires(Vector3(4.5, -1.0, 2.0), 1.0, 1.0, 2.0, 6, BROWN)

    DrawCylinder(Vector3(1.0, 0.0, -4.0), 0.0, 1.5, 3.0, 8, GOLD)
    DrawCylinderWires(Vector3(1.0, 0.0, -4.0), 0.0, 1.5, 3.0, 8, PINK)

    DrawGrid(10, 1.0)

    EndMode3D()

    DrawText("Press Spacebar to switch camera type", 10,
            GetScreenHeight() - 30, 20, DARKGRAY)

    if camera.type == CAMERA_ORTHOGRAPHIC
        DrawText("ORTHOGRAPHIC", 10, 40, 20, BLACK)
    else

```

(continues on next page)

(continued from previous page)

```

if camera.type = CAMERA_PERSPECTIVE
    DrawText("PERSPECTIVE", 10, 40, 20, BLACK)
ok
ok

DrawFPS(10, 10)

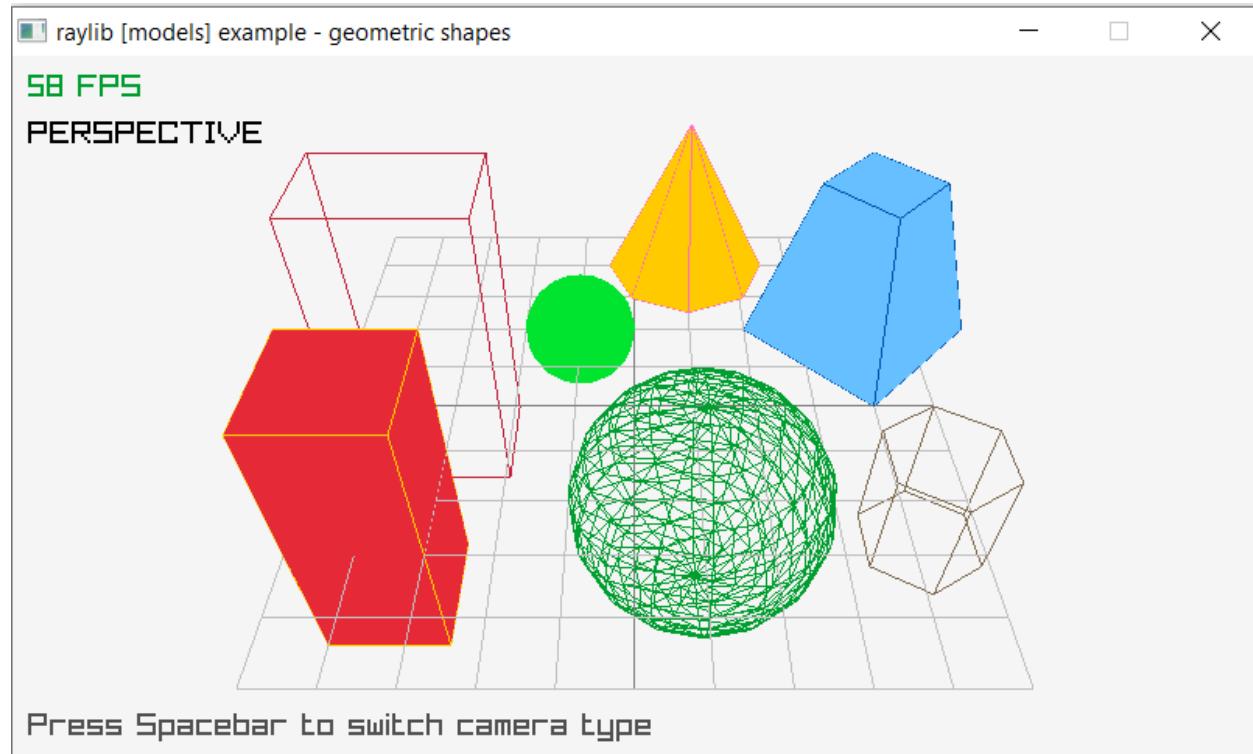
EndDrawing()

end

CloseWindow()

```

Screen Shot:



57.26 Cubic Map

```

load "raylib.ring"

screenWidth  = 800
screenHeight = 450

InitWindow(screenWidth, screenHeight,
           "raylib [models] example - cubesmap loading and drawing")

camera = Camera3D( 16.0, 14.0, 16.0,
                  0.0, 0.0, 0.0,
                  0.0, 1.0, 0.0,

```

(continues on next page)

(continued from previous page)

```

        45.0, 0 )

image      = LoadImage("cubicmap.png")
cubicmap = LoadTextureFromImage(image)

mesh       = GenMeshCubicmap(image, Vector3( 1.0, 1.0, 1.0 ))
model     = LoadModelFromMesh(mesh)

texture   = LoadTexture("cubicmap_atlas.png")

setmodelmaterialtexture(model, 0, MAP_DIFFUSE, texture)

mapPosition = Vector3( -16.0, 0.0, -8.0 )

UnloadImage(image)
SetCameraMode(camera, CAMERA_ORBITAL)
SetTargetFPS(60)

while !WindowShouldClose()

    UpdateCamera(camera)

    BeginDrawing()

        ClearBackground(RAYWHITE)
        BeginMode3D(camera)
            DrawModel(model, mapPosition, 1.0, WHITE)
        EndMode3D()

        DrawTextureEx(cubicmap, Vector2( screenWidth -
                                         cubicmap.width*4 - 20, 20 ),
                      0.0, 4.0, WHITE)
        DrawRectangleLines(screenWidth - cubicmap.width*4 -
                           20, 20, cubicmap.width*4,
                           cubicmap.height*4, GREEN)

        DrawText("cubicmap image used to", 658, 90, 10, GRAY)
        DrawText("generate map 3d model", 658, 104, 10, GRAY)
        DrawFPS(10, 10)

    EndDrawing()

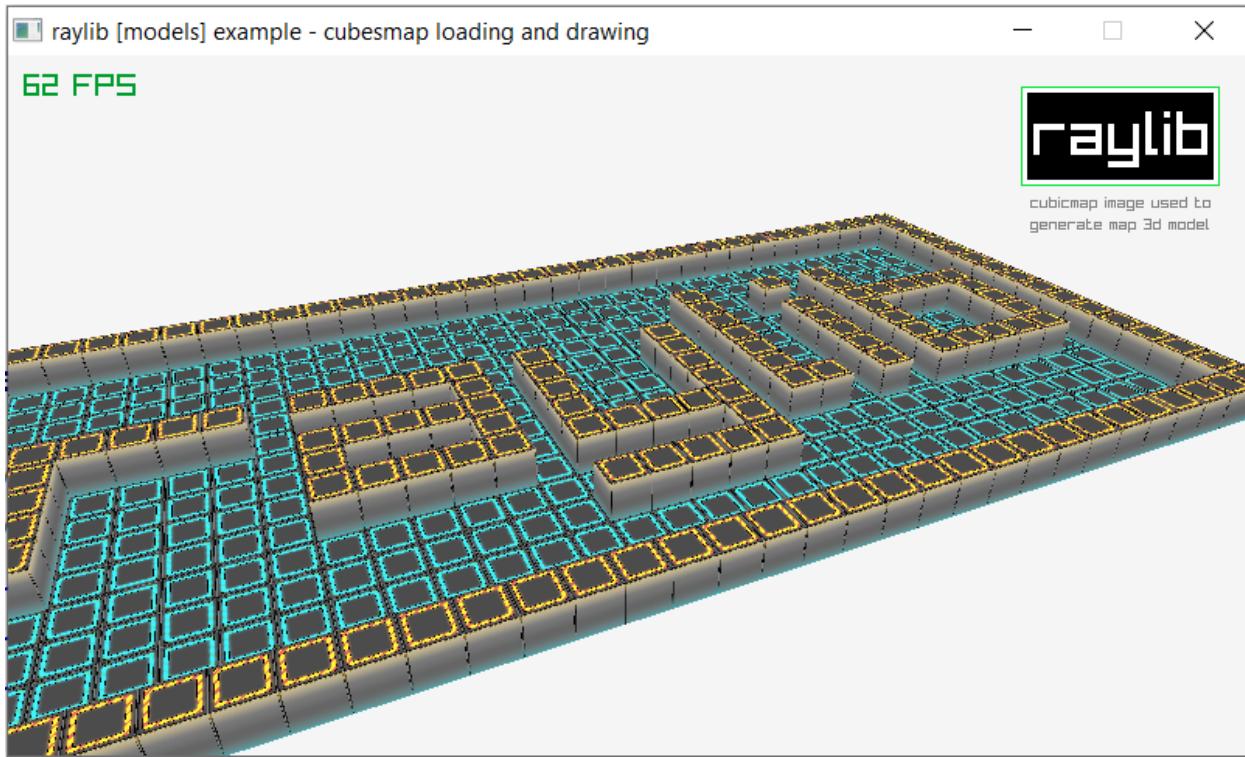
end

UnloadTexture(cubicmap)
UnloadTexture(texture)
UnloadModel(model)

CloseWindow()

```

Screen Shot:



57.27 Functions

```

void InitWindow(int width, int height, const char *title)
bool WindowShouldClose(void)
void CloseWindow(void)
bool IsWindowReady(void)
bool IsWindowMinimized(void)
bool IsWindowResized(void)
bool IsWindowHidden(void)
void ToggleFullscreen(void)
void UnhideWindow(void)
void HideWindow(void)
void SetWindowIcon(Image image)
void SetWindowTitle(const char *title)
void SetWindowPosition(int x, int y)
void SetWindowMonitor(int monitor)
void SetWindowMinSize(int width, int height)
void SetWindowSize(int width, int height)
void *GetWindowHandle(void)
int GetScreenWidth(void)
int GetScreenHeight(void)
int GetMonitorCount(void)
int GetMonitorWidth(int monitor)
int GetMonitorHeight(int monitor)
int GetMonitorPhysicalWidth(int monitor)
int GetMonitorPhysicalHeight(int monitor)
const char *GetMonitorName(int monitor)
const char *GetClipboardText(void)
void SetClipboardText(const char *text)

```

(continues on next page)

(continued from previous page)

```

void ShowCursor(void)
void HideCursor(void)
bool IsCursorHidden(void)
void EnableCursor(void)
void DisableCursor(void)
void ClearBackground(Color color)
void BeginDrawing(void)
void EndDrawing(void)
void BeginMode2D(Camera2D camera)
void EndMode2D(void)
void BeginMode3D(Camera3D camera)
void EndMode3D(void)
void BeginTextureMode(RenderTexture2D target)
void EndTextureMode(void)
Ray GetMouseRay(Vector2 mousePosition, Camera3D camera)
Vector2 GetWorldToScreen(Vector3 position, Camera3D camera)
Matrix GetCameraMatrix(Camera3D camera)
void SetTargetFPS(int fps)
int GetFPS(void)
float GetFrameTime(void)
double GetTime(void)
int ColorToInt(Color color)
Vector4 ColorNormalize(Color color)
Vector3 ColorToHSV(Color color)
Color ColorFromHSV(Vector3 hsv)
Color GetColor(int hexValue)
Color Fade(Color color, float alpha)
void SetConfigFlags(unsigned char flags)
void SetTraceLogLevel(int logType)
void SetTraceLogExit(int logType)
void SetTraceLogCallback(TraceLogCallback callback)
void TraceLog(int logType, const char *text)
void TakeScreenshot(const char *fileName)
int GetRandomValue(int min, int max)
bool FileExists(const char *fileName)
bool IsFileExtension(const char *fileName, const char *ext)
const char *GetExtension(const char *fileName)
const char *GetFileName(const char *filePath)
const char *GetFileNameWithoutExt(const char *filePath)
const char *GetDirectoryPath(const char *fileName)
const char *GetWorkingDirectory(void)
char **GetDirectoryFiles(const char *dirPath, int *count)
void ClearDirectoryFiles(void)
bool ChangeDirectory(const char *dir)
bool IsFileDropped(void)
char **GetDroppedFiles(int *count)
void ClearDroppedFiles(void)
long GetFileModTime(const char *fileName)
void StorageSaveValue(int position, int value)
int StorageLoadValue(int position)
void OpenURL(const char *url)
bool IsKeyPressed(int key)
bool IsKeyDown(int key)
bool IsKeyReleased(int key)
bool IsKeyUp(int key)
int GetKeyPressed(void)
void SetExitKey(int key)

```

(continues on next page)

(continued from previous page)

```

bool IsGamepadAvailable(int gamepad)
bool IsGamepadName(int gamepad, const char *name)
const char *GetGamepadName(int gamepad)
bool IsGamepadButtonPressed(int gamepad, int button)
bool IsGamepadButtonDown(int gamepad, int button)
bool IsGamepadButtonReleased(int gamepad, int button)
bool IsGamepadButtonUp(int gamepad, int button)
int GetGamepadButtonPressed(void)
int GetGamepadAxisCount(int gamepad)
float GetGamepadAxisMovement(int gamepad, int axis)
bool IsMouseButtonPressed(int button)
bool IsMouseButtonDown(int button)
bool IsMouseButtonReleased(int button)
bool IsMouseButtonUp(int button)
int GetMouseX(void)
int GetMouseY(void)
Vector2 GetMousePosition(void)
void SetMousePosition(int x, int y)
void SetMouseOffset(int offsetX, int offsetY)
void SetMouseScale(float scaleX, float scaleY)
int GetMouseWheelMove(void)
int GetTouchX(void)
int GetTouchY(void)
Vector2 GetTouchPosition(int index)
void SetGesturesEnabled(unsigned int gestureFlags)
bool IsGestureDetected(int gesture)
int GetGestureDetected(void)
int GetTouchPointsCount(void)
float GetGestureHoldDuration(void)
Vector2 GetGestureDragVector(void)
float GetGestureDragAngle(void)
Vector2 GetGesturePinchVector(void)
float GetGesturePinchAngle(void)
void SetCameraMode(Camera3D camera, int mode)
void UpdateCamera(Camera3D *camera)
void SetCameraPanControl(int panKey)
void SetCameraAltControl(int altKey)
void SetCameraSmoothZoomControl(int szKey)
void SetCameraMoveControls(int frontKey, int backKey, int rightKey, int leftKey,
                           int upKey, int downKey)
void DrawPixel(int posX, int posY, Color color)
void DrawPixelV(Vector2 position, Color color)
void DrawLine(int startPosX, int startPosY, int endPosX, int endPosY, Color color)
void DrawLineV(Vector2 startPos, Vector2 endPos, Color color)
void DrawLineEx(Vector2 startPos, Vector2 endPos, float thick, Color color)
void DrawLineBezier(Vector2 startPos, Vector2 endPos, float thick, Color color)
void DrawLineStrip(Vector2 *points, int numPoints, Color color)
void DrawCircle(int centerX, int centerY, float radius, Color color)
void DrawCircleSector(Vector2 center, float radius, int startAngle, int endAngle,
                      int segments, Color color)
void DrawCircleSectorLines(Vector2 center, float radius, int startAngle,
                           int endAngle, int segments, Color color)
void DrawCircleGradient(int centerX, int centerY, float radius,
                        Color color1, Color color2)
void DrawCircleV(Vector2 center, float radius, Color color)
void DrawCircleLines(int centerX, int centerY, float radius, Color color)
void DrawRing(Vector2 center, float innerRadius, float outerRadius,
             int segments, Color color)

```

(continues on next page)

(continued from previous page)

```

        int startAngle, int endAngle, int segments, Color color)
void DrawRingLines(Vector2 center, float innerRadius, float outerRadius,
                  int startAngle, int endAngle, int segments, Color color)
void DrawRectangle(int posX, int posY, int width, int height, Color color)
void DrawRectangleV(Vector2 position, Vector2 size, Color color)
void DrawRectangleRec(Rectangle rec, Color color)
void DrawRectanglePro(Rectangle rec, Vector2 origin,
                      float rotation, Color color)
void DrawRectangleGradientV(int posX, int posY, int width,
                            int height, Color color1, Color color2)
void DrawRectangleGradientH(int posX, int posY, int width,
                            int height, Color color1, Color color2)
void DrawRectangleGradientEx(Rectangle rec, Color col1,
                            Color col2, Color col3, Color col4)
void DrawRectangleLines(int posX, int posY, int width,
                       int height, Color color)
void DrawRectangleLinesEx(Rectangle rec, int lineThick, Color color)
void DrawRectangleRounded(Rectangle rec, float roundness,
                        int segments, Color color)
void DrawRectangleRoundedLines(Rectangle rec, float roundness,
                              int segments, int lineThick, Color color)
void DrawTriangle(Vector2 v1, Vector2 v2, Vector2 v3, Color color)
void DrawTriangleLines(Vector2 v1, Vector2 v2, Vector2 v3, Color color)
void DrawTriangleFan(Vector2 *points, int numPoints, Color color)
void DrawPoly(Vector2 center, int sides, float radius,
             float rotation, Color color)
void SetShapesTexture(Texture2D texture, Rectangle source)
bool CheckCollisionRecs(Rectangle rec1, Rectangle rec2)
bool CheckCollisionCircles(Vector2 center1, float radius1,
                           Vector2 center2, float radius2)
bool CheckCollisionCircleRec(Vector2 center, float radius,
                            Rectangle rec)
Rectangle GetCollisionRec(Rectangle rec1, Rectangle rec2)
bool CheckCollisionPointRec(Vector2 point, Rectangle rec)
bool CheckCollisionPointCircle(Vector2 point, Vector2 center, float radius)
bool CheckCollisionPointTriangle(Vector2 point, Vector2 p1,
                                 Vector2 p2, Vector2 p3)
Image LoadImage(const char *fileName)
Image LoadImageEx(Color *pixels, int width, int height)
Image LoadImagePro(void *data, int width, int height, int format)
Image LoadImageRaw(const char *fileName, int width, int height,
                  int format, int headerSize)
void ExportImage(Image image, const char *fileName)
void ExportImageAsCode(Image image, const char *fileName)
Texture2D LoadTexture(const char *fileName)
Texture2D LoadTextureFromImage(Image image)
TextureCubemap LoadTextureCubemap(Image image, int layoutType)
RenderTexture2D LoadRenderTexture(int width, int height)
void UnloadImage(Image image)
void UnloadTexture(Texture2D texture)
void UnloadRenderTexture(RenderTexture2D target)
Color *GetImageData(Image image)
Vector4 *GetImageDataNormalized(Image image)
int GetPixelDataSize(int width, int height, int format)
Image GetTextureData(Texture2D texture)
Image GetScreenData(void)
void UpdateTexture(Texture2D texture, const void *pixels)

```

(continues on next page)

(continued from previous page)

```

Image ImageCopy(Image image)
void ImageToPOT(Image *image, Color fillColor)
void ImageFormat(Image *image, int newFormat)
void ImageAlphaMask(Image *image, Image alphaMask)
void ImageAlphaClear(Image *image, Color color, float threshold)
void ImageAlphaCrop(Image *image, float threshold)
void ImageAlphaPremultiply(Image *image)
void ImageCrop(Image *image, Rectangle crop)
void ImageResize(Image *image, int newWidth, int newHeight)
void ImageResizeNN(Image *image, int newWidth, int newHeight)
void ImageResizeCanvas(Image *image, int newWidth, int newHeight,
                      int offsetX, int offsetY, Color color)
void ImageMipmaps(Image *image)
void ImageDither(Image *image, int rBpp, int gBpp, int bBpp, int aBpp)
Color *ImageExtractPalette(Image image, int maxPaletteSize, int *extractCount)
Image ImageText(const char *text, int fontSize, Color color)
Image ImageTextEx(Font font, const char *text, float fontSize,
                 float spacing, Color tint)
void ImageDraw(Image *dst, Image src, Rectangle srcRec, Rectangle dstRec)
void ImageDrawRectangle(Image *dst, Rectangle rec, Color color)
void ImageDrawRectangleLines(Image *dst, Rectangle rec, int thick, Color color)
void ImageDrawText(Image *dst, Vector2 position, const char *text,
                  int fontSize, Color color)
void ImageDrawTextEx(Image *dst, Vector2 position, Font font,
                    const char *text, float fontSize, float spacing, Color color)
void ImageFlipVertical(Image *image)
void ImageFlipHorizontal(Image *image)
void ImageRotateCW(Image *image)
void ImageRotateCCW(Image *image)
void ImageColorTint(Image *image, Color color)
void ImageColorInvert(Image *image)
void ImageColorGrayscale(Image *image)
void ImageColorContrast(Image *image, float contrast)
void ImageColorBrightness(Image *image, int brightness)
void ImageColorReplace(Image *image, Color color, Color replace)
Image GenImageColor(int width, int height, Color color)
Image GenImageGradientV(int width, int height, Color top, Color bottom)
Image GenImageGradientH(int width, int height, Color left, Color right)
Image GenImageGradientRadial(int width, int height, float density,
                            Color inner, Color outer)
Image GenImageChecked(int width, int height, int checksX, int checksY,
                      Color col1, Color col2)
Image GenImageWhiteNoise(int width, int height, float factor)
Image GenImagePerlinNoise(int width, int height, int offsetX,
                         int offsetY, float scale)
Image GenImageCellular(int width, int height, int tileSize)
void GenTextureMipmaps(Texture2D *texture)
void SetTextureFilter(Texture2D texture, int filterMode)
void SetTextureWrap(Texture2D texture, int wrapMode)
void DrawTexture(Texture2D texture, int posX, int posY, Color tint)
void DrawTextureV(Texture2D texture, Vector2 position, Color tint)
void DrawTextureEx(Texture2D texture, Vector2 position,
                  float rotation, float scale, Color tint)
void DrawTextureRec(Texture2D texture, Rectangle sourceRec,
                   Vector2 position, Color tint)
void DrawTextureQuad(Texture2D texture, Vector2 tiling, Vector2 offset,
                     Rectangle quad, Color tint)

```

(continues on next page)

(continued from previous page)

```

void DrawTexturePro(Texture2D texture, Rectangle sourceRec,
    Rectangle destRec, Vector2 origin, float rotation, Color tint)
void DrawTextureNPatch(Texture2D texture, NPatchInfo nPatchInfo,
    Rectangle destRec, Vector2 origin, float rotation, Color tint)
Font GetFontDefault(void)
Font LoadFont(const char *fileName)
Font LoadFontEx(const char *fileName, int fontSize,
    int *fontChars, int charsCount)
Font LoadFontFromImage(Image image, Color key, int firstChar)
CharInfo *LoadFontData(const char *fileName, int fontSize,
    int *fontChars, int charsCount, int type)
Image GenImageFontAtlas(CharInfo *chars, int charsCount,
    int fontSize, int padding, int packMethod)
void UnloadFont(Font font)
void DrawFPS(int posX, int posY)
void DrawText(const char *text, int posX, int posY, int fontSize, Color color)
void DrawTextEx(Font font, const char *text, Vector2 position,
    float fontSize, float spacing, Color tint)
void DrawTextRec(Font font, const char *text, Rectangle rec,
    float fontSize, float spacing, bool wordWrap, Color tint)
void DrawTextRecEx(Font font, const char *text, Rectangle rec,
    float fontSize, float spacing, bool wordWrap, Color tint,
    int selectStart, int selectLength, Color selectText, Color selectBack)
int MeasureText(const char *text, int fontSize)
Vector2 MeasureTextEx(Font font, const char *text,
    float fontSize, float spacing)
int GetGlyphIndex(Font font, int character)
int GetNextCodepoint(const char *text, int *count)
bool TextIsEqual(const char *text1, const char *text2)
unsigned int TextLength(const char *text)
unsigned int TextCountCodepoints(const char *text)
const char *TextFormat(const char *text)
const char *TextSubtext(const char *text, int position, int length)
const char *TextReplace(char *text, const char *replace, const char *by)
const char *TextInsert(const char *text, const char *insert, int position)
const char **TextJoin(const char **textList, int count, const char *delimiter)
const char **TextSplit(const char *text, char delimiter, int *count)
void TextAppend(char *text, const char *append, int *position)
int TextFindIndex(const char *text, const char *find)
const char *TextToUpper(const char *text)
const char *TextToLower(const char *text)
const char *TextToPascal(const char *text)
int TextToInteger(const char *text)
void DrawLine3D(Vector3 startPos, Vector3 endPos, Color color)
void DrawCircle3D(Vector3 center, float radius, Vector3 rotationAxis,
    float rotationAngle, Color color)
void DrawCube(Vector3 position, float width, float height, float length, Color color)
void DrawCubeV(Vector3 position, Vector3 size, Color color)
void DrawCubeWires(Vector3 position, float width, float height,
    float length, Color color)
void DrawCubeWiresV(Vector3 position, Vector3 size, Color color)
void DrawCubeTexture(Texture2D texture, Vector3 position,
    float width, float height, float length, Color color)
void DrawSphere(Vector3 centerPos, float radius, Color color)
void DrawSphereEx(Vector3 centerPos, float radius, int rings,
    int slices, Color color)
void DrawSphereWires(Vector3 centerPos, float radius, int rings,
    int slices, Color color)

```

(continues on next page)

(continued from previous page)

```

    int slices, Color color)
void DrawCylinder(Vector3 position, float radiusTop, float radiusBottom,
                  float height, int slices, Color color)
void DrawCylinderWires(Vector3 position, float radiusTop,
                      float radiusBottom, float height, int slices, Color color)
void DrawPlane(Vector3 centerPos, Vector2 size, Color color)
void DrawRay(Ray ray, Color color)
void DrawGrid(int slices, float spacing)
void DrawGizmo(Vector3 position)
Model LoadModel(const char *fileName)
Model LoadModelFromMesh(Mesh mesh)
void UnloadModel(Model model)
Mesh *LoadMeshes(const char *fileName, int *meshCount)
void ExportMesh(Mesh mesh, const char *fileName)
void UnloadMesh(Mesh *mesh)
Material *LoadMaterials(const char *fileName, int *materialCount)
Material LoadMaterialDefault(void)
void UnloadMaterial(Material material)
void SetMaterialTexture(Material *material, int mapType, Texture2D texture)
void SetModelMeshMaterial(Model *model, int meshId, int materialId)
ModelAnimation *LoadModelAnimations(const char *fileName, int *animsCount)
void UpdateModelAnimation(Model model, ModelAnimation anim, int frame)
void UnloadModelAnimation(ModelAnimation anim)
bool IsModelAnimationValid(Model model, ModelAnimation anim)
Mesh GenMeshPoly(int sides, float radius)
Mesh GenMeshPlane(float width, float length, int resX, int resZ)
Mesh GenMeshCube(float width, float height, float length)
Mesh GenMeshSphere(float radius, int rings, int slices)
Mesh GenMeshHemiSphere(float radius, int rings, int slices)
Mesh GenMeshCylinder(float radius, float height, int slices)
Mesh GenMeshTorus(float radius, float size, int radSeg, int sides)
Mesh GenMeshKnot(float radius, float size, int radSeg, int sides)
Mesh GenMeshHeightmap(Image heightmap, Vector3 size)
Mesh GenMeshCubicmap(Image cubicmap, Vector3 cubeSize)
BoundingBox MeshBoundingBox(Mesh mesh)
void MeshTangents(Mesh *mesh)
void MeshBinormals(Mesh *mesh)
void DrawModel(Model model, Vector3 position, float scale, Color tint)
void DrawModelEx(Model model, Vector3 position, Vector3 rotationAxis,
                 float rotationAngle, Vector3 scale, Color tint)
void DrawModelWires(Model model, Vector3 position, float scale, Color tint)
void DrawModelWiresEx(Model model, Vector3 position,
                      Vector3 rotationAxis, float rotationAngle, Vector3 scale, Color tint)
void DrawBoundingBox(BoundingBox box, Color color)
void DrawBillboard(Camera3D camera, Texture2D texture,
                   Vector3 center, float size, Color tint)
void DrawBillboardRec(Camera3D camera, Texture2D texture,
                      Rectangle sourceRec, Vector3 center, float size, Color tint)
bool CheckCollisionSpheres(Vector3 centerA, float radiusA,
                           Vector3 centerB, float radiusB)
bool CheckCollisionBoxes(BoundingBox box1, BoundingBox box2)
bool CheckCollisionBoxSphere(BoundingBox box, Vector3 centerSphere, float radiusSphere)
bool CheckCollisionRaySphere(Ray ray, Vector3 spherePosition, float sphereRadius)
bool CheckCollisionRaySphereEx(Ray ray, Vector3 spherePosition,
                             float sphereRadius, Vector3 *collisionPoint)
bool CheckCollisionRayBox(Ray ray, BoundingBox box)

```

(continues on next page)

(continued from previous page)

```

RayHitInfo GetCollisionRayModel(Ray ray, Model *model)
RayHitInfo GetCollisionRayTriangle(Ray ray, Vector3 p1, Vector3 p2, Vector3 p3)
RayHitInfo GetCollisionRayGround(Ray ray, float groundHeight)
char *LoadText(const char *fileName)
Shader LoadShader(const char *vsFileName, const char *fsFileName)
Shader LoadShaderCode(char *vsCode, char *fsCode)
void UnloadShader(Shader shader)
Shader GetShaderDefault(void)
Texture2D GetTextureDefault(void)
int GetShaderLocation(Shader shader, const char *uniformName)
void SetShaderValue(Shader shader, int uniformLoc,
                     const void *value, int uniformType)
void SetShaderValueV(Shader shader, int uniformLoc,
                     const void *value, int uniformType, int count)
void SetShaderValueMatrix(Shader shader, int uniformLoc, Matrix mat)
void SetShaderValueTexture(Shader shader, int uniformLoc, Texture2D texture)
void SetMatrixProjection(Matrix proj)
void SetMatrixModelview(Matrix view)
Matrix GetMatrixModelview(void)
Texture2D GenTextureCubemap(Shader shader, Texture2D skyHDR, int size)
Texture2D GenTextureIrradiance(Shader shader, Texture2D cubemap, int size)
Texture2D GenTexturePrefilter(Shader shader, Texture2D cubemap, int size)
Texture2D GenTextureBRDF(Shader shader, int size)
void BeginShaderMode(Shader shader)
void EndShaderMode(void)
void BeginBlendMode(int mode)
void EndBlendMode(void)
void BeginScissorMode(int x, int y, int width, int height)
void EndScissorMode(void)
void InitVrSimulator(void)
void CloseVrSimulator(void)
void UpdateVrTracking(Camera3D *camera)
void SetVrConfiguration(VrDeviceInfo info, Shader distortion)
bool IsVrSimulatorReady(void)
void ToggleVrMode(void)
void BeginVrDrawing(void)
void EndVrDrawing(void)
void InitAudioDevice(void)
void CloseAudioDevice(void)
bool IsAudioDeviceReady(void)
void SetMasterVolume(float volume)
Wave LoadWave(const char *fileName)
Wave LoadWaveEx(void *data, int sampleCount, int sampleRate,
                int sampleSize, int channels)
Sound LoadSound(const char *fileName)
Sound LoadSoundFromWave(Wave wave)
void UpdateSound(Sound sound, const void *data, int samplesCount)
void UnloadWave(Wave wave)
void UnloadSound(Sound sound)
void ExportWave(Wave wave, const char *fileName)
void ExportWaveAsCode(Wave wave, const char *fileName)
void PlaySound(Sound sound)
void PauseSound(Sound sound)
void ResumeSound(Sound sound)
void StopSound(Sound sound)
bool IsSoundPlaying(Sound sound)
void SetSoundVolume(Sound sound, float volume)

```

(continues on next page)

(continued from previous page)

```

void SetSoundPitch(Sound sound, float pitch)
void WaveFormat(Wave *wave, int sampleRate, int sampleSize, int channels)
Wave WaveCopy(Wave wave)
void WaveCrop(Wave *wave, int initSample, int finalSample)
float *GetWaveData(Wave wave)
Music LoadMusicStream(const char *fileName)
void UnloadMusicStream(Music music)
void PlayMusicStream(Music music)
void UpdateMusicStream(Music music)
void StopMusicStream(Music music)
void PauseMusicStream(Music music)
void ResumeMusicStream(Music music)
bool IsMusicPlaying(Music music)
void SetMusicVolume(Music music, float volume)
void SetMusicPitch(Music music, float pitch)
void SetMusicLoopCount(Music music, int count)
float GetMusicTimeLength(Music music)
float GetMusicTimePlayed(Music music)
AudioStream InitAudioStream(unsigned int sampleRate,
                           unsigned int sampleSize, unsigned int channels)
void UpdateAudioStream(AudioStream stream, const void *data, int samplesCount)
void CloseAudioStream(AudioStream stream)
bool IsAudioBufferProcessed(AudioStream stream)
void PlayAudioStream(AudioStream stream)
void PauseAudioStream(AudioStream stream)
void ResumeAudioStream(AudioStream stream)
bool IsAudioStreamPlaying(AudioStream stream)
void StopAudioStream(AudioStream stream)
void SetAudioStreamVolume(AudioStream stream, float volume)
void SetAudioStreamPitch(AudioStream stream, float pitch)
void GuiEnable(void)
void GuiDisable(void)
void GuiLock(void)
void GuiUnlock(void)
void GuiState(int state)
void GuiFont(Font font)
void GuiFade(float alpha)
void GuiSetStyle(int control, int property, int value)
int GuiGetStyle(int control, int property)
bool GuiWindowBox(Rectangle bounds, const char *text)
void GuiGroupBox(Rectangle bounds, const char *text)
void GuiLine(Rectangle bounds, const char *text)
void GuiPanel(Rectangle bounds)
Rectangle GuiScrollPane(Rectangle bounds, Rectangle content, Vector2 *scroll)
void GuiLabel(Rectangle bounds, const char *text)
bool GuiButton(Rectangle bounds, const char *text)
bool GuiLabelButton(Rectangle bounds, const char *text)
bool GuiImageButton(Rectangle bounds, Texture2D texture)
bool GuiImageButtonEx(Rectangle bounds, Texture2D texture,
                     Rectangle texSource, const char *text)
bool GuiToggle(Rectangle bounds, const char *text, bool active)
int GuiToggleGroup(Rectangle bounds, const char *text, int active)
bool GuiCheckBox(Rectangle bounds, const char *text, bool checked)
int GuiComboBox(Rectangle bounds, const char *text, int active)=
bool GuiDropdownBox(Rectangle bounds, const char *text,
                    int *active, bool editMode)
bool GuiSpinner(Rectangle bounds, int *value, int minValue,

```

(continues on next page)

(continued from previous page)

```
    int maxValue, bool editMode)
bool GuiValueBox(Rectangle bounds, int *value, int minValue,
                 int maxValue, bool editMode)
bool GuiTextBox(Rectangle bounds, char *text, int textSize, bool editMode)
bool GuiTextBoxMulti(Rectangle bounds, char *text, int textSize, bool editMode)
float GuiSlider(Rectangle bounds, const char *text, float value,
                float minValue, float maxValue, bool showValue)
float GuiSliderBar(Rectangle bounds, const char *text, float value,
                   float minValue, float maxValue, bool showValue)
float GuiProgressBar(Rectangle bounds, const char *text, float value,
                     float minValue, float maxValue, bool showValue)
void GuiStatusBar(Rectangle bounds, const char *text)
void GuiDummyRec(Rectangle bounds, const char *text)
int GuiScrollBar(Rectangle bounds, int value, int minValue, int maxValue)
Vector2 GuiGrid(Rectangle bounds, float spacing, int subdivs)
bool GuiListView(Rectangle bounds, const char *text, int *active,
                 int *scrollIndex, bool editMode)
bool GuiListViewEx(Rectangle bounds, const char **text, int count,
                  int *enabled, int *active, int *focus, int *scrollIndex, bool editMode)
int GuiMessageBox(Rectangle bounds, const char *windowTitle,
                  const char *message, const char *buttons)
int GuiTextInputBox(Rectangle bounds, const char *windowTitle,
                    const char *message, char *text, const char *buttons)
Color GuiColorPicker(Rectangle bounds, Color color)
void GuiLoadStyle(const char *fileName)
void GuiLoadStyleProps(const int *props, int count)
void GuiLoadStyleDefault(void)
void GuiUpdateStyleComplete(void)
const char *GuiIconText(int iconId, const char *text)
```

USING RINGOPENGL AND RINGFREEGLUT FOR 3D GRAPHICS

In this chapter we will learn about using RingOpenGL

58.1 Samples Source (Authors)

The samples in this chapter are based on C Tutorials
from

- (1) <http://www.lighthouse3d.com/tutorials/glut-tutorial/>
- (2) <http://www.wikihow.com/Make-a-Cube-in-OpenGL>

58.2 What is RingOpenGL?

RingOpenGL contains the Ring binding to the OpenGL library

You can learn about OpenGL from : <https://www.opengl.org/>

RingOpenGL comes with support for the next versions

- OpenGL 1.1
- OpenGL 1.2
- OpenGL 1.3
- OpenGL 1.4
- OpenGL 1.5
- OpenGL 2.0
- OpenGL 2.1
- OpenGL 3.0
- OpenGL 3.2
- OpenGL 3.3
- OpenGL 4.0
- OpenGL 4.1
- OpenGL 4.2
- OpenGL 4.3

- OpenGL 4.4
- OpenGL 4.5
- OpenGL 4.6

For example, if you want to use OpenGL 2.1 then load RingOpenGL 2.1 library

```
load "opengl21lib.ring"
```

58.3 What is RingFreeGLUT?

RingFreeGLUT contains the Ring binding to the FreeGLUT library

You can learn about FreeGLUT from : <http://freeglut.sourceforge.net/>

To use the RingFreeGLUT library, Just load the library

```
load "freeglut.ring"
```

58.4 The First Window using RingFreeGLUT

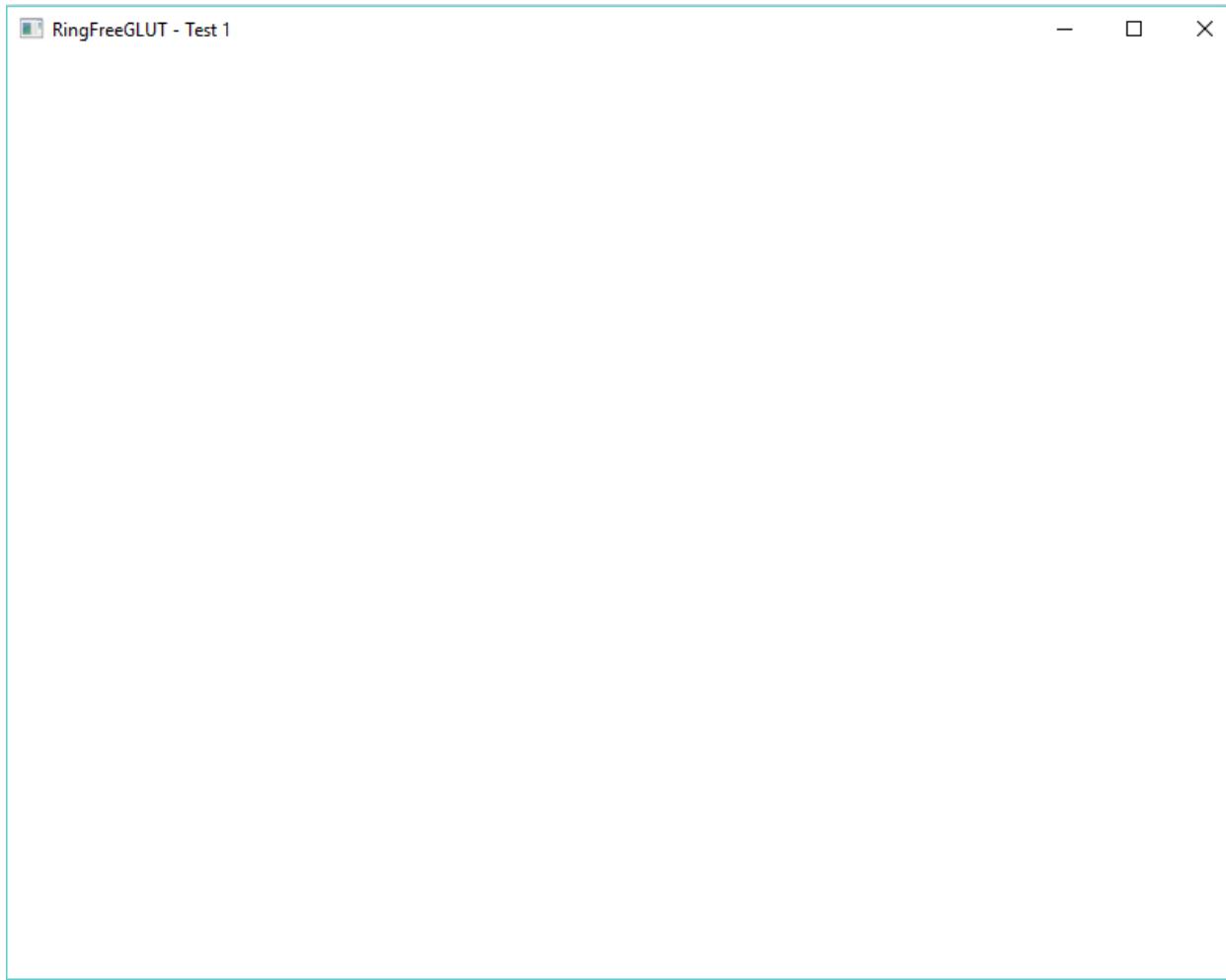
Example:

```
load "freeglut.ring"

func main
    glutInit()
    glutInitDisplayMode(GLUT_SINGLE)
    glutInitWindowSize(800, 600)
    glutInitWindowPosition(100, 10)
    glutCreateWindow("RingFreeGLUT - Test 1")
    glutDisplayFunc(:displayCode)
    glutMainLoop()

func displayCode
```

Screen Shot



58.5 Drawing using RingOpenGL

Example:

```
load "freeglut.ring"
load "opengl21lib.ring"

func main
    glutInit()
    glutInitDisplayMode(GLUT_SINGLE)
    glutInitWindowSize(800, 600)
    glutInitWindowPosition(100, 10)
    glutCreateWindow("RingFreeGLUT - Test 2")
    glutDisplayFunc(:displayCode)
    glutMainLoop()

func displaycode
    glClear(GL_COLOR_BUFFER_BIT)
    glColor3f(0, 255, 0)
    glBegin(GL_POLYGON)
```

(continues on next page)

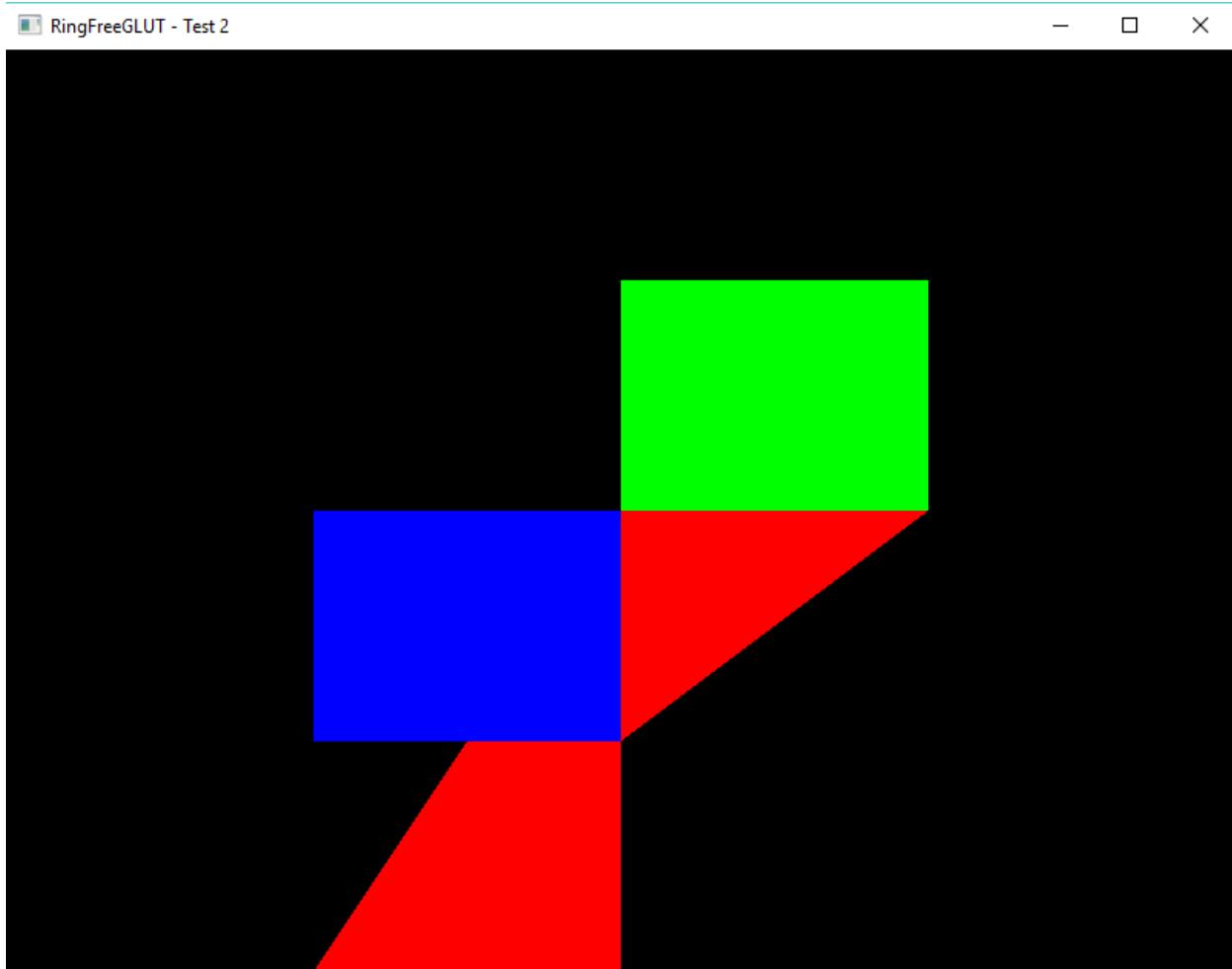
(continued from previous page)

```
glVertex3f(0.0, 0.0, 0.0)
glVertex3f(0.5, 0.0, 0.0)
glVertex3f(0.5, 0.5, 0.0)
glVertex3f(0.0, 0.5, 0.0)

glEnd()
glColor3f(255,0,0)
glBegin(GL_POLYGON)
    glVertex3f(0.0, 0.0, 0.0)
    glVertex3f(0.5, 0.0, 0.0)
    glVertex3f(-0.5,- 1, 0.0)
    glVertex3f(0.0, -1, 0.0)
glEnd()
glColor3f(0,0,255)
glBegin(GL_POLYGON)
    glVertex3f(0.0, 0.0, 0.0)
    glVertex3f(-0.5, 0.0, 0.0)
    glVertex3f(-0.5,- 0.5, 0.0)
    glVertex3f(0.0, -0.5, 0.0)
glEnd()

glFlush()
```

Screen Shot



58.6 The First Triangle

Example:

```
load "freeglut.ring"
load "opengl21lib.ring"

func main
    glutInit()
    glutInitDisplayMode(GLUT_DEPTH | GLUT_DOUBLE | GLUT_RGBA)
    glutInitWindowSize(320, 320)
    glutInitWindowPosition(100, 10)
    glutCreateWindow("RingFreeGLUT - Test 3")
    glutDisplayFunc(:renderScene)
    glutMainLoop()

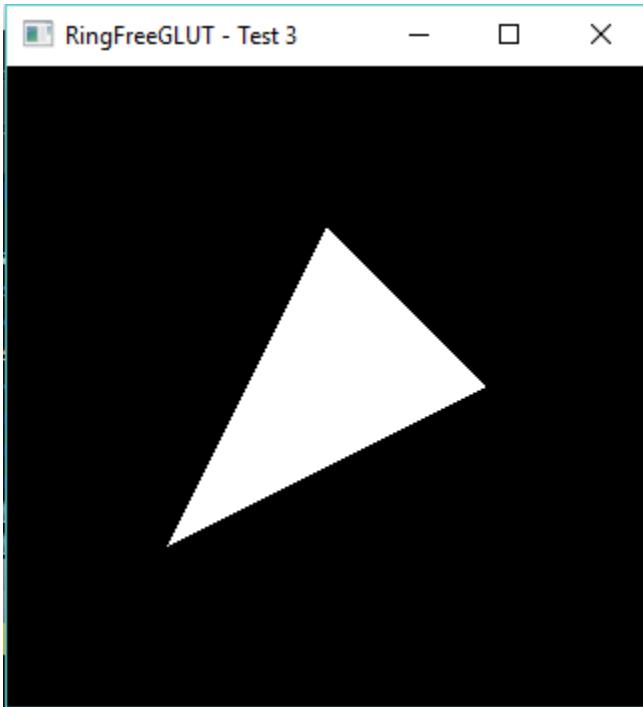
func renderScene

    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)

    glBegin(GL_TRIANGLES)
        glVertex3f(-0.5,-0.5,0.0)
        glVertex3f(0.5,0.0,0.0)
        glVertex3f(0.0,0.5,0.0)
    glEnd()

    glutSwapBuffers()
```

Screen Shot



58.7 Window Resize Event

Example:

```

load "freeglut.ring"
load "opengl21lib.ring"

func main

    // init GLUT and create window
    glutInit()
    glutInitDisplayMode(GLUT_DEPTH | GLUT_DOUBLE | GLUT_RGBA)
    glutInitWindowPosition(100,100)
    glutInitWindowSize(320,320)
    glutCreateWindow("RingFreeGLUT - Test 4")

    glutDisplayFunc(:renderScene)
    glutReshapeFunc(:changeSize)

    glutMainLoop()

func renderScene

    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)

    glBegin(GL_TRIANGLES)
        glVertex3f(-2,-2,-5.0)
        glVertex3f(2,0.0,-5.0)
        glVertex3f(0.0,2,-5.0)
    glEnd()

    glutSwapBuffers()

func changesize

    h = glutEventHeight()
    w = glutEventWidth()

        // Prevent a divide by zero, when window is too short
        // (you cant make a window of zero width).
    if (h = 0)
        h = 1
    ok

    ratio = w * 1.0 / h

    // Use the Projection Matrix
    glMatrixMode(GL_PROJECTION)

    // Reset Matrix
    glLoadIdentity()

    // Set the viewport to be the entire window
    glViewport(0, 0, w, h)

    // Set the correct perspective.
    gluPerspective(45,ratio,1,100)

```

(continues on next page)

(continued from previous page)

```
// Get Back to the Modelview
glMatrixMode(GL_MODELVIEW)
```

58.8 Triangle Rotation

Example:

```
load "freeglut.ring"
load "opengl21lib.ring"

angle = 0

func main

    // init GLUT and create window
    glutInit()
    glutInitDisplayMode(GLUT_DEPTH | GLUT_DOUBLE | GLUT_RGBA)
    glutInitWindowPosition(100, 100)
    glutInitWindowSize(320, 320)
    glutCreateWindow("RingFreeGLUT - Test 5")

    glutDisplayFunc(:renderScene)
    glutReshapeFunc(:changeSize)
    glutIdleFunc(:renderScene)

    glutMainLoop()

func renderScene

    // Clear Color and Depth Buffers
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)

    // Reset transformations
    glLoadIdentity()
    // Set the camera
    gluLookAt(      0.0, 0.0, 10.0,
                  0.0, 0.0, 0.0,
                  0.0, 1.0, 0.0)

    glRotatef(angle, 0.0, 1.0, 0.0)

    glBegin(GL_TRIANGLES)
        glVertex3f(-2.0, -2.0, 0.0)
        glVertex3f( 2.0, 0.0, 0.0)
        glVertex3f( 0.0, 2.0, 0.0)
    glEnd()

    angle+=0.1

    glutSwapBuffers();

func changesize
```

(continues on next page)

(continued from previous page)

```
h = glutEventHeight()
w = glutEventWidth()

        // Prevent a divide by zero, when window is too short
// (you can't make a window of zero width).
if (h == 0)
    h = 1
ok

ratio = w * 1.0 / h

// Use the Projection Matrix
glMatrixMode(GL_PROJECTION)

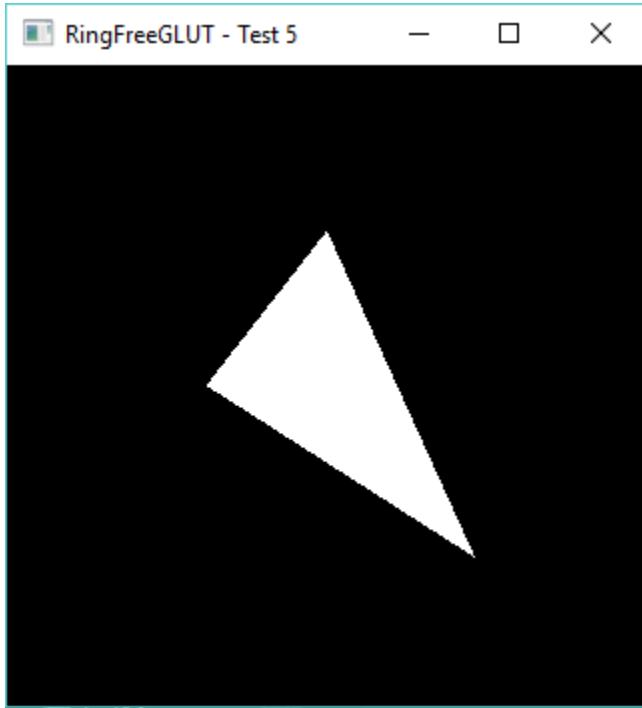
// Reset Matrix
glLoadIdentity()

// Set the viewport to be the entire window
glViewport(0, 0, w, h)

// Set the correct perspective.
gluPerspective(45, ratio, 1, 100)

// Get Back to the Modelview
glMatrixMode(GL_MODELVIEW)
```

Screen Shot



58.9 Keyboard Events and Colors

Example:

```

load "freeglut.ring"
load "opengl21lib.ring"

angle = 0

red=1.0
blue=1.0
green=1.0

func main

    // init GLUT and create window
    glutInit()
    glutInitDisplayMode(GLUT_DEPTH | GLUT_DOUBLE | GLUT_RGBA)
    glutInitWindowPosition(100,100)
    glutInitWindowSize(320,320)
    glutCreateWindow("RingFreeGLUT - Test 6")

    glutDisplayFunc(:renderScene)
    glutReshapeFunc(:changeSize)
    glutIdleFunc(:renderScene)

    // here are the new entries
    glutKeyboardFunc(:processNormalKeys)
    glutSpecialFunc(:processSpecialKeys)

    glutMainLoop()

func renderScene

    // Clear Color and Depth Buffers
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)

    // Reset transformations
    glLoadIdentity()
    // Set the camera
    gluLookAt(      0.0, 0.0, 10.0,
                  0.0, 0.0, 0.0,
                  0.0, 1.0, 0.0)

    glRotatef(angle, 0.0, 1.0, 0.0)

    glColor3f(red,green,blue);

    glBegin(GL_TRIANGLES)
        glVertex3f(-2.0,-2.0, 0.0)
        glVertex3f( 2.0, 0.0, 0.0)
        glVertex3f( 0.0, 2.0, 0.0)
    glEnd()

    angle+=0.1

```

(continues on next page)

(continued from previous page)

```

glutSwapBuffers();

func changesize

    h = glutEventHeight()
    w = glutEventWidth()

        // Prevent a divide by zero, when window is too short
        // (you cant make a window of zero width).
    if (h = 0)
        h = 1
    ok

    ratio = w * 1.0 / h

    // Use the Projection Matrix
    glMatrixMode(GL_PROJECTION)

    // Reset Matrix
    glLoadIdentity()

    // Set the viewport to be the entire window
    glViewport(0, 0, w, h)

    // Set the correct perspective.
    gluPerspective(45, ratio, 1, 100)

    // Get Back to the Modelview
    glMatrixMode(GL_MODELVIEW)

func processNormalKeys
    key = GLUTEventKey()
    if key = 27
        shutdown()
    ok

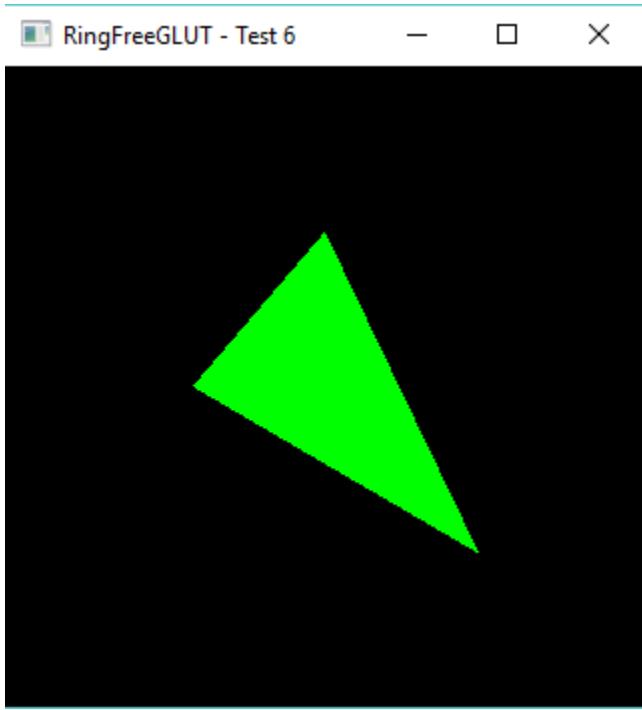
func processSpecialKeys

    key = GLUTEventKey()

    switch key
        on GLUT_KEY_F1
            red = 1.0
            green = 0.0
            blue = 0.0
        on GLUT_KEY_F2
            red = 0.0
            green = 1.0
            blue = 0.0
        on GLUT_KEY_F3
            red = 0.0
            green = 0.0
            blue = 1.0
    off

```

Screen Shot



58.10 The Camera

Example:

```

load "freeglut.ring"
load "opengl21lib.ring"

// angle of rotation for the camera direction
angle=0.0
// actual vector representing the camera's direction
lx=0.0
lz=-1.0
// XZ position of the camera
x=0.0
z=5.0

func drawSnowMan

    glColor3f(1.0, 1.0, 1.0)

    // Draw Body
        glTranslatef(0.0 ,0.75, 0.0)
        glutSolidSphere(0.75,20,20)

    // Draw Head
        glTranslatef(0.0, 1.0, 0.0)
        glutSolidSphere(0.25,20,20)

    // Draw Eyes
        glPushMatrix()
        glColor3f(0.0,0.0,0.0)

```

(continues on next page)

(continued from previous page)

```

glTranslatef(0.05, 0.10, 0.18)
glutSolidSphere(0.05,10,10)
glTranslatef(-0.1, 0.0, 0.0)
glutSolidSphere(0.05,10,10)

glPopMatrix()

// Draw Nose
glColor3f(1.0, 0.5, 0.5)
glutSolidCone(0.08,0.5,10,2)

func changeSize
    w = glutEventWidth()
    h = glutEventHeight()

    // Prevent a divide by zero, when window is too short
    // (you cant make a window of zero width).
    if h = 0
        h = 1
    ok

    ratio = w * 1.0 / h

    // Use the Projection Matrix
    glMatrixMode(GL_PROJECTION)

    // Reset Matrix
    glLoadIdentity()

    // Set the viewport to be the entire window
    glViewport(0, 0, w, h)

    // Set the correct perspective.
    gluPerspective(45.0, ratio, 0.1, 100.0);

    // Get Back to the Modelview
    glMatrixMode(GL_MODELVIEW)

func processNormalKeys
    key = glutEventKey()

    if key = 27
        shutdown()
    ok

func renderScene
    // Clear Color and Depth Buffers

    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)

    // Reset transformations

```

(continues on next page)

(continued from previous page)

```

glLoadIdentity()
// Set the camera
gluLookAt(      x, 1.0, z,
                x+lx, 1.0, z+lz,
                0.0, 1.0, 0.0)

// Draw ground

glColor3f(0.9, 0.9, 0.9)
glBegin(GL_QUADS)
    glVertex3f(-100.0, 0.0, -100.0)
    glVertex3f(-100.0, 0.0, 100.0)
    glVertex3f( 100.0, 0.0, 100.0)
    glVertex3f( 100.0, 0.0, -100.0)
glEnd()

// Draw 36 SnowMen
for i = -3 to 2
    for j=-3 to 2
        glPushMatrix()
        glTranslatef(i*10.0, 0, j * 10.0)
        drawSnowMan()
        glPopMatrix()
    next
next
glutSwapBuffers()

```

```

func processSpecialKeys

key = glutEventKey()

fraction = 0.1

switch key
    on GLUT_KEY_LEFT
        angle -= 0.01
        lx = sin(angle)
        lz = -cos(angle)
    on GLUT_KEY_RIGHT
        angle += 0.01
        lx = sin(angle)
        lz = -cos(angle)
    on GLUT_KEY_UP
        x += lx * fraction
        z += lz * fraction
    on GLUT_KEY_DOWN
        x -= lx * fraction
        z -= lz * fraction
off

func main

// init GLUT and create window

```

(continues on next page)

(continued from previous page)

```

glutInit()
glutInitDisplayMode(GLUT_DEPTH | GLUT_DOUBLE | GLUT_RGBA)

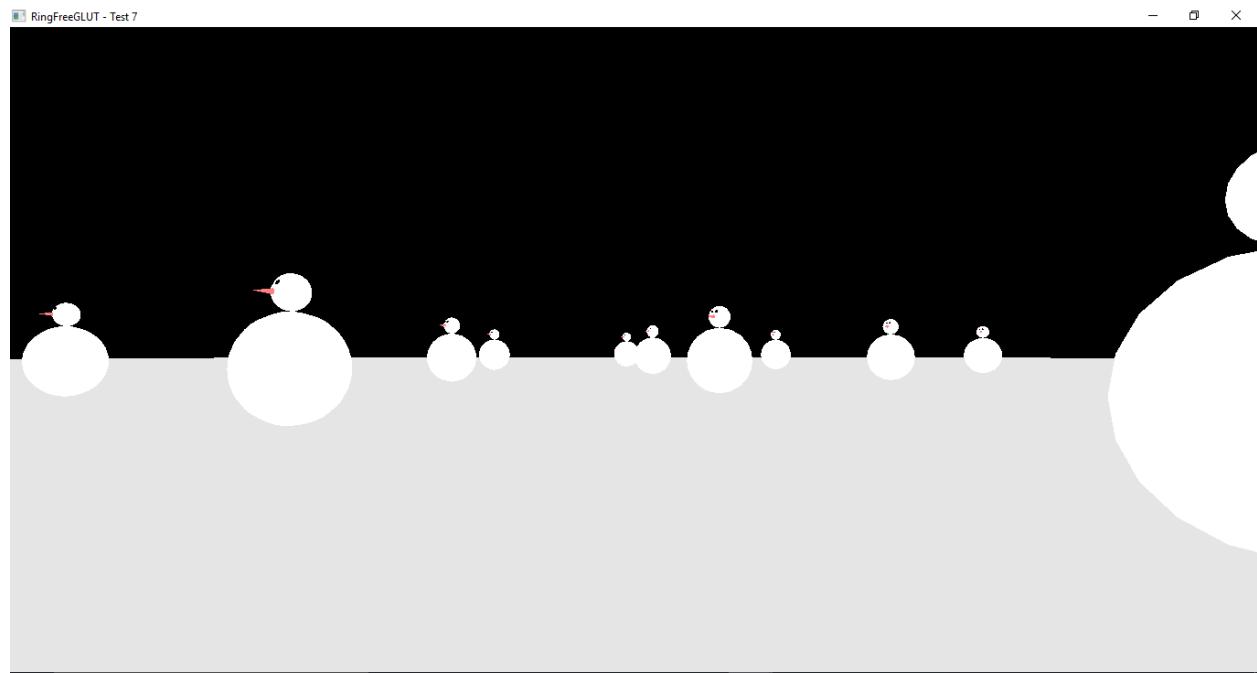
glutInitWindowPosition(100,100)
glutInitWindowSize(320,320)
glutCreateWindow("RingFreeGLUT - Test 7")

// register callbacks
glutDisplayFunc(:renderScene)
glutReshapeFunc(:changeSize)
glutIdleFunc(:renderScene)
glutKeyboardFunc(:processNormalKeys)
glutSpecialFunc(:processSpecialKeys)

// OpenGL init
glEnable(GL_DEPTH_TEST)

// enter GLUT event processing cycle
glutMainLoop()

```

Screen Shot**Another Example:**

```

load "freeglut.ring"
load "opengl21lib.ring"

// angle of rotation for the camera direction
angle = 0.0

// actual vector representing the camera's direction
lx=0.0 lz=-1.0

```

(continues on next page)

(continued from previous page)

```

// XZ position of the camera
x=0.0 z=5.0
// the key states. These variables will be zero
//when no key is being presses
deltaAngle = 0.0
deltaMove = 0

func changeSize
    w = glutEventWidth()
    h = glutEventHeight()

    // Prevent a divide by zero, when window is too short
    // (you cant make a window of zero width).
    if h = 0
        h = 1
    ok

    ratio = w * 1.0 / h

    // Use the Projection Matrix
    glMatrixMode(GL_PROJECTION)

    // Reset Matrix
    glLoadIdentity()

    // Set the viewport to be the entire window
    glViewport(0, 0, w, h)

    // Set the correct perspective.
    gluPerspective(45.0, ratio, 0.1, 100.0)

    // Get Back to the Modelview
    glMatrixMode(GL_MODELVIEW)

func drawSnowMan

    glColor3f(1.0, 1.0, 1.0)

    // Draw Body

        glTranslatef(0.0 ,0.75, 0.0)
        glutSolidSphere(0.75,20,20)

    // Draw Head
        glTranslatef(0.0, 1.0, 0.0)
        glutSolidSphere(0.25,20,20)

    // Draw Eyes
        glPushMatrix()
        glColor3f(0.0,0.0,0.0)
        glTranslatef(0.05, 0.10, 0.18)
        glutSolidSphere(0.05,10,10)
        glTranslatef(-0.1, 0.0, 0.0)
        glutSolidSphere(0.05,10,10)
        glPopMatrix()

```

(continues on next page)

(continued from previous page)

```

// Draw Nose
    glColor3f(1.0, 0.5, 0.5)
    glRotatef(0.0, 1.0, 0.0, 0.0)
    glutSolidCone(0.08, 0.5, 10, 2)

func computePos deltaMove

    x += deltaMove * lx * 0.1
    z += deltaMove * lz * 0.1

func computeDir deltaAngle

    angle += deltaAngle
    lx = sin(angle)
    lz = -cos(angle)

func renderScene

    if deltaMove
        computePos(deltaMove)
    ok

    if deltaAngle
        computeDir(deltaAngle)
    ok

    // Clear Color and Depth Buffers
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)

    // Reset transformations
    glLoadIdentity()
    // Set the camera
    gluLookAt(      x, 1.0, z,
                    x+lx, 1.0, z+lz,
                    0.0, 1.0, 0.0)

// Draw ground

    glColor3f(0.9, 0.9, 0.9)
    glBegin(GL_QUADS)
        glVertex3f(-100.0, 0.0, -100.0)
        glVertex3f(-100.0, 0.0, 100.0)
        glVertex3f( 100.0, 0.0, 100.0)
        glVertex3f( 100.0, 0.0, -100.0)
    glEnd()

// Draw 36 SnowMen

    for i = -3 to 2
        for j=-3 to 2
            glPushMatrix()
            glTranslatef(i*10.0, 0, j * 10.0)
            drawSnowMan()
            glPopMatrix()

```

(continues on next page)

(continued from previous page)

```

next
next
glutSwapBuffers()

func pressKey
    key = glutEventKey()
    xx = glutEventX()
    yy = glutEventY()

    switch key
        on GLUT_KEY_LEFT
            deltaAngle = -0.01
        on GLUT_KEY_RIGHT
            deltaAngle = 0.01
        on GLUT_KEY_UP
            deltaMove = 0.5
        on GLUT_KEY_DOWN
            deltaMove = -0.5
    off

func releaseKey
    key = glutEventKey()

    switch key
        on GLUT_KEY_LEFT
            deltaAngle = 0.0
        on GLUT_KEY_RIGHT
            deltaAngle = 0.0
        on GLUT_KEY_UP
            deltaMove = 0
        on GLUT_KEY_DOWN
            deltaMove = 0
    off

func main
    // init GLUT and create window
    glutInit()
    glutInitDisplayMode(GLUT_DEPTH | GLUT_DOUBLE | GLUT_RGBA)
    glutInitWindowPosition(100,100)
    glutInitWindowSize(320,320)
    glutCreateWindow("RingFreeGLUT - Test 8")

    // register callbacks
    glutDisplayFunc(:renderScene)
    glutReshapeFunc(:changeSize)
    glutIdleFunc(:renderScene)

    glutSpecialFunc(:pressKey)

    // here are the new entries
    glutIgnoreKeyRepeat(1)
    glutSpecialUpFunc(:releaseKey)

    // OpenGL init

```

(continues on next page)

(continued from previous page)

```
glEnable(GL_DEPTH_TEST)

// enter GLUT event processing cycle
	glutMainLoop()
```

58.11 Mouse Events

Example:

```
load "freeglut.ring"
load "opengl21lib.ring"

// angle of rotation for the camera direction
angle = 0.0

// actual vector representing the camera's direction
lx=0.0 lz=-1.0

// XZ position of the camera
x=0.0 z=5.0

// the key states. These variables will be zero
//when no key is being presses
deltaAngle = 0.0
deltaMove = 0.0
xOrigin = -1

func changeSize
    w = glutEventWidth()
    h = glutEventHeight()

    // Prevent a divide by zero, when window is too short
    // (you cant make a window of zero width).
    if h = 0
        h = 1
    ok

    ratio = w * 1.0 / h

    // Use the Projection Matrix
    glMatrixMode(GL_PROJECTION)

    // Reset Matrix
    glLoadIdentity()

    // Set the viewport to be the entire window
    glViewport(0, 0, w, h)

    // Set the correct perspective.
    gluPerspective(45.0, ratio, 0.1, 100.0)

    // Get Back to the Modelview
    glMatrixMode(GL_MODELVIEW)
```

(continues on next page)

(continued from previous page)

```

func drawSnowMan

    glColor3f(1.0, 1.0, 1.0)

    // Draw Body
    glTranslatef(0.0 ,0.75, 0.0)
    glutSolidSphere(0.75,20,20)

    // Draw Head
    glTranslatef(0.0, 1.0, 0.0)
    glutSolidSphere(0.25,20,20)

    // Draw Eyes
    glPushMatrix()
    glColor3f(0.0,0.0,0.0)
    glTranslatef(0.05, 0.10, 0.18)
    glutSolidSphere(0.05,10,10)
    glTranslatef(-0.1, 0.0, 0.0)
    glutSolidSphere(0.05,10,10)
    glPopMatrix()

    // Draw Nose
    glColor3f(1.0, 0.5 , 0.5)
    glRotatef(0.0,1.0, 0.0, 0.0)
    glutSolidCone(0.08,0.5,10,2)

func computePos deltaMove

    x += deltaMove * lx * 0.1
    z += deltaMove * lz * 0.1

func renderScene

    if deltaMove
        computePos(deltaMove)
    ok

    // Clear Color and Depth Buffers
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)

    // Reset transformations
    glLoadIdentity()
    // Set the camera
    gluLookAt(      x, 1.0, z,
                    x+lx, 1.0, z+lz,
                    0.0, 1.0, 0.0)

    // Draw ground

    glColor3f(0.9, 0.9, 0.9)
    glBegin(GL_QUADS)
        glVertex3f(-100.0, 0.0, -100.0)
        glVertex3f(-100.0, 0.0, 100.0)
        glVertex3f( 100.0, 0.0, 100.0)
        glVertex3f( 100.0, 0.0, -100.0)

```

(continues on next page)

(continued from previous page)

```

glEnd()

// Draw 36 SnowMen

for i = -3 to 2
    for j=-3 to 2
        glPushMatrix()
        glTranslatef(i*10.0,0,j * 10.0)
        drawSnowMan()
        glPopMatrix()
    next
next
glutSwapBuffers()

func processNormalKeys

key = glutEventKey()

if key = 27
    shutdown()
ok

func pressKey
key = glutEventKey()

switch key
on GLUT_KEY_UP
    deltaMove = 0.5
on GLUT_KEY_DOWN
    deltaMove = -0.5
off

func releaseKey
key = glutEventKey()
switch key
on GLUT_KEY_UP
    deltaMove = 0
on GLUT_KEY_DOWN
    deltaMove = 0
off

func mouseMove
xx = glutEventX()
yy = glutEventY()
// this will only be true when the left button is down
if xOrigin >= 0

// update deltaAngle
deltaAngle = (xx - xOrigin) * 0.001

// update camera's direction
lx = sin(angle + deltaAngle)
lz = -cos(angle + deltaAngle)
ok

```

(continues on next page)

(continued from previous page)

```

func mouseButton

    button = glutEventButton()
    state = glutEventState()
    xx = glutEventX()
    yy = glutEventY()

    // only start motion if the left button is pressed
    if button == GLUT_LEFT_BUTTON
        // when the button is released
        if state == GLUT_UP
            angle += deltaAngle
            xOrigin = -1
        else
            // state == GLUT_DOWN
            xOrigin = xx
        ok
        fflush(stdout)
    ok

func main

    // init GLUT and create window
    glutInit()
    glutInitDisplayMode(GLUT_DEPTH | GLUT_DOUBLE | GLUT_RGBA)
    glutInitWindowPosition(100, 100)
    glutInitWindowSize(320, 320)
    glutCreateWindow("RingFreeGLUT - Test 9")

    // register callbacks
    glutDisplayFunc(:renderScene)
    glutReshapeFunc(:changeSize)
    glutIdleFunc(:renderScene)

    glutIgnoreKeyRepeat(1)
    glutKeyboardFunc(:processNormalKeys)
    glutSpecialFunc(:pressKey)
    glutSpecialUpFunc(:releaseKey)

    // here are the two new functions
    glutMouseFunc(:mouseButton)
    glutMotionFunc(:mouseMove)

    // OpenGL init
    glEnable(GL_DEPTH_TEST)

    // enter GLUT event processing cycle
    glutMainLoop()

```

58.12 Menu Events

Example:

```

load "freeglut.ring"
load "opengl21lib.ring"

// angle of rotation for the camera direction
angle = 0.0

// actual vector representing the camera's direction
lx=0.0 lz=-1.0

// XZ position of the camera
x=0.0 z=5.0

// the key states. These variables will be zero
//when no key is being presses
deltaAngle = 0.0
deltaMove = 0
xOrigin = -1

// Constant definitions for Menus

// for RingFreeGLUT - We must have different ID for each menu item
C_RED = 1
C_GREEN = 2
C_BLUE = 3
C_ORANGE = 4

C_FILL = 5
C_LINE = 6

C_SHRINK = 7
C_NORMAL = 8

// Pop up menu identifiers
fillMenu= 0
shrinkMenu= 0
mainMenu=0
colorMenu=0

// color for the nose
red = 1.0 blue=0.5 green=0.5

// scale of snowman
scale = 1.0

// menu status
menuFlag = 0

func changeSize
    w = glutEventWidth()
    h = glutEventHeight()

    // Prevent a divide by zero, when window is too short

```

(continues on next page)

(continued from previous page)

```

// (you cant make a window of zero width).
if h = 0
    h = 1
ok

ratio = w * 1.0 / h

// Use the Projection Matrix
glMatrixMode(GL_PROJECTION)

// Reset Matrix
glLoadIdentity()

// Set the viewport to be the entire window
glViewport(0, 0, w, h)

// Set the correct perspective.
gluPerspective(45.0, ratio, 0.1, 100.0)

// Get Back to the Modelview
glMatrixMode(GL_MODELVIEW)

func drawSnowMan

    glScalef(scale, scale, scale)
    glColor3f(1.0, 1.0, 1.0)

    // Draw Body
    glTranslatef(0.0, 0.75, 0.0)
    glutSolidSphere(0.75, 20, 20)

    // Draw Head
    glTranslatef(0.0, 1.0, 0.0)
    glutSolidSphere(0.25, 20, 20)

    // Draw Eyes
    glPushMatrix()
    glColor3f(0.0, 0.0, 0.0)
    glTranslatef(0.05, 0.10, 0.18)
    glutSolidSphere(0.05, 10, 10)
    glTranslatef(-0.1, 0.0, 0.0)
    glutSolidSphere(0.05, 10, 10)
    glPopMatrix()

    // Draw Nose
    glColor3f(red, green, blue)
    glRotatef(0.0, 1.0, 0.0, 0.0)
    glutSolidCone(0.08, 0.5, 10, 2)

    glColor3f(1.0, 1.0, 1.0)

func computePos deltaMove

    x += deltaMove * lx * 0.1
    z += deltaMove * lz * 0.1

```

(continues on next page)

(continued from previous page)

```

func renderScene

    if deltaMove
        computePos(deltaMove)
    ok

    // Clear Color and Depth Buffers
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)

    // Reset transformations
    glLoadIdentity()
    // Set the camera
    gluLookAt(      x, 1.0, z,
                    x+lx, 1.0, z+lz,
                    0.0, 1.0, 0.0)

    // Draw ground

    glColor3f(0.9, 0.9, 0.9)
    glBegin(GL_QUADS)
        glVertex3f(-100.0, 0.0, -100.0)
        glVertex3f(-100.0, 0.0, 100.0)
        glVertex3f( 100.0, 0.0, 100.0)
        glVertex3f( 100.0, 0.0, -100.0)
    glEnd()

    // Draw 36 SnowMen

    for i = -3 to 2
        for j = -3 to 2
            glPushMatrix()
            glTranslatef(i*10.0, 0.0, j * 10.0)
            drawSnowMan()
            glPopMatrix()
        next
    next
    glutSwapBuffers()

// -----
//          KEYBOARD
// -----


func processNormalKeys
    key = glutEventKey()
    xx = glutEventX()
    yy = glutEventY()

    glutSetMenu(mainMenu)
    switch key
        on 27
            glutDestroyMenu(mainMenu)
            glutDestroyMenu(fillMenu)
            glutDestroyMenu(colorMenu)
            glutDestroyMenu(shrinkMenu)
            shutdown()

```

(continues on next page)

(continued from previous page)

```

    on 's'
        if not menuFlag
            glutChangeToSubMenu(2, "Shrink", shrinkMenu)
        ok
    on 'c'
        if not menuFlag
            glutChangeToSubMenu(2, "Color", colorMenu)
        ok
    off
    if key = 27
        shutdown()
    ok

func pressKey

    key = glutEventKey()
    xx = glutEventX()
    yy = glutEventY()

    switch key
        on GLUT_KEY_UP
            deltaMove = 0.5
        on GLUT_KEY_DOWN
            deltaMove = -0.5
    off

func releaseKey

    key = glutEventKey()

    switch key
        on GLUT_KEY_UP
            deltaMove = 0
        on GLUT_KEY_DOWN
            deltaMove = 0
    off

// -----
//           MOUSE
// -----


func mouseMove
    xx = glutEventX()
    yy = glutEventY()

    // this will only be true when the left button is down
    if xOrigin >= 0

        // update deltaAngle
        deltaAngle = (xx - xOrigin) * 0.001

        // update camera's direction
        lx = sin(angle + deltaAngle)

```

(continues on next page)

(continued from previous page)

```

        lz = -cos(angle + deltaAngle)
ok

func mouseButton

    button = glutEventButton()
    state = glutEventState()
    xx = glutEventX()
    yy = glutEventY()

    // only start motion if the left button is pressed
    if button = GLUT_LEFT_BUTTON
        // when the button is released
        if state = GLUT_UP
            angle += deltaAngle
            xOrigin = -1
        else
            // state = GLUT_DOWN
            xOrigin = xx
        ok
    ok

// -----
//           MENUS
// -----


func processMenuStatus

    status = glutEventStatus()
    xx = glutEventX()
    yy = glutEventY()

    if status = GLUT_MENU_IN_USE
        menuFlag = 1
    else
        menuFlag = 0
    ok

func processMainMenu

    // nothing to do in here
    // all actions are for submenus

func processFillMenu

    option = glutEventValue()

    switch option

        on C_FILL
            glPolygonMode(GL_FRONT, GL_FILL)
        on C_LINE
            glPolygonMode(GL_FRONT, GL_LINE)

```

(continues on next page)

(continued from previous page)

```

off

func processShrinkMenu

    option = glutEventValue()

    switch option

        on C_SHRINK
            scale = 0.5
        on C_NORMAL
            scale = 1.0
    off

func processColorMenu

    option = glutEventValue()

    switch option
        on C_RED
            red = 1.0
            green = 0.0
            blue = 0.0
        on C_GREEN
            red = 0.0
            green = 1.0
            blue = 0.0
        on C_BLUE
            red = 0.0
            green = 0.0
            blue = 1.0
        on C_ORANGE
            red = 1.0
            green = 0.5
            blue = 0.5
    off

func createPopupMenus

    shrinkMenu = glutCreateMenu(:processShrinkMenu)

    glutAddMenuEntry("Shrink", C_SHRINK)
    glutAddMenuEntry("NORMAL", C_NORMAL)

    fillMenu = glutCreateMenu(:processFillMenu)

    glutAddMenuEntry("Fill", C_FILL)
    glutAddMenuEntry("Line", C_LINE)

    colorMenu = glutCreateMenu(:processColorMenu)
    glutAddMenuEntry("Red", C_RED)
    glutAddMenuEntry("Blue", C_BLUE)
    glutAddMenuEntry("Green", C_GREEN)
    glutAddMenuEntry("Orange", C_ORANGE)

```

(continues on next page)

(continued from previous page)

```

mainMenu = glutCreateMenu(:processMainMenu)

glutAddSubMenu("Polygon Mode", fillMenu)
glutAddSubMenu("Color", colorMenu)
// attach the menu to the right button
glutAttachMenu(GLUT_RIGHT_BUTTON)

// this will allow us to know if the menu is active
glutMenuStatusFunc(:processMenuStatus)

// -----
//          MAIN
// -----


func main

    // init GLUT and create window
    glutInit()
    glutInitDisplayMode(GLUT_DEPTH | GLUT_DOUBLE | GLUT_RGBA)
    glutInitWindowPosition(100, 100)
    glutInitWindowSize(320, 320)
    glutCreateWindow("RingFreeGLUT - Test 10")

    // register callbacks
    glutDisplayFunc(:renderScene)
    glutReshapeFunc(:changeSize)
    glutIdleFunc(:renderScene)

    glutIgnoreKeyRepeat(1)
    glutKeyboardFunc(:processNormalKeys)
    glutSpecialFunc(:pressKey)
    glutSpecialUpFunc(:releaseKey)

    // here are the two new functions
    glutMouseFunc(:mouseButton)
    glutMotionFunc(:mouseMove)

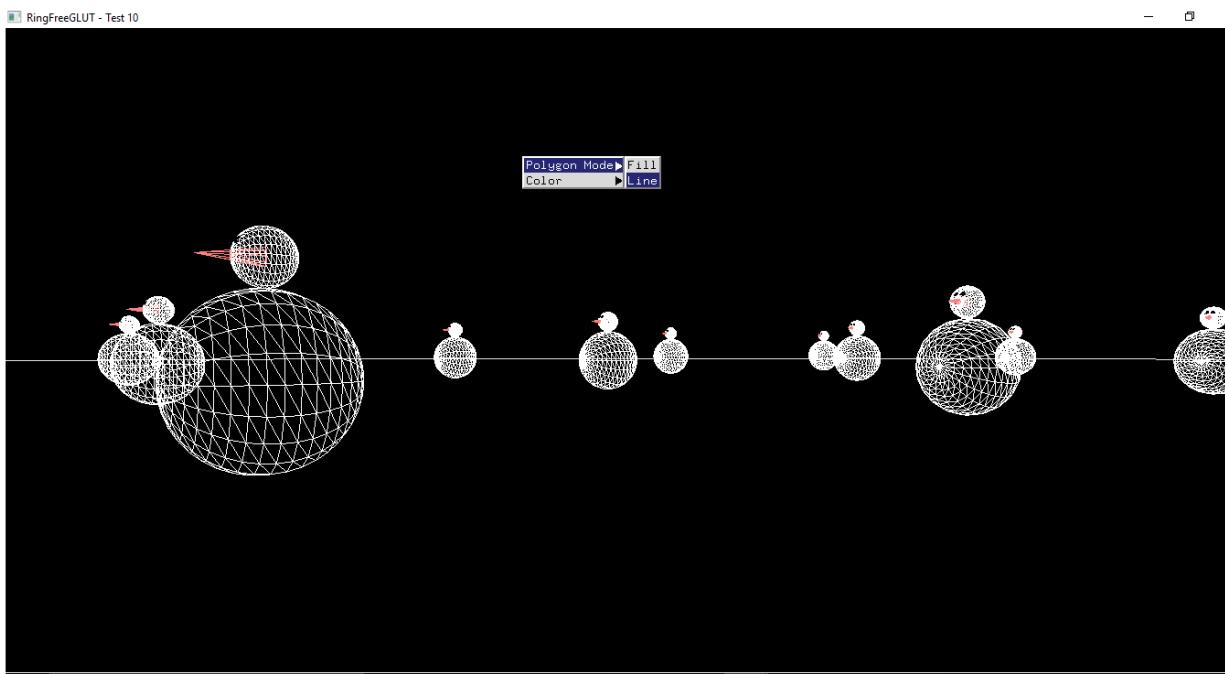
    // OpenGL init
    glEnable(GL_DEPTH_TEST)
    glEnable(GL_CULL_FACE)

    // init Menus
    createPopupMenu()

    // enter GLUT event processing cycle
    glutMainLoop()

```

Screen Shot



58.13 Using Fonts

Example:

```

load "freeglut.ring"
load "opengl21lib.ring"

// angle of rotation for the camera direction
angle = 0.0

// actual vector representing the camera's direction
lx=0.0 lz=-1.0

// XZ position of the camera
x=0.0 z=5.0

// the key states. These variables will be zero
//when no key is being presses
deltaAngle = 0
deltaMove = 0
xOrigin = -1

// Constant definitions for Menus
C_RED = 1
C_GREEN = 2
C_BLUE = 3
C_ORANGE = 4

C_FILL = 5
C_LINE = 6

```

(continues on next page)

(continued from previous page)

```

// Pop up menu identifiers
fillMenu=NULL
fontMenu=NULL
mainMenu=NULL
colorMenu=NULL

// color for the nose
red = 1.0
blue=0.5
green=0.5

// scale of snowman
scale = 1.0

// menu status
menuFlag = 0

// default font
font = GLUT_BITMAP_TIMES_ROMAN_24

C_INT_GLUT_BITMAP_8_BY_13 = 7
C_INT_GLUT_BITMAP_9_BY_15 = 8
C_INT_GLUT_BITMAP_TIMES_ROMAN_10 = 9
C_INT_GLUT_BITMAP_TIMES_ROMAN_24 = 10
C_INT_GLUT_BITMAP_HELVETICA_10 = 11
C_INT_GLUT_BITMAP_HELVETICA_12 = 12
C_INT_GLUT_BITMAP_HELVETICA_18 = 13

func changeSize
    w = glutEventWidth()
    h = glutEventHeight()

    // Prevent a divide by zero, when window is too short
    // (you cant make a window of zero width).
    if h = 0
        h = 1
    ok

    ratio = w * 1.0 / h

    // Use the Projection Matrix
    glMatrixMode(GL_PROJECTION)

    // Reset Matrix
    glLoadIdentity()

    // Set the viewport to be the entire window
    glViewport(0, 0, w, h)

    // Set the correct perspective.
    gluPerspective(45.0, ratio, 0.1, 100.0)

    // Get Back to the Modelview
    glMatrixMode(GL_MODELVIEW)

func drawSnowMan

```

(continues on next page)

(continued from previous page)

```

glScalef(scale, scale, scale)
glColor3f(1.0, 1.0, 1.0)

// Draw Body
    glTranslatef(0.0 ,0.75, 0.0)
    glutSolidSphere(0.75,20,20)

// Draw Head
    glTranslatef(0.0, 1.0, 0.0)
    glutSolidSphere(0.25,20,20)

// Draw Eyes
    glPushMatrix()
    glColor3f(0.0,0.0,0.0)
    glTranslatef(0.05, 0.10, 0.18)
    glutSolidSphere(0.05,10,10)
    glTranslatef(-0.1, 0.0, 0.0)
    glutSolidSphere(0.05,10,10)
    glPopMatrix()

// Draw Nose
    glColor3f(red, green, blue)
    glRotatef(0.0,1.0, 0.0, 0.0)
    glutSolidCone(0.08,0.5,10,2)

    glColor3f(1.0, 1.0, 1.0)

func renderBitmapString x,y,z,font,string
    glRasterPos3f(x, y,z)
    for c in string
        glutBitmapCharacter(font,ascii(c))
    next

func computePos deltaMove

    x += deltaMove * lx * 0.1
    z += deltaMove * lz * 0.1

func renderScene

    if deltaMove
        computePos(deltaMove)
    ok

    // Clear Color and Depth Buffers
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)

    // Reset transformations
    glLoadIdentity()

    // Set the camera
    gluLookAt(      x, 1.0, z,
                    x+lx, 1.0, z+lz,
                    0.0, 1.0, 0.0)

```

(continues on next page)

(continued from previous page)

```

// Draw ground

glColor3f(0.9, 0.9, 0.9)
glBegin(GL_QUADS)
    glVertex3f(-100.0, 0.0, -100.0)
    glVertex3f(-100.0, 0.0, 100.0)
    glVertex3f( 100.0, 0.0, 100.0)
    glVertex3f( 100.0, 0.0, -100.0)
glEnd()

// Draw 36 SnowMen
for i = -3 to 2
    for j = -3 to 2
        glPushMatrix()
        glTranslatef(i*10.0, 0.0, j * 10.0)
        drawSnowMan()
        number = (i+3)*6+(j+3)
        renderBitmapString(0.0, 0.5, 0.0, font, ""+number)
        glPopMatrix()
    next
next

glutSwapBuffers()

// -----
//          KEYBOARD
// -----


func processNormalKeys
    key = glutEventKey()
    xx = glutEventX()
    yy = glutEventY()

    switch key
        on 27
            glutDestroyMenu(mainMenu)
            glutDestroyMenu(fillMenu)
            glutDestroyMenu(colorMenu)
            glutDestroyMenu(fontMenu)
            Shutdown()
        off

func pressKey

    key = glutEventKey()
    xx = glutEventX()
    yy = glutEventY()

    switch key
        on GLUT_KEY_UP
            deltaMove = 0.5
        on GLUT_KEY_DOWN
            deltaMove = -0.5
    off

```

(continues on next page)

(continued from previous page)

```

func releaseKey

    key = glutEventKey()

    switch key
        on GLUT_KEY_UP
            deltaMove = 0
        on GLUT_KEY_DOWN
            deltaMove = 0
    off

// -----
//          MOUSE
// -----


func mouseMove
    xx = glutEventX()
    yy = glutEventY()

    // this will only be true when the left button is down
    if xOrigin >= 0

        // update deltaAngle
        deltaAngle = (xx - xOrigin) * 0.001

        // update camera's direction
        lx = sin(angle + deltaAngle)
        lz = -cos(angle + deltaAngle)
    ok

func mouseButton

    button = glutEventButton()
    state = glutEventState()
    xx = glutEventX()
    yy = glutEventY()

    // only start motion if the left button is pressed
    if button = GLUT_LEFT_BUTTON
        // when the button is released
        if state = GLUT_UP
            angle += deltaAngle
            xOrigin = -1
        else
            // state = GLUT_DOWN
            xOrigin = xx
    ok
ok

// -----
//          MENUS
// -----

```

(continues on next page)

(continued from previous page)

```

func processMenuStatus

    status = glutEventStatus()

    if status = GLUT_MENU_IN_USE
        menuFlag = 1
    else
        menuFlag = 0
    ok

func processMainMenu

    // nothing to do in here
    // all actions are for submenus

func processFillMenu

    option = glutEventValue()

    switch option

        on C_FILL
            glPolygonMode(GL_FRONT, GL_FILL)
        on C_LINE
            glPolygonMode(GL_FRONT, GL_LINE)
    off

func processFontMenu

    option = glutEventValue()

    switch (option) {
        on C_INT GLUT_BITMAP_8_BY_13
            font = GLUT_BITMAP_8_BY_13
        on C_INT GLUT_BITMAP_9_BY_15
            font = GLUT_BITMAP_9_BY_15
        on C_INT GLUT_BITMAP_TIMES_ROMAN_10
            font = GLUT_BITMAP_TIMES_ROMAN_10
        on C_INT GLUT_BITMAP_TIMES_ROMAN_24
            font = GLUT_BITMAP_TIMES_ROMAN_24
        on C_INT GLUT_BITMAP_HELVETICA_10
            font = GLUT_BITMAP_HELVETICA_10
        on C_INT GLUT_BITMAP_HELVETICA_12
            font = GLUT_BITMAP_HELVETICA_12
        on C_INT GLUT_BITMAP_HELVETICA_18
            font = GLUT_BITMAP_HELVETICA_18
    off

func processColorMenu

    option = glutEventValue()

    switch option
        on C_RED

```

(continues on next page)

(continued from previous page)

```

        red = 1.0
        green = 0.0
        blue = 0.0
    on C_GREEN
        red = 0.0
        green = 1.0
        blue = 0.0
    on C_BLUE
        red = 0.0
        green = 0.0
        blue = 1.0
    on C_ORANGE
        red = 1.0
        green = 0.5
        blue = 0.5
off

func createPopupMenu

fontMenu = glutCreateMenu(:processFontMenu)

glutAddMenuEntry("BITMAP_8_BY_13 ",C_INT GLUT_BITMAP_8_BY_13 )
glutAddMenuEntry("BITMAP_9_BY_15",C_INT GLUT_BITMAP_9_BY_15 )
glutAddMenuEntry("BITMAP_TIMES_ROMAN_10 ",C_INT GLUT_BITMAP_TIMES_ROMAN_10 )
glutAddMenuEntry("BITMAP_TIMES_ROMAN_24",C_INT GLUT_BITMAP_TIMES_ROMAN_24 )
glutAddMenuEntry("BITMAP_HELVETICA_10 ",C_INT GLUT_BITMAP_HELVETICA_10 )
glutAddMenuEntry("BITMAP_HELVETICA_12",C_INT GLUT_BITMAP_HELVETICA_12 )
glutAddMenuEntry("BITMAP_HELVETICA_18",C_INT GLUT_BITMAP_HELVETICA_18 )

fillMenu = glutCreateMenu(:processFillMenu)

glutAddMenuEntry("Fill",C_FILL)
glutAddMenuEntry("Line",C_LINE)

colorMenu = glutCreateMenu(:processColorMenu)
glutAddMenuEntry("Red",C_RED);
glutAddMenuEntry("Blue",C_BLUE);
glutAddMenuEntry("Green",C_GREEN);
glutAddMenuEntry("Orange",C_ORANGE);

mainMenu = glutCreateMenu(:processMainMenu)

glutAddSubMenu("Polygon Mode", fillMenu)
glutAddSubMenu("Color", colorMenu)
glutAddSubMenu("Font", fontMenu)
// attach the menu to the right button
glutAttachMenu(GLUT_RIGHT_BUTTON)

// this will allow us to know if the menu is active
glutMenuStatusFunc(:processMenuStatus)

// -----
//          MAIN
// -----

```

(continues on next page)

(continued from previous page)

```

func main

    // init GLUT and create window
    glutInit()
    glutInitDisplayMode(GLUT_DEPTH | GLUT_DOUBLE | GLUT_RGBA)
    glutInitWindowPosition(100, 100)
    glutInitWindowSize(320, 320)
    glutCreateWindow("RingFreeGLUT - Test 11")

    // register callbacks
    glutDisplayFunc(:renderScene)
    glutReshapeFunc(:changeSize)
    glutIdleFunc(:renderScene)

    glutIgnoreKeyRepeat(1)
    glutKeyboardFunc(:processNormalKeys)
    glutSpecialFunc(:pressKey)
    glutSpecialUpFunc(:releaseKey)

    // here are the two new functions
    glutMouseFunc(:mouseButton)
    glutMotionFunc(:mouseMove)

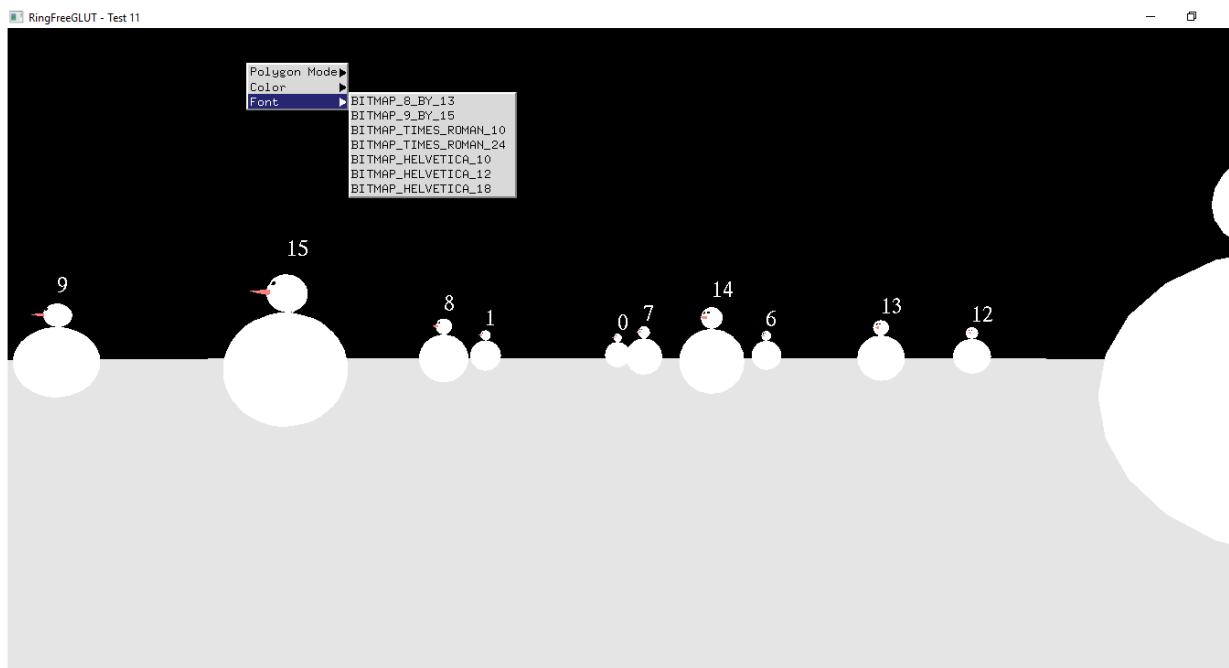
    // OpenGL init
    glEnable(GL_DEPTH_TEST)
    glEnable(GL_CULL_FACE)

    // init Menus
    createPopupMenu()

    // enter GLUT event processing cycle
    glutMainLoop()

```

Screen Shot



58.14 Frames Per Second

Example

```

load "freeglut.ring"
load "opengl21lib.ring"

// angle of rotation for the camera direction
angle = 0.0

// actual vector representing the camera's direction
lx=0.0 lz=-1.0

// XZ position of the camera
x=0.0 z=5.0

// the key states. These variables will be zero
//when no key is being presses
deltaAngle = 0.0
deltaMove = 0
xOrigin = -1

// Constant definitions for Menus
C_RED = 1
C_GREEN = 2
C_BLUE = 3
C_ORANGE = 4

C_FILL = 5
C_LINE = 6

// Pop up menu identifiers
fillMenu=NULL
fontMenu=NULL
mainMenu=NULL
colorMenu=NULL

// color for the nose
red = 1.0
blue=0.5
green=0.5

// scale of snowman
scale = 1.0

// menu status
menuFlag = 0

// default font
font = GLUT_BITMAP_TIMES_ROMAN_24

C_INT_GLUT_BITMAP_8_BY_13 = 7
C_INT_GLUT_BITMAP_9_BY_15 = 8
C_INT_GLUT_BITMAP_TIMES_ROMAN_10 = 9
C_INT_GLUT_BITMAP_TIMES_ROMAN_24 = 10
C_INT_GLUT_BITMAP_HELVETICA_10 = 11
C_INT_GLUT_BITMAP_HELVETICA_12 = 12

```

(continues on next page)

(continued from previous page)

```

C_INT_GLUT_BITMAP_HELVETICA_18 = 13

// width and height of the window
h = 0
w = 0

// variables to compute frames per second
frame=0
time=0
timebase=0
s = ""

func changeSize
    w = glutEventWidth()
    h = glutEventHeight()

    // Prevent a divide by zero, when window is too short
    // (you cant make a window of zero width).
    if h = 0
        h = 1
    ok

    ratio = w * 1.0 / h

    // Use the Projection Matrix
    glMatrixMode(GL_PROJECTION)

    // Reset Matrix
    glLoadIdentity()

    // Set the viewport to be the entire window
    glViewport(0, 0, w, h)

    // Set the correct perspective.
    gluPerspective(45.0, ratio, 0.1, 100.0)

    // Get Back to the Modelview
    glMatrixMode(GL_MODELVIEW)

func drawSnowMan

    glScalef(scale, scale, scale)
    glColor3f(1.0, 1.0, 1.0)

    // Draw Body
    glTranslatef(0.0 ,0.75, 0.0)
    glutSolidSphere(0.75,20,20)

    // Draw Head
    glTranslatef(0.0, 1.0, 0.0)
    glutSolidSphere(0.25,20,20)

    // Draw Eyes
    glPushMatrix()
    glColor3f(0.0,0.0,0.0)
    glTranslatef(0.05, 0.10, 0.18)
    glutSolidSphere(0.05,10,10)

```

(continues on next page)

(continued from previous page)

```

glTranslatef(-0.1, 0.0, 0.0)
glutSolidSphere(0.05,10,10)
glPopMatrix()

// Draw Nose
    glColor3f(red, green, blue)
    glRotatef(0.0,1.0, 0.0, 0.0)
    glutSolidCone(0.08,0.5,10,2)

    glColor3f(1.0, 1.0, 1.0)

func renderBitmapString x,y,z,font,string
    glRasterPos3f(x, y,z)
    for c in string
        glutBitmapCharacter(font,ascii(c))
    next

func renderStrokeFontString x,y,z,font,string
    glPushMatrix()
    glTranslatef(x, y,z)
    glScalef(0.002, 0.002, 0.002)
    for c in string
        glutStrokeCharacter(font, Ascii(c));
    next
    glPopMatrix()

func restorePerspectiveProjection

    glMatrixMode(GL_PROJECTION)
    // restore previous projection matrix
    glPopMatrix()

    // get back to modelview mode
    glMatrixMode(GL_MODELVIEW)

func setOrthographicProjection

    // switch to projection mode
    glMatrixMode(GL_PROJECTION)

    // save previous matrix which contains the
    //settings for the perspective projection
    glPushMatrix()

    // reset matrix
    glLoadIdentity()

    // set a 2D orthographic projection
    gluOrtho2D(0, w, h, 0)

    // switch back to modelview mode
    glMatrixMode(GL_MODELVIEW)

```

(continues on next page)

(continued from previous page)

```

func computePos deltaMove

    x += deltaMove * lx * 0.1
    z += deltaMove * lz * 0.1


func renderScene

    if deltaMove
        computePos(deltaMove)
    ok

    // Clear Color and Depth Buffers
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)

    // Reset transformations
    glLoadIdentity()

    // Set the camera
    gluLookAt(      x, 1.0, z,
                    x+lx, 1.0, z+lz,
                    0.0, 1.0, 0.0)

    // Draw ground

    glColor3f(0.9, 0.9, 0.9)
    glBegin(GL_QUADS)
        glVertex3f(-100.0, 0.0, -100.0)
        glVertex3f(-100.0, 0.0, 100.0)
        glVertex3f( 100.0, 0.0, 100.0)
        glVertex3f( 100.0, 0.0, -100.0)
    glEnd()

    // Draw 9 SnowMen
    for i = -3 to -1
        for j = -3 to -1
            glPushMatrix()
            glTranslatef(i*10.0, 0.0, j * 10.0)
            drawSnowMan()
            number = (i+3)*3+(j+3)
            renderBitmapString(0.0, 0.5, 0.0, font , ""+number)
            glPopMatrix()
        next
    next

    // Code to compute frames per second
    frame++

    time=glutGet(GLUT_ELAPSED_TIME)
    if time - timebase > 1000
        s = "RingFreeGLUT - FPS: " + (frame*1000.0/(time-timebase))
        timebase = time
        frame = 0
    ok

    // Code to display a string (fps) with bitmap fonts
    setOrthographicProjection()

```

(continues on next page)

(continued from previous page)

```

glPushMatrix()
glLoadIdentity()
renderBitmapString(5, 30, 0, GLUT_BITMAP_HELVETICA_18, s)
glPopMatrix()

restorePerspectiveProjection()

glutSwapBuffers()

// -----
//           KEYBOARD
// -----

func processNormalKeys
    key = glutEventKey()
    xx = glutEventX()
    yy = glutEventY()

    switch key
        on 27
            glutDestroyMenu(mainMenu)
            glutDestroyMenu(fillMenu)
            glutDestroyMenu(colorMenu)
            glutDestroyMenu(fontMenu)
            Shutdown()
        off

func pressKey

    key = glutEventKey()
    xx = glutEventX()
    yy = glutEventY()

    switch key
        on GLUT_KEY_UP
            deltaMove = 0.5
        on GLUT_KEY_DOWN
            deltaMove = -0.5
    off

func releaseKey

    key = glutEventKey()

    switch key
        on GLUT_KEY_UP
            deltaMove = 0
        on GLUT_KEY_DOWN
            deltaMove = 0
    off

// -----

```

(continues on next page)

(continued from previous page)

```

//           MOUSE
// -----
func mouseMove
    xx = glutEventX()
    yy = glutEventY()

    // this will only be true when the left button is down
    if xOrigin >= 0

        // update deltaAngle
        deltaAngle = (xx - xOrigin) * 0.001

        // update camera's direction
        lx = sin(angle + deltaAngle)
        lz = -cos(angle + deltaAngle)
    ok

func mouseButton

    button = glutEventButton()
    state = glutEventState()
    xx = glutEventX()
    yy = glutEventY()

    // only start motion if the left button is pressed
    if button = GLUT_LEFT_BUTTON
        // when the button is released
        if state = GLUT_UP
            angle += deltaAngle
            xOrigin = -1
        else
            // state = GLUT_DOWN
            xOrigin = xx
        ok
    ok

// -----
//           MENUS
// -----
func processMenuStatus

    status = glutEventStatus()

    if status = GLUT_MENU_IN_USE
        menuFlag = 1
    else
        menuFlag = 0
    ok

func processMainMenu

    // nothing to do in here

```

(continues on next page)

(continued from previous page)

```

// all actions are for submenus

func processFillMenu

    option = glutEventValue()

    switch option

        on C_FILL
            glPolygonMode(GL_FRONT, GL_FILL)
        on C_LINE
            glPolygonMode(GL_FRONT, GL_LINE)
    off

func processFontMenu

    option = glutEventValue()

    switch (option) {
        on C_INT GLUT_BITMAP_8_BY_13
            font = GLUT_BITMAP_8_BY_13
        on C_INT GLUT_BITMAP_9_BY_15
            font = GLUT_BITMAP_9_BY_15
        on C_INT GLUT_BITMAP_TIMES_ROMAN_10
            font = GLUT_BITMAP_TIMES_ROMAN_10
        on C_INT GLUT_BITMAP_TIMES_ROMAN_24
            font = GLUT_BITMAP_TIMES_ROMAN_24
        on C_INT GLUT_BITMAP_HELVETICA_10
            font = GLUT_BITMAP_HELVETICA_10
        on C_INT GLUT_BITMAP_HELVETICA_12
            font = GLUT_BITMAP_HELVETICA_12
        on C_INT GLUT_BITMAP_HELVETICA_18
            font = GLUT_BITMAP_HELVETICA_18
    off

func processColorMenu

    option = glutEventValue()

    switch option
        on C_RED
            red = 1.0
            green = 0.0
            blue = 0.0
        on C_GREEN
            red = 0.0
            green = 1.0
            blue = 0.0
        on C_BLUE
            red = 0.0
            green = 0.0
            blue = 1.0
        on C_ORANGE
            red = 1.0
            green = 0.5

```

(continues on next page)

(continued from previous page)

```

        blue = 0.5
off

func createPopupMenus

    fontMenu = glutCreateMenu(:processFontMenu)

    glutAddMenuEntry("BITMAP_8_BY_13 ", C_INT GLUT_BITMAP_8_BY_13 )
    glutAddMenuEntry("BITMAP_9_BY_15", C_INT GLUT_BITMAP_9_BY_15 )
    glutAddMenuEntry("BITMAP_TIMES_ROMAN_10 ", C_INT GLUT_BITMAP_TIMES_ROMAN_10 )
    glutAddMenuEntry("BITMAP_TIMES_ROMAN_24", C_INT GLUT_BITMAP_TIMES_ROMAN_24 )
    glutAddMenuEntry("BITMAP_HELVETICA_10 ", C_INT GLUT_BITMAP_HELVETICA_10 )
    glutAddMenuEntry("BITMAP_HELVETICA_12", C_INT GLUT_BITMAP_HELVETICA_12 )
    glutAddMenuEntry("BITMAP_HELVETICA_18", C_INT GLUT_BITMAP_HELVETICA_18 )

    fillMenu = glutCreateMenu(:processFillMenu)

    glutAddMenuEntry("Fill", C_FILL)
    glutAddMenuEntry("Line", C_LINE)

    colorMenu = glutCreateMenu(:processColorMenu)
    glutAddMenuEntry("Red", C_RED);
    glutAddMenuEntry("Blue", C_BLUE);
    glutAddMenuEntry("Green", C_GREEN);
    glutAddMenuEntry("Orange", C_ORANGE);

    mainMenu = glutCreateMenu(:processMainMenu)

    glutAddSubMenu("Polygon Mode", fillMenu)
    glutAddSubMenu("Color", colorMenu)
    glutAddSubMenu("Font", fontMenu)
    // attach the menu to the right button
    glutAttachMenu(GLUT_RIGHT_BUTTON)

    // this will allow us to know if the menu is active
    glutMenuStatusFunc(:processMenuStatus)

// -----
//          MAIN
// -----


func main

    // init GLUT and create window
    glutInit()
    glutInitDisplayMode(GLUT_DEPTH | GLUT_DOUBLE | GLUT_RGBA)
    glutInitWindowPosition(100, 100)
    glutInitWindowSize(320, 320)
    glutCreateWindow("RingFreeGLUT - Test - 9 SnowMan")

    // register callbacks
    glutDisplayFunc(:renderScene)
    glutReshapeFunc(:changeSize)
    glutIdleFunc(:renderScene)

```

(continues on next page)

(continued from previous page)

```

glutIgnoreKeyRepeat(1)
glutKeyboardFunc(:processNormalKeys)
glutSpecialFunc(:pressKey)
glutSpecialUpFunc(:releaseKey)

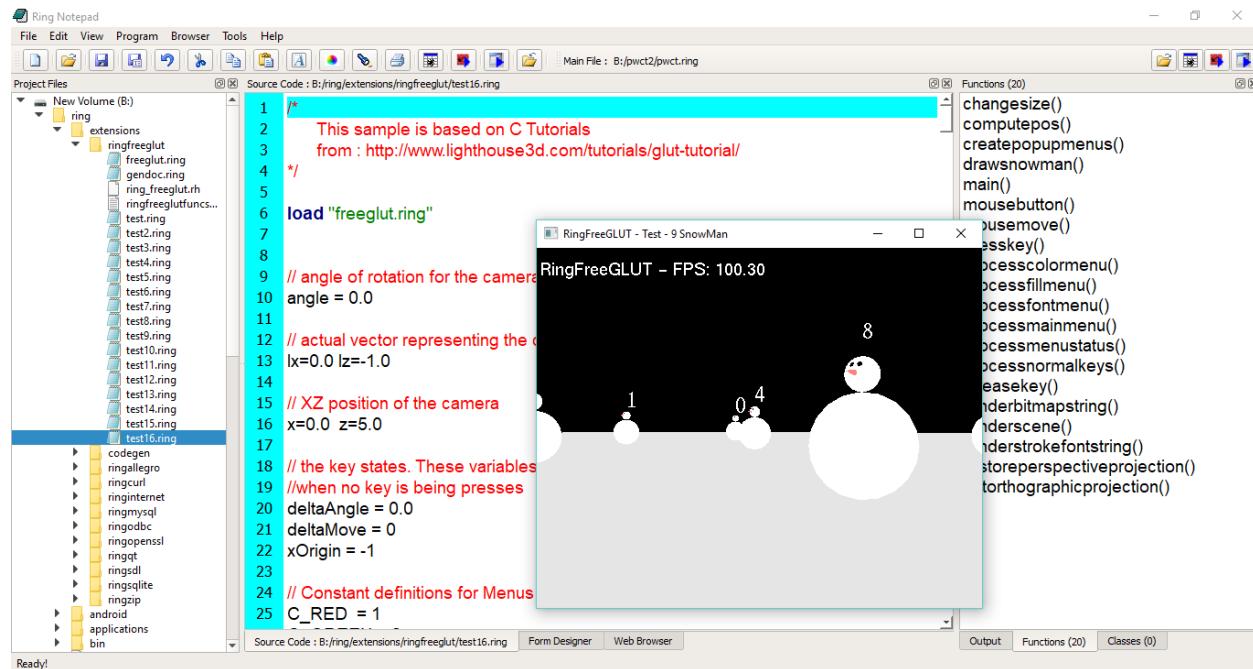
// here are the two new functions
glutMouseFunc(:mouseButton)
glutMotionFunc(:mouseMove)

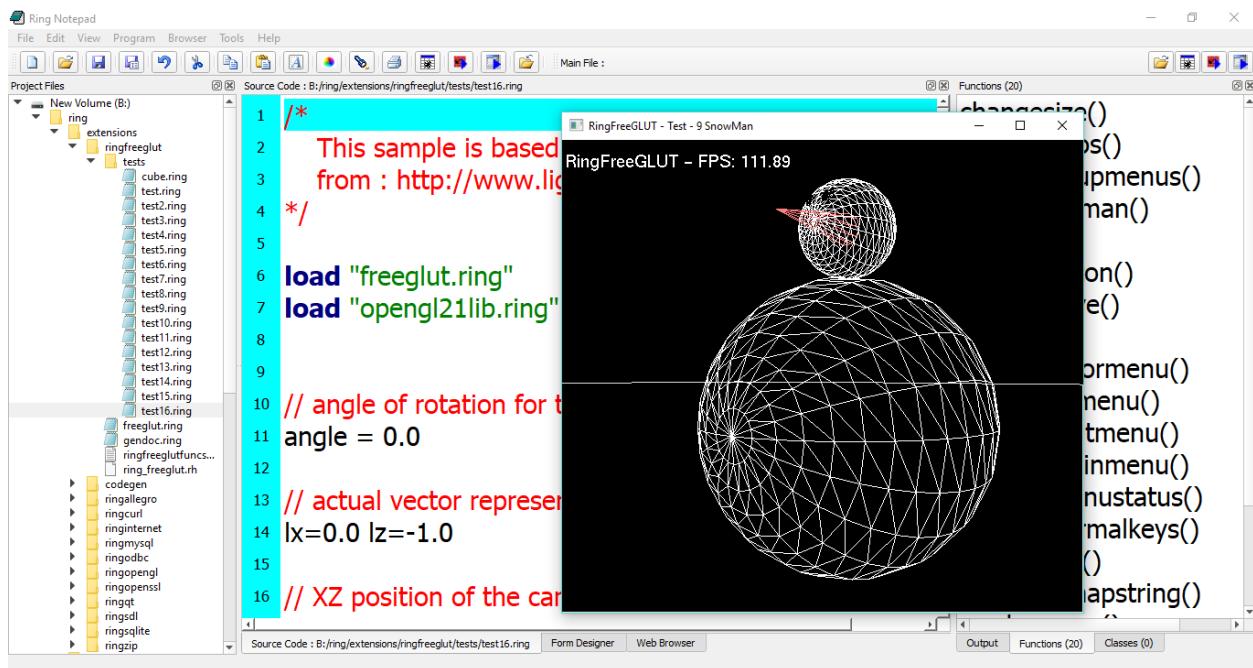
// OpenGL init
glEnable(GL_DEPTH_TEST)
glEnable(GL_CULL_FACE)

// init Menus
createPopupMenu()

// enter GLUT event processing cycle
glutMainLoop()

```

Screen Shots:**The First screen shot****The Second screen shot**



58.15 Make a Cube using RingOpenGL and RingFreeGLUT

Example:

```

load "freeglut.ring"
load "opengl21lib.ring"

// -----
// Global Variables
// -----
rotate_y=0
rotate_x=0

// -----
// display() Callback function
// -----
func display

    // Clear screen and Z-buffer
    glClear(GL_COLOR_BUFFER_BIT|GL_DEPTH_BUFFER_BIT)

    // Reset transformations
    glLoadIdentity()

    // Rotate when user changes rotate_x and rotate_y
    glRotatef( rotate_x, 1.0, 0.0, 0.0 )
    glRotatef( rotate_y, 0.0, 1.0, 0.0 )

    //Multi-colored side - FRONT
    glBegin(GL_POLYGON)

        glColor3f( 1.0, 0.0, 0.0 )      glVertex3f( 0.5, -0.5, -0.5 )      # P1 is red
        ...
        ...
        ...
    glEnd()
  
```

(continues on next page)

(continued from previous page)

```

glColor3f( 0.0, 1.0, 0.0 )      glVertex3f( 0.5, 0.5, -0.5 )      # P2 is green
glColor3f( 0.0, 0.0, 1.0 )      glVertex3f( -0.5, 0.5, -0.5 )     # P3 is blue
glColor3f( 1.0, 0.0, 1.0 )      glVertex3f( -0.5, -0.5, -0.5 )    # P4 is purple

glEnd()

// White side - BACK
glBegin(GL_POLYGON)
glColor3f( 1.0, 1.0, 1.0 )
glVertex3f( 0.5, -0.5, 0.5 )
glVertex3f( 0.5, 0.5, 0.5 )
glVertex3f( -0.5, 0.5, 0.5 )
glVertex3f( -0.5, -0.5, 0.5 )
glEnd()

// Purple side - RIGHT
glBegin(GL_POLYGON)
glColor3f( 1.0, 0.0, 1.0 )
glVertex3f( 0.5, -0.5, -0.5 )
glVertex3f( 0.5, 0.5, -0.5 )
glVertex3f( 0.5, 0.5, 0.5 )
glVertex3f( 0.5, -0.5, 0.5 )
glEnd()

// Green side - LEFT
glBegin(GL_POLYGON)
glColor3f( 0.0, 1.0, 0.0 )
glVertex3f( -0.5, -0.5, 0.5 )
glVertex3f( -0.5, 0.5, 0.5 )
glVertex3f( -0.5, 0.5, -0.5 )
glVertex3f( -0.5, -0.5, -0.5 )
glEnd()

// Blue side - TOP
glBegin(GL_POLYGON)
glColor3f( 0.0, 0.0, 1.0 )
glVertex3f( 0.5, 0.5, 0.5 )
glVertex3f( 0.5, 0.5, -0.5 )
glVertex3f( -0.5, 0.5, -0.5 )
glVertex3f( -0.5, 0.5, 0.5 )
glEnd()

// Red side - BOTTOM
glBegin(GL_POLYGON)
glColor3f( 1.0, 0.0, 0.0 )
glVertex3f( 0.5, -0.5, -0.5 )
glVertex3f( 0.5, -0.5, 0.5 )
glVertex3f( -0.5, -0.5, 0.5 )
glVertex3f( -0.5, -0.5, -0.5 )
glEnd()

glFlush()
glutSwapBuffers()

// -----
// specialKeys() Callback Function

```

(continues on next page)

(continued from previous page)

```

// -----
func specialKeys

    key = glutEventKey()

    // Right arrow - increase rotation by 5 degree
    switch Key

        on GLUT_KEY_RIGHT
            rotate_y += 5

        // Left arrow - decrease rotation by 5 degree
        on GLUT_KEY_LEFT
            rotate_y -= 5

        on GLUT_KEY_UP
            rotate_x += 5

        on GLUT_KEY_DOWN
            rotate_x -= 5

    off

    // Request display update
    glutPostRedisplay()

// -----
// main() function
// -----
func main

    // Initialize GLUT and process user parameters
    glutInit()

    // Request double buffered true color window with Z-buffer
    glutInitDisplayMode(GLUT_DOUBLE | GLUT_RGB | GLUT_DEPTH)

    // Create window
    glutCreateWindow("Awesome Cube")

    // Enable Z-buffer depth test
    glEnable(GL_DEPTH_TEST)

    // Callback functions
    glutDisplayFunc(:display)
    glutSpecialFunc(:specialKeys)

    // Pass control to GLUT for events
    glutMainLoop()

    // Return to OS

```

Screen Shot:

The screenshot shows a Ring Notepad interface with the following details:

- Project Files:** A tree view showing various Ring files and extensions like ringallegro, ringcurl, ringfreelut, ringmysql, ringodbc, ringopenssl, ringqt, ringsqlite, ringzip, graphics, and include.
- Source Code:** The main file is `cube.ring`. The code is as follows:

```

22 glClear(GL_COLOR_BUFFER_BIT|GL_DEPTH_BUFFER_BIT)
23
24 // Reset transformations
25 glLoadIdentity()
26
27 // Rotate when user changes rotate_x and rotate_y
28 glRotatef(rotate_x, 1.0, 0.0, 0.0)
29 glRotatef(rotate_y, 0.0, 1.0, 0.0)
30
31 //Multi-colored side - FRONT
32 glBegin(GL_POLYGON)
33
34 glColor3f( 1.0, 0.0, 0.0 )    glVertex3f( 0.5, -0.5, -0.5 )    # P1 is red
35 glColor3f( 0.0, 1.0, 0.0 )    glVertex3f( 0.5, 0.5, -0.5 )    # P2 is green
36 glColor3f( 0.0, 0.0, 1.0 )    glVertex3f( -0.5, 0.5, -0.5 )   # P3 is blue
37 glColor3f( 1.0, 0.0, 1.0 )    glVertex3f( -0.5, -0.5, -0.5 )  # P4 is purple
38

```

- Preview Window:** A window titled "Awesome Cube" displays a 3D cube with faces colored red, green, blue, and purple.
- Status Bar:** Shows "Line : 31 Column : 28 Total Lines : 145".

USING RINGOPENGL AND RINGALLEGRO FOR 3D GRAPHICS

In this chapter we will learn about using RingOpenGL and RingAllegro

59.1 3D Cube and Texture

Source Code:

```
# Load Libraries
    load "gamelib.ring"           # RingAllegro Library
    load "opengl21lib.ring"        # RingOpenGL Library

#=====
# To Support MacOS X
    al_run_main()
    func al_game_start            # Called by al_run_main()
        main()                   # Now we call our main function
#=====

func main

    new GraphicsApp {
        start()
    }

class GraphicsApp from GraphicsAppBase

    TITLE = "Ring Cube"

    bitmap texture

    xrot = 0.0
    yrot = 0.0
    zrot = 0.0

    func loadresources

        bitmap = al_load_bitmap("ring.bmp")
        texture = al_get_opengl_texture(bitmap)

    func destroyResources

        al_destroy_bitmap(bitmap)
```

(continues on next page)

(continued from previous page)

```

func drawScene

    w = 800 h = 600
    ratio = w / h

    glViewport(0, 0, w, h)
    glMatrixMode(GL_PROJECTION)
    glLoadIdentity()

    gluPerspective(45, ratio, 1, 100)
    glMatrixMode(GL_MODELVIEW)
    glLoadIdentity()

    glEnable(GL_TEXTURE_2D)
    glShadeModel(GL_SMOOTH)
    glClearColor(0.0, 0.0, 0.0, 0.5)
    glClearDepth(1.0)
    glEnable(GL_DEPTH_TEST)
    glEnable(GL_CULL_FACE)
    glDepthFunc(GL_LEQUAL)
    glHint(GL_PERSPECTIVE_CORRECTION_HINT, GL_NICEST)

    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)
    glLoadIdentity()
    glTranslatef(0.0, 0.0, -5.0)

    glRotatef(xrot, 1.0, 0.0, 0.0)
    glRotatef(yrot, 0.0, 1.0, 0.0)
    glRotatef(zrot, 0.0, 0.0, 1.0)

    glBindTexture(GL_TEXTURE_2D, texture)

    glBegin(GL_QUADS)
        // Front Face
        glTexCoord2f(0.0, 0.0) glVertex3f(-1.0, -1.0, 1.0)
        glTexCoord2f(1.0, 0.0) glVertex3f( 1.0, -1.0, 1.0)
        glTexCoord2f(1.0, 1.0) glVertex3f( 1.0, 1.0, 1.0)
        glTexCoord2f(0.0, 1.0) glVertex3f(-1.0, 1.0, 1.0)
        // Back Face
        glTexCoord2f(1.0, 0.0) glVertex3f(-1.0, -1.0, -1.0)
        glTexCoord2f(1.0, 1.0) glVertex3f(-1.0, 1.0, -1.0)
        glTexCoord2f(0.0, 1.0) glVertex3f( 1.0, 1.0, -1.0)
        glTexCoord2f(0.0, 0.0) glVertex3f( 1.0, -1.0, -1.0)
        // Top Face
        glTexCoord2f(0.0, 1.0) glVertex3f(-1.0, 1.0, -1.0)
        glTexCoord2f(0.0, 0.0) glVertex3f(-1.0, 1.0, 1.0)
        glTexCoord2f(1.0, 0.0) glVertex3f( 1.0, 1.0, 1.0)
        glTexCoord2f(1.0, 1.0) glVertex3f( 1.0, 1.0, -1.0)
        // Bottom Face
        glTexCoord2f(1.0, 1.0) glVertex3f(-1.0, -1.0, -1.0)
        glTexCoord2f(0.0, 1.0) glVertex3f( 1.0, -1.0, -1.0)
        glTexCoord2f(0.0, 0.0) glVertex3f( 1.0, -1.0, 1.0)
        glTexCoord2f(1.0, 0.0) glVertex3f(-1.0, -1.0, 1.0)
        // Right face
        glTexCoord2f(1.0, 0.0) glVertex3f( 1.0, -1.0, -1.0)
        glTexCoord2f(1.0, 1.0) glVertex3f( 1.0, 1.0, -1.0)

```

(continues on next page)

(continued from previous page)

```

glTexCoord2f(0.0, 1.0) glVertex3f( 1.0, 1.0, 1.0)
glTexCoord2f(0.0, 0.0) glVertex3f( 1.0, -1.0, 1.0)
// Left Face
glTexCoord2f(0.0, 0.0) glVertex3f(-1.0, -1.0, -1.0)
glTexCoord2f(1.0, 0.0) glVertex3f(-1.0, -1.0, 1.0)
glTexCoord2f(1.0, 1.0) glVertex3f(-1.0, 1.0, 1.0)
glTexCoord2f(0.0, 1.0) glVertex3f(-1.0, 1.0, -1.0)
glEnd()

xrot += 0.3
yrot += 0.2
zrot += 0.4

class GraphicsAppBase

    display event_queue ev timeout
    timer redraw = true

    FPS = 60

    SCREEN_W = 800
    SCREEN_H = 600

    KEY_UP = 1
    KEY_DOWN = 2
    KEY_LEFT = 3
    KEY_RIGHT = 4

    Key = [false, false, false, false]

    TITLE = "Graphics Application"

    func start

        SetUp()
        loadResources()
        eventsLoop()
        destroy()

    func setup

        al_init()
        al_init_image_addon()
        al_set_new_display_flags(ALLEGRO_OPENGL)
        display = al_create_display(SCREEN_W, SCREEN_H)
        al_set_Window_title(display, TITLE)
        al_clear_to_color(al_map_rgb(0, 0, 0))
        event_queue = al_create_event_queue()
        al_register_event_source(event_queue,
            al_get_display_event_source(display))
        ev = al_new_allegro_event()
        timeout = al_new_allegro_timeout()
        al_init_timeout(timeout, 0.06)
        timer = al_create_timer(1.0 / FPS)
        al_register_event_source(event_queue,
            al_get_timer_event_source(timer))

```

(continues on next page)

(continued from previous page)

```

al_start_timer(timer)
al_install_mouse()
al_register_event_source(event_queue,
    al_get_mouse_event_source())
al_install_keyboard()
al_register_event_source(event_queue,
    al_get_keyboard_event_source())

func eventsLoop

    while true
        al_init_timeout(timeout, 0.06)
        al_wait_for_event_until(event_queue, ev, timeout)
        switch al_get_allegro_event_type(ev)
        on ALLEGRO_EVENT_DISPLAY_CLOSE
            exit
        on ALLEGRO_EVENT_TIMER
            redraw = true
        on ALLEGRO_EVENT_MOUSE_AXES
            mouse_x = al_get_allegro_event_mouse_x(ev)
            mouse_y = al_get_allegro_event_mouse_y(ev)
        on ALLEGRO_EVENT_MOUSE_ENTER_DISPLAY
            mouse_x = al_get_allegro_event_mouse_x(ev)
            mouse_y = al_get_allegro_event_mouse_y(ev)
        on ALLEGRO_EVENT_MOUSE_BUTTON_UP
            exit
        on ALLEGRO_EVENT_KEY_DOWN
            switch al_get_allegro_event_keyboard_keycode(ev)
            on ALLEGRO_KEY_UP
                key[KEY_UP] = true
            on ALLEGRO_KEY_DOWN
                key[KEY_DOWN] = true
            on ALLEGRO_KEY_LEFT
                key[KEY_LEFT] = true
            on ALLEGRO_KEY_RIGHT
                key[KEY_RIGHT] = true
            off
        on ALLEGRO_EVENT_KEY_UP
            switch al_get_allegro_event_keyboard_keycode(ev)
            on ALLEGRO_KEY_UP
                key[KEY_UP] = false
            on ALLEGRO_KEY_DOWN
                key[KEY_DOWN] = false
            on ALLEGRO_KEY_LEFT
                key[KEY_LEFT] = false
            on ALLEGRO_KEY_RIGHT
                key[KEY_RIGHT] = false
            on ALLEGRO_KEY_ESCAPE
                exit
            off
        off
        if redraw and al_is_event_queue_empty(event_queue)
            redraw = false
            drawScene()
            al_flip_display()
        ok
        callgc()

```

(continues on next page)

(continued from previous page)

```

end

func destroy

    destroyResources()
    al_destroy_timer(timer)
    al_destroy_allegro_event(ev)
    al_destroy_allegro_timeout(timeout)
    al_destroy_event_queue(event_queue)
    al_destroy_display(display)
    al_exit()

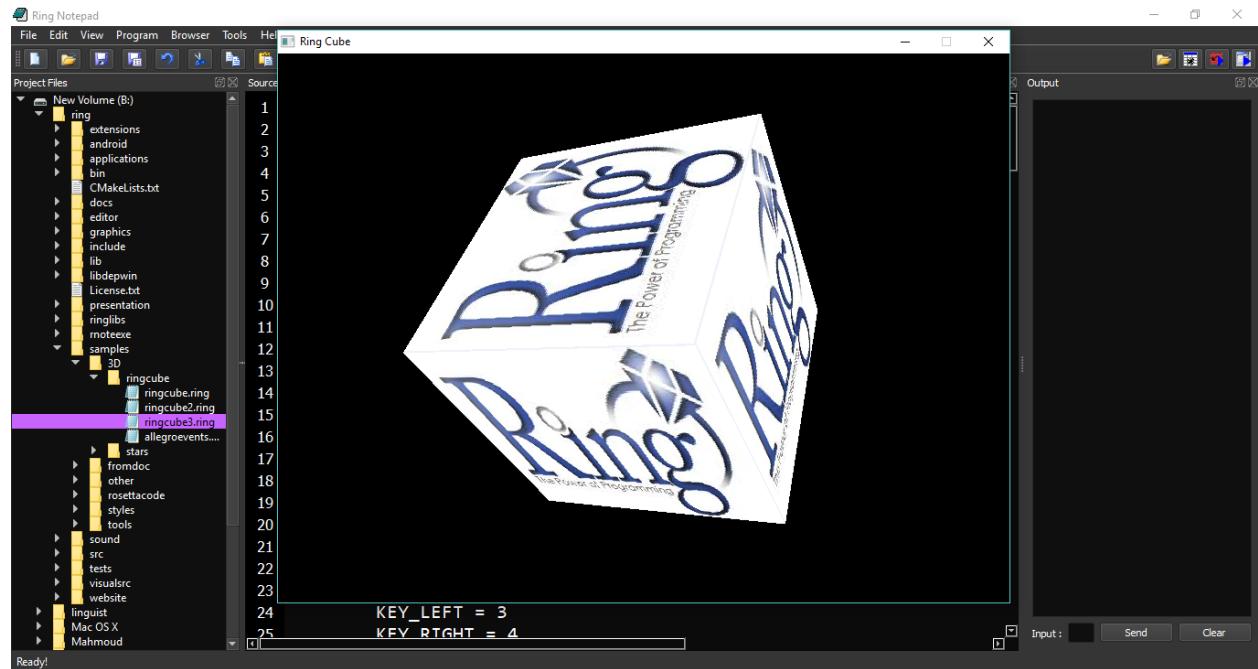
func loadresources

func drawScene

func destroyResources

```

Screen Shot:



59.2 Many Cubes

Source Code:

```

# Load Libraries
load "gamelib.ring"           # RingAllegro Library
load "opengl21lib.ring"        # RingOpenGL Library

#=====
# To Support MacOS X
al_run_main()

```

(continues on next page)

(continued from previous page)

```

func al_game_start      # Called by al_run_main()
    main()               # Now we call our main function
#=====

func main

    new GraphicsApp {
        start()
    }

class GraphicsApp from GraphicsAppBase

    TITLE = "Many Cubes"

    bitmap bitmap2 bitmap3
    texture texture2 texture3

    fps = 120
    xrot = 0.0
    yrot = 0.0
    zrot = 0.0

    nPerspective = 100

    func loadresources

        bitmap = al_load_bitmap("skyl1.jpg")
        texture = al_get_opengl_texture(bitmap)

        bitmap2 = al_load_bitmap("sky2.jpg")
        texture2 = al_get_opengl_texture(bitmap2)

        bitmap3 = al_load_bitmap("sky3.jpg")
        texture3 = al_get_opengl_texture(bitmap3)

    func destroyResources

        al_destroy_bitmap(bitmap)
        al_destroy_bitmap(bitmap2)
        al_destroy_bitmap(bitmap3)

    func drawScene

        prepare()
        cubes()
        rotate()

    func Prepare
        w = 800 h = 600
        ratio = w / h
        glViewport(0, 0, w, h)
        glMatrixMode(GL_PROJECTION)
        glLoadIdentity()
        gluPerspective(-nPerspective, ratio, 1, nPerspective)
        glMatrixMode(GL_MODELVIEW)

```

(continues on next page)

(continued from previous page)

```

glLoadIdentity()
glEnable(GL_TEXTURE_2D)
glShadeModel(GL_SMOOTH)
glClearColor(0.0, 0.0, 0.0, 0.5)
glClearDepth(1.0)
glEnable(GL_DEPTH_TEST)
glEnable(GL_CULL_FACE)
glDepthFunc(GL_LESS)
glHint(GL_PERSPECTIVE_CORRECTION_HINT, GL_NICEST)
glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)

func Cubes
    cube(5,-3.4,-5,:sky1)
    cube(0,-3,-5,:sky1)
    cube(-5,-3,-5,:sky1)
    cube(5,0.5,-5,:sky2)
    cube(0,0.5,-5,:sky2)
    cube(-5,0.5,-5,:sky2)
    cube(5,4,-5,:sky3)
    cube(0,4,-5,:sky3)
    cube(-5,4,-5,:sky3)

func Rotate
    xrot += 0.3 * 5
    yrot += 0.2 * 5
    zrot += 0.4 * 5
    nPerspective += 0.5

func cube(x,y,z,nTexture)
    glLoadIdentity()
    glTranslatef(x,y,z)
    glRotatef(xrot,1.0,0.0,0.0)
    glRotatef(yrot,0.0,1.0,0.0)
    glRotatef(zrot,0.0,0.0,1.0)
    drawcube(nTexture)

func drawcube(cTexture)

    switch cTexture
        on :sky1
            glBindTexture(GL_TEXTURE_2D, texture)
        on :sky2
            glBindTexture(GL_TEXTURE_2D, texture2)
        on :sky3
            glBindTexture(GL_TEXTURE_2D, texture3)
    off

    glBegin(GL_QUADS)
        // Front Face
        glTexCoord2f(0.0, 0.0) glVertex3f(-1.0, -1.0, 1.0)
        glTexCoord2f(1.0, 0.0) glVertex3f( 1.0, -1.0, 1.0)
        glTexCoord2f(1.0, 1.0) glVertex3f( 1.0, 1.0, 1.0)
        glTexCoord2f(0.0, 1.0) glVertex3f(-1.0, 1.0, 1.0)
        // Back Face
        glTexCoord2f(1.0, 0.0) glVertex3f(-1.0, -1.0, -1.0)

```

(continues on next page)

(continued from previous page)

```

glTexCoord2f(1.0, 1.0) glVertex3f(-1.0, 1.0, -1.0)
glTexCoord2f(0.0, 1.0) glVertex3f( 1.0, 1.0, -1.0)
glTexCoord2f(0.0, 0.0) glVertex3f( 1.0, -1.0, -1.0)
// Top Face
glTexCoord2f(0.0, 1.0) glVertex3f(-1.0, 1.0, -1.0)
glTexCoord2f(0.0, 0.0) glVertex3f(-1.0, 1.0, 1.0)
glTexCoord2f(1.0, 0.0) glVertex3f( 1.0, 1.0, 1.0)
glTexCoord2f(1.0, 1.0) glVertex3f( 1.0, 1.0, -1.0)
// Bottom Face
glTexCoord2f(1.0, 1.0) glVertex3f(-1.0, -1.0, -1.0)
glTexCoord2f(0.0, 1.0) glVertex3f( 1.0, -1.0, -1.0)
glTexCoord2f(0.0, 0.0) glVertex3f( 1.0, -1.0, 1.0)
glTexCoord2f(1.0, 0.0) glVertex3f(-1.0, -1.0, 1.0)

// Right face
glTexCoord2f(1.0, 0.0) glVertex3f( 1.0, -1.0, -1.0)
glTexCoord2f(1.0, 1.0) glVertex3f( 1.0, 1.0, -1.0)
glTexCoord2f(0.0, 1.0) glVertex3f( 1.0, 1.0, 1.0)
glTexCoord2f(0.0, 0.0) glVertex3f( 1.0, -1.0, 1.0)

// Left Face
glTexCoord2f(0.0, 0.0) glVertex3f(-1.0, -1.0, -1.0)
glTexCoord2f(1.0, 0.0) glVertex3f(-1.0, -1.0, 1.0)
glTexCoord2f(1.0, 1.0) glVertex3f(-1.0, 1.0, 1.0)
glTexCoord2f(0.0, 1.0) glVertex3f(-1.0, 1.0, -1.0)
glEnd()

class GraphicsAppBase

    display event_queue ev timeout
    timer redraw = true

    FPS = 60

    SCREEN_W = 800
    SCREEN_H = 600

    KEY_UP = 1
    KEY_DOWN = 2
    KEY_LEFT = 3
    KEY_RIGHT = 4

    Key = [false, false, false, false]

    TITLE = "Graphics Application"

    func start

        SetUp()
        loadResources()
        eventsLoop()
        destroy()

    func setup

        al_init()

```

(continues on next page)

(continued from previous page)

```

al_init_image_addon()
al_set_new_display_flags(ALLEGRO_OPENGL)
display = al_create_display(SCREEN_W, SCREEN_H)
al_set_window_title(display, TITLE)
al_clear_to_color(al_map_rgb(0, 0, 0))
event_queue = al_create_event_queue()
al_register_event_source(event_queue,
    al_get_display_event_source(display))
ev = al_new_allegro_event()
timeout = al_new_allegro_timeout()
al_init_timeout(timeout, 0.06)
timer = al_create_timer(1.0 / FPS)
al_register_event_source(event_queue,
    al_get_timer_event_source(timer))
al_start_timer(timer)
al_install_mouse()
al_register_event_source(event_queue,
    al_get_mouse_event_source())
al_install_keyboard()
al_register_event_source(event_queue,
    al_get_keyboard_event_source())

func eventsLoop

while true
    al_init_timeout(timeout, 0.06)
    al_wait_for_event_until(event_queue, ev, timeout)
    switch al_get_allegro_event_type(ev)
    on ALLEGRO_EVENT_DISPLAY_CLOSE
        exit
    on ALLEGRO_EVENT_TIMER
        redraw = true
    on ALLEGRO_EVENT_MOUSE_AXES
        mouse_x = al_get_allegro_event_mouse_x(ev)
        mouse_y = al_get_allegro_event_mouse_y(ev)
    on ALLEGRO_EVENT_MOUSE_ENTER_DISPLAY
        mouse_x = al_get_allegro_event_mouse_x(ev)
        mouse_y = al_get_allegro_event_mouse_y(ev)
    on ALLEGRO_EVENT_MOUSE_BUTTON_UP
        exit
    on ALLEGRO_EVENT_KEY_DOWN
        switch al_get_allegro_event_keyboard_keycode(ev)
        on ALLEGRO_KEY_UP
            key[KEY_UP] = true
        on ALLEGRO_KEY_DOWN
            key[KEY_DOWN] = true
        on ALLEGRO_KEY_LEFT
            key[KEY_LEFT] = true
        on ALLEGRO_KEY_RIGHT
            key[KEY_RIGHT] = true
        off
    on ALLEGRO_EVENT_KEY_UP
        switch al_get_allegro_event_keyboard_keycode(ev)
        on ALLEGRO_KEY_UP
            key[KEY_UP] = false
        on ALLEGRO_KEY_DOWN
            key[KEY_DOWN] = false

```

(continues on next page)

(continued from previous page)

```

        on ALLEGRO_KEY_LEFT
            key[KEY_LEFT] = false
        on ALLEGRO_KEY_RIGHT
            key[KEY_RIGHT] = false
        on ALLEGRO_KEY_ESCAPE
            exit
        off
    if redraw and al_is_event_queue_empty(event_queue)
        redraw = false
        drawScene()
        al_flip_display()
    ok
    callgc()
end

func destroy

    destroyResources()
    al_destroy_timer(timer)
    al_destroy_allegro_event(ev)
    al_destroy_allegro_timeout(timeout)
    al_destroy_event_queue(event_queue)
    al_destroy_display(display)
    al_exit()

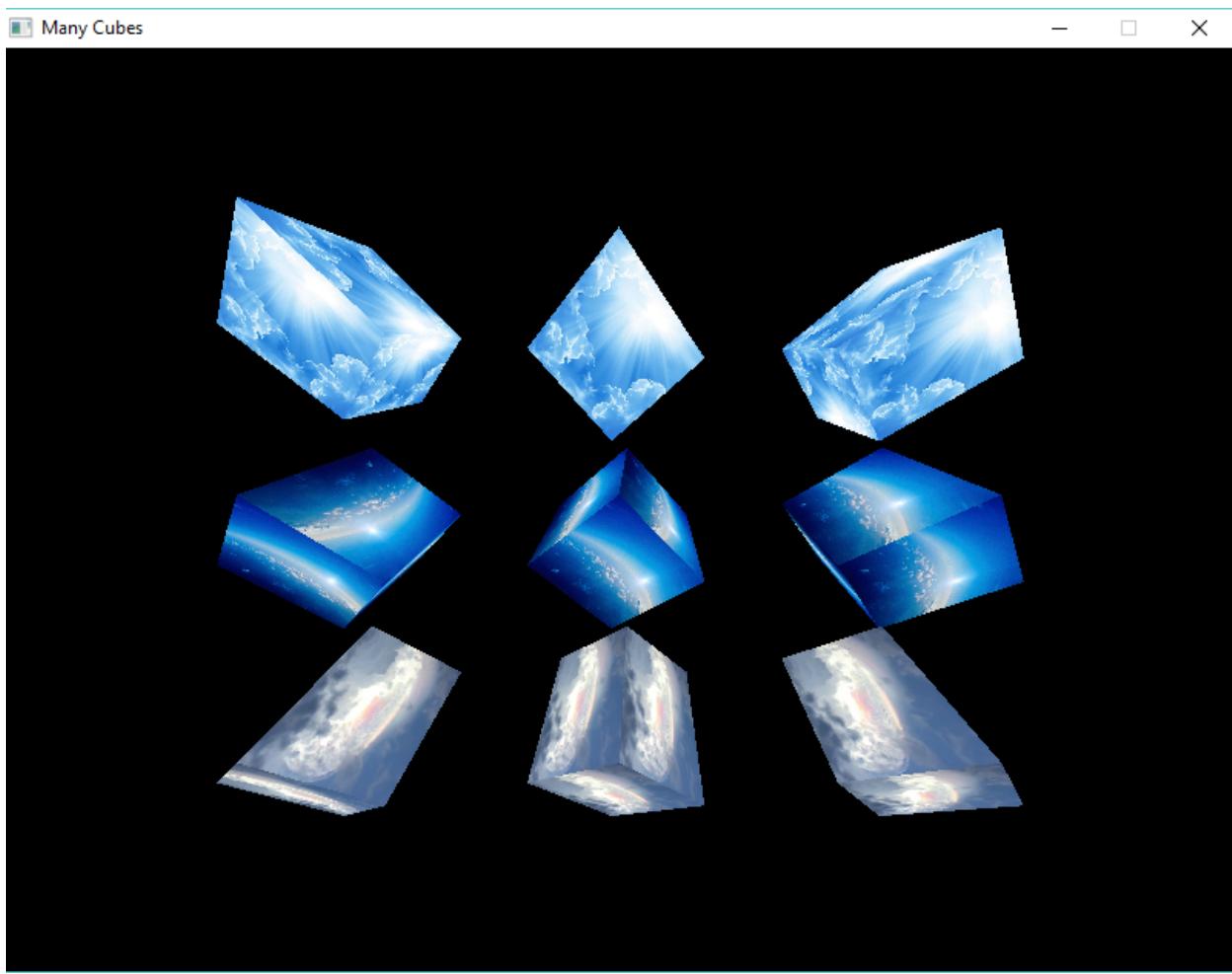
func loadresources

func drawScene

func destroyResources

```

Screen Shot:



59.3 TicTacToe 3D Game

Source Code:

```
# Load Libraries
load "gamelib.ring"           # RingAllegro Library
load "opengl21lib.ring"        # RingOpenGL Library

#=====
# To Support MacOS X
al_run_main()
func al_game_start            # Called by al_run_main()
    main()                   # Now we call our main function
#=====

func main
    new TicTacToe3D {
        start()
    }

class TicTacToe3D from GameLogic
```

(continues on next page)

(continued from previous page)

```

FPS = 60
TITLE = "TicTacToe 3D"

oBackground = new GameBackground
oGameSound = new GameSound
oGameCube = new GameCube
oGameOver = new GameOver
oGameInterface = new GameInterface

func loadresources
    oGameOver.loadresources()
    oGameSound.loadresources()
    oBackground.loadresources()
    oGameCube.loadresources()

func destroyResources
    oGameOver.destroyResources()
    oGameSound.destroyResources()
    oBackground.destroyResources()
    oGameCube.destroyResources()

func drawScene
    oBackground.update()
    oGameInterface.update(self)

func MouseClickEvent
    oGameInterface.MouseClickEvent(self)

class GameInterface

    func Update oGame
        prepare()
        cubes(oGame)

    func Prepare
        w = 1024 h = 768
        ratio = w / h
        glViewport(0, 0, w, h)
        glMatrixMode(GL_PROJECTION)
        glLoadIdentity()
        gluPerspective(-120, ratio, 1, 120)
        glMatrixMode(GL_MODELVIEW)
        glLoadIdentity()
        glEnable(GL_TEXTURE_2D)
        glShadeModel(GL_SMOOTH)
        glClearColor(0.0, 0.0, 0.0, 0.5)
        glClearDepth(1.0)
        glEnable(GL_DEPTH_TEST)
        glEnable(GL_CULL_FACE)
        glDepthFunc(GL_LESS)
        glHint(GL_PERSPECTIVE_CORRECTION_HINT, GL_NICEST)

    func Cubes oGame
        oGame.oGameCube {
            aGameMap = oGame.aGameMap
            cube( 5 , -3 , -5 , aGameMap[1][1] )

```

(continues on next page)

(continued from previous page)

```

        cube( 0 , -3 , -5 , aGameMap[1][2] )
        cube( -5 , -3 , -5 , aGameMap[1][3] )
        cube( 5 , 1 , -5 , aGameMap[2][1] )
        cube( 0 , 1 , -5 , aGameMap[2][2] )
        cube( -5 , 1 , -5 , aGameMap[2][3] )
        cube( 5 , 5 , -5 , aGameMap[3][1] )
        cube( 0 , 5 , -5 , aGameMap[3][2] )
        cube( -5 , 5 , -5 , aGameMap[3][3] )
        rotate()
    }

func MouseClickEvent oGame
    oGame {
        aBtn = Point2Button(Mouse_X,Mouse_Y)
        nRow = aBtn[1]
        nCol = aBtn[2]
        if nRow != 0 and nCol != 0
            if aGameMap[nRow][nCol] == :n
                aGameMap[nRow][nCol] = cActivePlayer
                ChangeActivePlayer()
                CheckGameOver()
            ok
        ok
    }

Class GameLogic from GraphicsAppBase

    aGameMap = [
        [ :n , :n , :n ] ,
        [ :n , :n , :n ] ,
        [ :n , :n , :n ]
    ]

    aGameButtons = [
        [176,88,375,261],           # x1,y1,x2,y2
        [423,88,591,261],           # [1,1]
        [645,88,876,261],           # [1,2]
        [176,282,375,428],           # [1,3]
        [423,282,591,428],           # [2,1]
        [645,282,876,428],           # [2,2]
        [176,454,375,678],           # [2,3]
        [423,454,591,678],           # [3,1]
        [645,454,876,678]           # [3,2]
    ]
    ok

    cActivePlayer = :x

    func point2button x,y
        nRow = 0
        nCol = 0
        for t = 1 to len(aGameButtons)
            rect = aGameButtons[t]
            if x >= rect[1] and x <= rect[3] and
                y >= rect[2] and y <= rect[4]
                switch t
                    on 1 nRow = 1 nCol = 1
                    on 2 nRow = 1 nCol = 2

```

(continues on next page)

(continued from previous page)

```

on 3 nRow = 1 nCol = 3
on 4 nRow = 2 nCol = 1
on 5 nRow = 2 nCol = 2
on 6 nRow = 2 nCol = 3
on 7 nRow = 3 nCol = 1
on 8 nRow = 3 nCol = 2
on 9 nRow = 3 nCol = 3

off
exit

ok
next
return [nRow, nCol]

func ChangeActivePlayer()
    if cActivePlayer = :x
        cActivePlayer = :o
    else
        cActivePlayer = :x
    ok

func CheckGameOver
    aList = [
        aGameMap[1][1],
        aGameMap[1][2],
        aGameMap[1][3],
        aGameMap[2][1],
        aGameMap[2][2],
        aGameMap[2][3],
        aGameMap[3][1],
        aGameMap[3][2],
        aGameMap[3][3]
    ]
    for item in aList
        switch item
            on :x item = 1
            on :o item = 2
            on :n item = 0
        off
    next
    nStatus = CheckWinner(aList)
    if nStatus
        oGameOver {
            switch nStatus
                on 1 Player1Win(this)
                on 2 Player2Win(this)
                on 3 NoOneWin(this)
            off
        }
        refreshGame()
    ok

func refreshGame
    aGameMap = [
        [ :n, :n, :n ],
        [ :n, :n, :n ],
        [ :n, :n, :n ]
    ]

```

(continues on next page)

(continued from previous page)

```

cActivePlayer = :x

func CheckWinner lst
    //vertical check
    for v=1 to 9 step 3
        if lst[v]!=0 and lst[v+1]!=0 and lst[v+2]!=0
            if lst[v]=lst[v+1] and lst[v+1]=lst[v+2]
                return lst[v]
        ok
    ok
next
//horzintal
for h=1 to 3
    if lst[h]!=0 and lst[h+3]!=0 and lst[h+6]!=0
        if lst[h]=lst[h+3] and lst[h+3]=lst[h+6]
            return lst[h]
    ok
ok
next
//Cross
if lst[1]!=0 and lst[5]!=0 and lst[9]!=0
    if lst[1]=lst[5] and lst[5]=lst[9] return lst[1] ok
ok
if lst[3]!=0 and lst[5]!=0 and lst[7]!=0
    if lst[3]=lst[5] and lst[5]=lst[7] return lst[3] ok
ok
//tie
tie=true
for i=1 to 9
    if lst[i]==0 tie=false exit ok
next
if tie=true return 3 ok return 0

```

```

class GameOver

    font bitmap

    func loadresources
        font = al_load_ttf_font("font/pirulen.ttf", 54, 0 )
        bitmap = al_load_bitmap("image/ballon.png")

    func destroyResources
        al_destroy_bitmap(bitmap)
        al_destroy_font(font)

    func Player1Win oGame
        showMsg(oGame, 80, 430, "Good job X you won!")

    func Player2Win oGame
        showMsg(oGame, 80, 430, "Good job O you won!")

    func NoOneWin oGame
        showMsg(oGame, 150, 430, "Oh no it's a tie!")

    func ShowMsg oGame,x,y,cMsg

```

(continues on next page)

(continued from previous page)

```

oGame {
    drawScene()
    al_flip_display()
    al_rest(0.3)
    newdisplay = al_create_display(SCREEN_W, SCREEN_H)
    al_set_window_title(newdisplay, TITLE)
    al_clear_to_color(al_map_rgb(255,255,255))
    al_draw_bitmap(this.bitmap,200,50,1)
    al_draw_text(this.font,
                al_map_rgb(0,0,255), x,y,
                ALLEGRO_ALIGN_LEFT, cMsg)
    al_flip_display()
    al_rest(2)
    al_destroy_display(newdisplay)
    al_set_target_backbuffer(display)
}

class GameCube

    bitmap bitmap2 bitmap3
    textureX textureO textureN

    xrot = 0.0
    yrot = 0.0
    zrot = 0.0

    func loadresources
        bitmap = al_load_bitmap("image/o.png")
        textureO = al_get_opengl_texture(bitmap)
        bitmap2 = al_load_bitmap("image/x.png")
        textureX = al_get_opengl_texture(bitmap2)
        bitmap3 = al_load_bitmap("image/empty.png")
        textureN = al_get_opengl_texture(bitmap3)

    func destroyResources
        al_destroy_bitmap(bitmap)
        al_destroy_bitmap(bitmap2)
        al_destroy_bitmap(bitmap3)

    func cube(x,y,z,nTexture)
        glLoadIdentity()
        glTranslatef(x,y,z)
        glRotatef(xrot,1.0,0.0,0.0)
        glRotatef(yrot,0.0,1.0,0.0)
        glRotatef(zrot,0.0,0.0,1.0)
        setCubeTexture(nTexture)
        drawCube()

    func setCubeTexture cTexture
        switch cTexture
            on :x
                glBindTexture(GL_TEXTURE_2D, textureX)
            on :o
                glBindTexture(GL_TEXTURE_2D, textureO)
            on :n
                glBindTexture(GL_TEXTURE_2D, textureN)
        off

```

(continues on next page)

(continued from previous page)

```

func Rotate
    xrot += 0.3 * 5
    yrot += 0.2 * 5
    zrot += 0.4 * 5

func drawcube
    glBegin(GL_QUADS)
        // Front Face
        glTexCoord2f(0.0, 0.0) glVertex3f(-1.0, -1.0, 1.0)
        glTexCoord2f(1.0, 0.0) glVertex3f( 1.0, -1.0, 1.0)
        glTexCoord2f(1.0, 1.0) glVertex3f( 1.0, 1.0, 1.0)
        glTexCoord2f(0.0, 1.0) glVertex3f(-1.0, 1.0, 1.0)
        // Back Face
        glTexCoord2f(1.0, 0.0) glVertex3f(-1.0, -1.0, -1.0)
        glTexCoord2f(1.0, 1.0) glVertex3f(-1.0, 1.0, -1.0)
        glTexCoord2f(0.0, 1.0) glVertex3f( 1.0, 1.0, -1.0)
        glTexCoord2f(0.0, 0.0) glVertex3f( 1.0, -1.0, -1.0)
        // Top Face
        glTexCoord2f(0.0, 1.0) glVertex3f(-1.0, 1.0, -1.0)
        glTexCoord2f(0.0, 0.0) glVertex3f(-1.0, 1.0, 1.0)
        glTexCoord2f(1.0, 0.0) glVertex3f( 1.0, 1.0, 1.0)
        glTexCoord2f(1.0, 1.0) glVertex3f( 1.0, 1.0, -1.0)
        // Bottom Face
        glTexCoord2f(1.0, 1.0) glVertex3f(-1.0, -1.0, -1.0)
        glTexCoord2f(0.0, 1.0) glVertex3f( 1.0, -1.0, -1.0)
        glTexCoord2f(0.0, 0.0) glVertex3f( 1.0, -1.0, 1.0)
        glTexCoord2f(1.0, 0.0) glVertex3f(-1.0, -1.0, 1.0)

        // Right face
        glTexCoord2f(1.0, 0.0) glVertex3f( 1.0, -1.0, -1.0)
        glTexCoord2f(1.0, 1.0) glVertex3f( 1.0, 1.0, -1.0)
        glTexCoord2f(0.0, 1.0) glVertex3f( 1.0, 1.0, 1.0)
        glTexCoord2f(0.0, 0.0) glVertex3f( 1.0, -1.0, 1.0)

        // Left Face
        glTexCoord2f(0.0, 0.0) glVertex3f(-1.0, -1.0, -1.0)
        glTexCoord2f(1.0, 0.0) glVertex3f(-1.0, -1.0, 1.0)
        glTexCoord2f(1.0, 1.0) glVertex3f(-1.0, 1.0, 1.0)
        glTexCoord2f(0.0, 1.0) glVertex3f(-1.0, 1.0, -1.0)
    glEnd()

class GameBackground

    nBackX = 0
    nBackY = 0
    nBackDiffx = -1
    nBackDiffy = -1
    nBackMotion = 1
    aBackMotionList = [
        [ -1, -1 ], , # Down - Right
        [ 0, 1 ], , # Up
        [ -1, -1 ], , # Down - Right
        [ 0, 1 ], , # Up
        [ 1, -1 ], , # Down - Left
        [ 0, 1 ], , # Up
    ]

```

(continues on next page)

(continued from previous page)

```

[ 1 , -1 ] ,           # Down - Left
[ 0 , 1 ]             # Up
]

bitmap

func Update
    draw()
    motion()

func draw
    al_draw_bitmap(bitmap,nBackX,nBackY,1)

func motion
    nBackX += nBackDiffx
    nBackY += nBackDiffy
    if (nBackY = -350) or (nBackY = 0)
        nBackMotion++
        if nBackMotion > len(aBackMotionList)
            nBackMotion = 1
        ok
        nBackDiffx = aBackMotionList[nBackMotion][1]
        nBackDiffy = aBackMotionList[nBackMotion][2]
    ok

func loadResources
    bitmap = al_load_bitmap("image/back.jpg")

func destroyResources
    al_destroy_bitmap(bitmap)

class GameSound

    sample sampleid

    func loadresources
        sample = al_load_sample( "sound/music1.wav" )
        sampleid = al_new_allegro_sample_id()
        al_play_sample(sample, 1.0, 0.0,1.0,ALLEGRO_PLAYMODE_LOOP,sampleid)

    func destroyResources
        al_destroy_allegro_sample_id(sampleid)
        al_destroy_sample(sample)

class GraphicsAppBase

    display event_queue ev timeout
    timer
    redraw      = true
    FPS         = 60
    SCREEN_W    = 1024
    SCREEN_H    = 700
    KEY_UP      = 1
    KEY_DOWN    = 2
    KEY_LEFT    = 3

```

(continues on next page)

(continued from previous page)

```

KEY_RIGHT           = 4
Key                 = [false, false, false, false]
Mouse_X             = 0
Mouse_Y             = 0
TITLE               = "Graphics Application"
PRINT_MOUSE_XY     = False

func start
    SetUp()
    loadResources()
    eventsLoop()
    destroy()

func setup
    al_init()
    al_init_font_addon()
    al_init_ttf_addon()
    al_init_image_addon()
    al_install_audio()
    al_init_acodec_addon()
    al_reserve_samples(1)
    al_set_new_display_flags(ALLEGRO_OPENGL)
    display = al_create_display(SCREEN_W, SCREEN_H)
    al_set_window_title(display, TITLE)
    al_clear_to_color(al_map_rgb(0, 0, 0))
    event_queue = al_create_event_queue()
    al_register_event_source(event_queue,
        al_get_display_event_source(display))
    ev = al_new_allegro_event()
    timeout = al_new_allegro_timeout()
    al_init_timeout(timeout, 0.06)
    timer = al_create_timer(1.0 / FPS)
    al_register_event_source(event_queue,
        al_get_timer_event_source(timer))
    al_start_timer(timer)
    al_install_mouse()
    al_register_event_source(event_queue,
        al_get_mouse_event_source())
    al_install_keyboard()
    al_register_event_source(event_queue,
        al_get_keyboard_event_source())

func eventsLoop
    while true
        al_init_timeout(timeout, 0.06)
        al_wait_for_event_until(event_queue, ev, timeout)
        switch al_get_allegro_event_type(ev)
        on ALLEGRO_EVENT_DISPLAY_CLOSE
            CloseEvent()
        on ALLEGRO_EVENT_TIMER
            redraw = true
        on ALLEGRO_EVENT_MOUSE_AXES
            mouse_x = al_get_allegro_event_mouse_x(ev)
            mouse_y = al_get_allegro_event_mouse_y(ev)
            if PRINT_MOUSE_XY
                see "x = " + mouse_x + nl
                see "y = " + mouse_y + nl

```

(continues on next page)

(continued from previous page)

```

    ok
    on ALLEGRO_EVENT_MOUSE_ENTER_DISPLAY
        mouse_x = al_get_allegro_event_mouse_x(ev)
        mouse_y = al_get_allegro_event_mouse_y(ev)
    on ALLEGRO_EVENT_MOUSE_BUTTON_UP
        MouseClickEvent()
    on ALLEGRO_EVENT_KEY_DOWN
        switch al_get_allegro_event_keyboard_keycode(ev)
            on ALLEGRO_KEY_UP
                key[KEY_UP] = true
            on ALLEGRO_KEY_DOWN
                key[KEY_DOWN] = true
            on ALLEGRO_KEY_LEFT
                key[KEY_LEFT] = true
            on ALLEGRO_KEY_RIGHT
                key[KEY_RIGHT] = true
        off
    on ALLEGRO_EVENT_KEY_UP
        switch al_get_allegro_event_keyboard_keycode(ev)
            on ALLEGRO_KEY_UP
                key[KEY_UP] = false
            on ALLEGRO_KEY_DOWN
                key[KEY_DOWN] = false
            on ALLEGRO_KEY_LEFT
                key[KEY_LEFT] = false
            on ALLEGRO_KEY_RIGHT
                key[KEY_RIGHT] = false
            on ALLEGRO_KEY_ESCAPE
                exit
        off
    off
    if redraw and al_is_event_queue_empty(event_queue)
        redraw = false
        drawScene()
        al_flip_display()
    ok
    callgc()
end

func destroy
    destroyResources()
    al_destroy_timer(timer)
    al_destroy_allegro_event(ev)
    al_destroy_allegro_timeout(timeout)
    al_destroy_event_queue(event_queue)
    al_destroy_display(display)
    al_exit()

func loadresources

func drawScene

func destroyResources

func MouseClickEvent
    exit          # Exit from the Events Loop

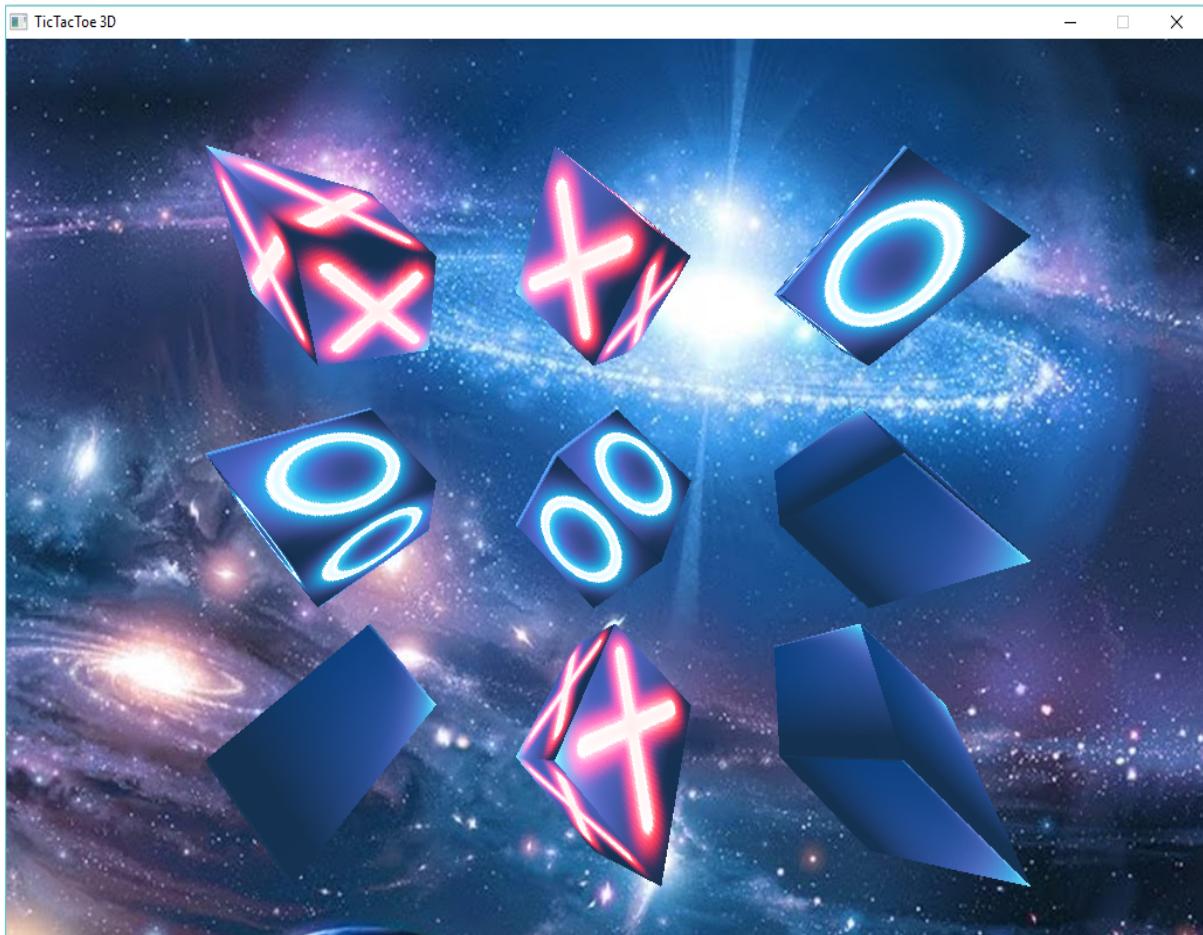
```

(continues on next page)

(continued from previous page)

```
func CloseEvent  
    exit  
        # Exit from the Events Loop
```

Screen Shot:



59.4 More 3D Samples

You will find the samples in ring/samples/3D folder

The next screen shot for the Top-Down view - Many levels of cubes sample

The screenshot shows the Ring Notepad interface. On the left, the source code for a 3D sample is displayed:

```

22
23 class GraphicsApp from GraphicsAppB
24
25     TITLE = "Sample : Top-Down"
26
27     bitmap texture font
28     bitmap2 texture2
29
30     // angle of rotation for the
31     // camera
32     angle=0.0
33
34     // actual vector representing
35     // the camera's position
36     lx=0.0
37     lz=-1.0
38
39     // XZ position of the camera
40     x=0.0
41     z=5.0
42
43     fraction = 0.1
44
45     nSpeed = 10
46
47     func loadresources
48
49         bitmap = al_Load_bitmap("front.bmp")
50         texture = al_get_opengl_texture(bitmap)
51         font = al_load_ttf_font("font.ttf", 16)
52         bitmap2 = al_load_bitmap("back.bmp")

```

On the right, a screenshot of the application window titled "Sample : Top-Down View - Many Levels of Cubes" is shown. The window displays a 3D scene with multiple layers of blue cubes against a starry background. The text "RING IS FUN!" is visible in the center of the screen.

The next screen shot for the Camera Sample

The screenshot shows the Ring Notepad interface. On the left, the source code for a camera sample is displayed:

```

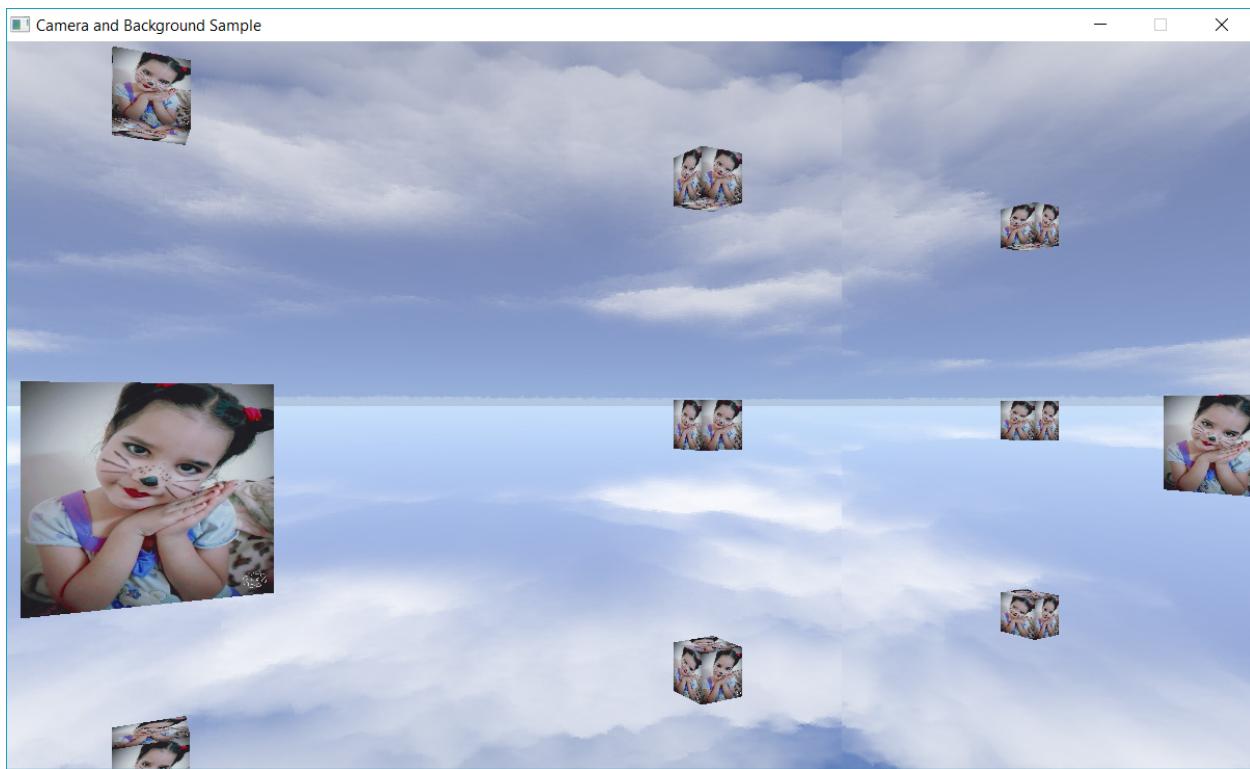
22
23 class GraphicsApp from GraphicsAppB
24
25     TITLE = "The Camera Sample"
26
27     bitmap texture font
28
29     // angle of rotation for the
30     // camera
31     angle=0.0
32
33     // actual vector representing
34     // the camera's position
35     lx=0.0
36     lz=-1.0
37
38     // XZ position of the camera
39     x=0.0
40     z=5.0
41
42     fraction = 0.1
43
44     func SetCamera
45         angle = 0.5
46         lx = sin(angle)
47         lz = -cos(angle)
48
49     func loadresources

```

On the right, a screenshot of the application window titled "The Camera Sample" is shown. The window displays a 3D scene with a camera moving through a series of blue cubes, creating a perspective effect.

The next screen shot for the Camera and background sample

Developer : Azzeddine Remmal



THE GOLD MAGIC 800 GAME

In this chapter we will learn about the Gold Magic 800 Game

The game is developed using Ring, RingAllegro and RingOpenGL

You will find the game in ring/applications/goldmagic800 folder

60.1 The Game Story

Your friend discovered a unique and special box, created by the best wizard in the world 7000 years ago, when you close this box and move it; you will find a new gold under the box, it's an infinite source of gold. The Box exists in a special environment full of puzzles, no one can enter this environment because it's protected by the magic. Your friend created a new robot using nanotechnology that can move the box using a remote control device. Your mission is to solve all of these puzzles and get this box forever to be the richest people in the world.

60.2 How to play?

The Gold Magic 800 is a puzzle game that will teach your unconscious mind to think like an entrepreneur.

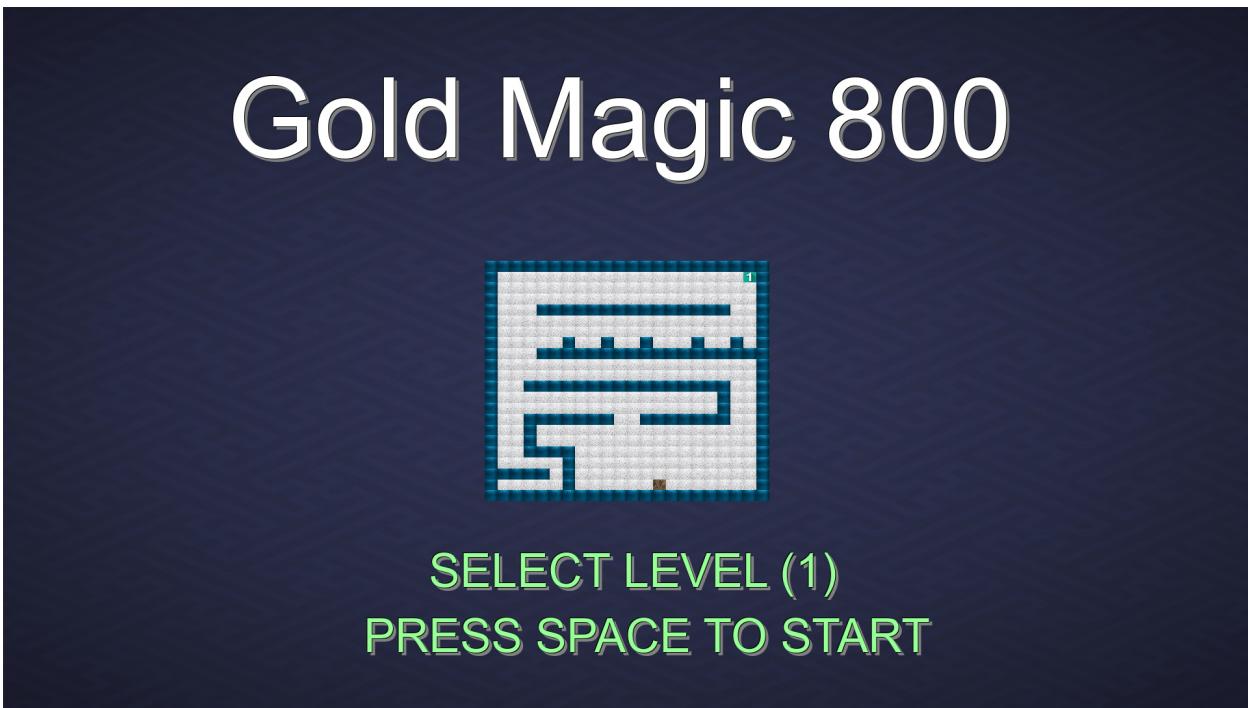
The game is based on moving your box around to get gold score (=800) to open the First Door (Box Number 1) Then directly put your box on the Door (this will open the next door), Then continue to put your box on all of the next doors in the level, You need the score (800) only for the first door, The next doors doesn't require this condition, but your way of gold will be converted to a wall once you put the Box on any door, so select your path carefully.

60.3 What will you learn?

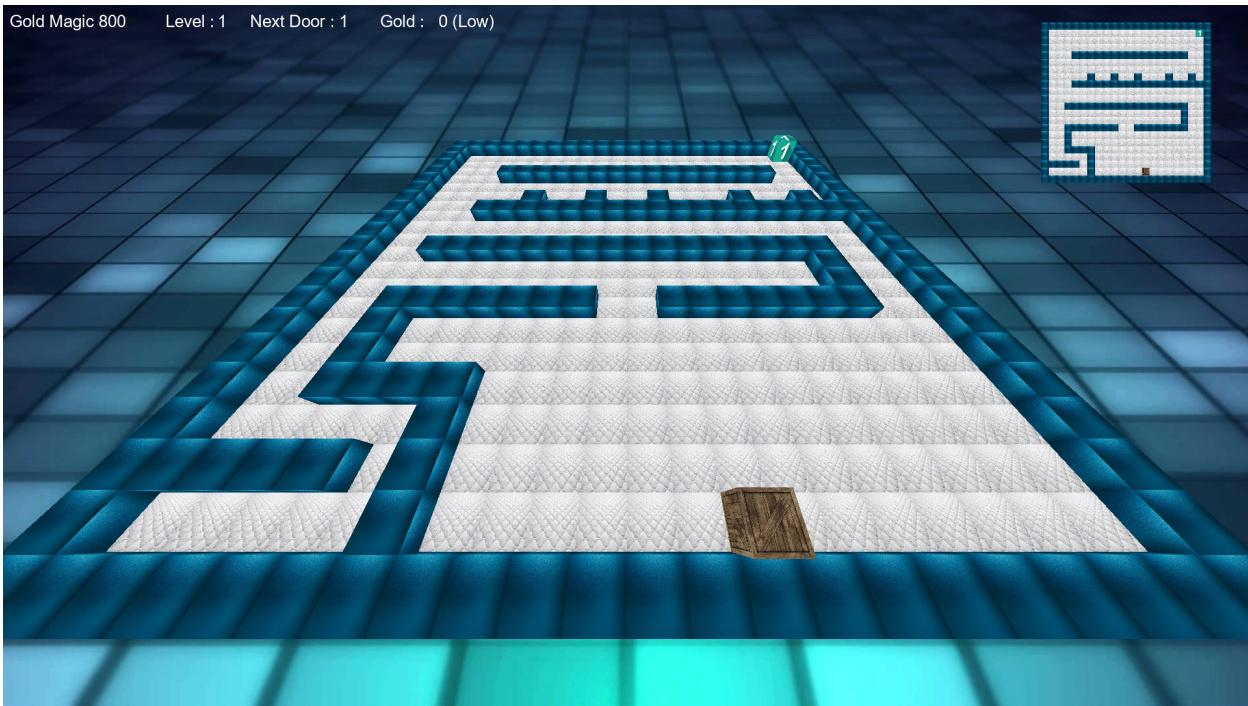
- 1- Plan First
- 2- Move to your target directly then go to get the required resources
- 3- Look to the future when you evaluate the different solutions
- 4- Try to avoid mistakes, Also learn from them
- 5- Respect the Cost (800)
- 6- Focus and be careful
- 7- Be patient and Enjoy!

60.4 Screen Shots

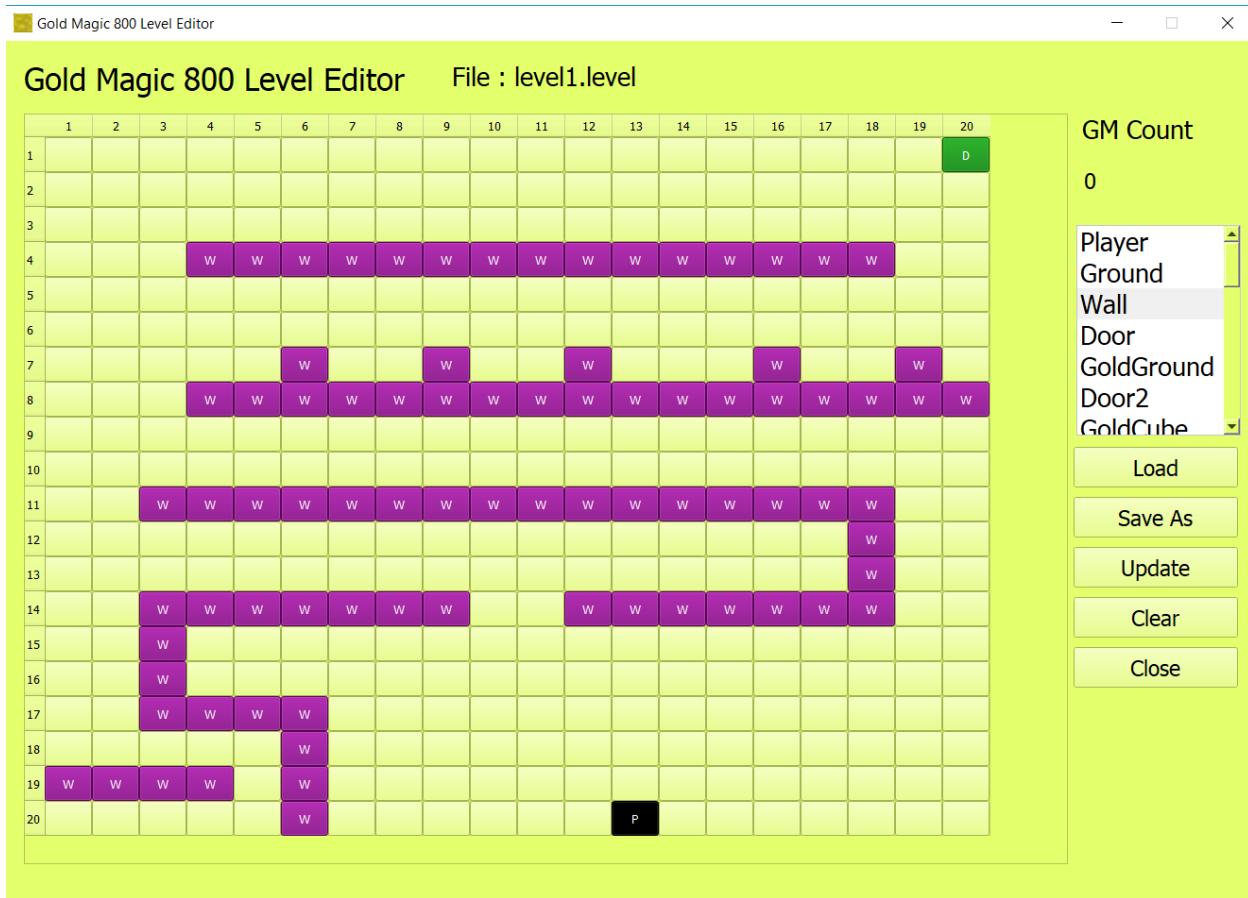
We can select the level



The next screen shot for level (1)



The Gold Magic 800 Level Editor

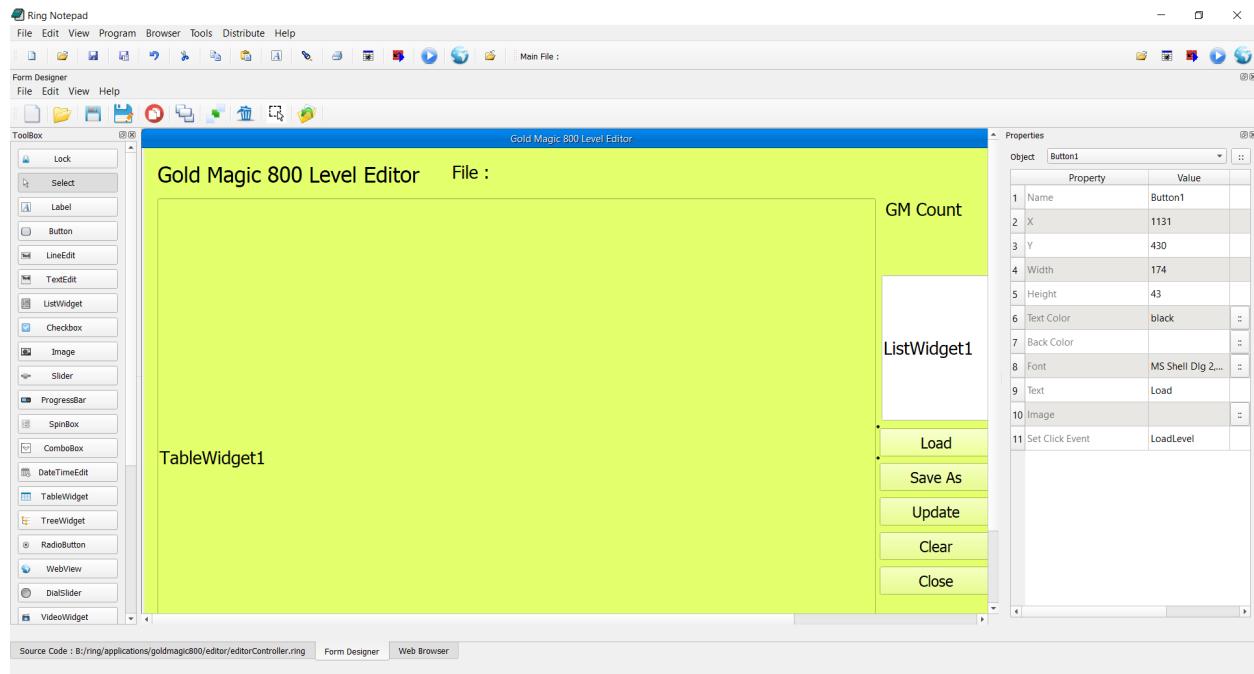


60.5 Source Code

You will find the Level Editor source code in this folder

<https://github.com/ring-lang/ring/tree/master/applications/goldmagic800/editor>

The user interface of the Level Editor is designed using the Ring Form Designer.



The next file contains the Level Editor Controller Class

<https://github.com/ring-lang/ring/blob/master/applications/goldmagic800/editor/editorController.ring>

You will find the Game Engine source code in this folder

<https://github.com/ring-lang/ring/tree/master/applications/goldmagic800>

CHAPTER
SIXTYONE

PERFORMANCE TIPS

In this chapter we will learn more about the Ring performance.

61.1 Introduction

Ring is designed to be a simple, small and flexible language in the first place, but also it is fast enough for many applications.

Ring can do each of the next tasks in around 1 second using normal computers in the market during the last 5 years

- (1) Compiling 100,000 lines of code
- (2) Executing empty loop that count from 1 to 10,000,000
- (3) Executing 1000 search operation using linear search in a list contains 100,000 items, trying to find the last item (The worst case)
- (4) Creating list contains 1,000,000 items then summing all of the list items
- (5) Adding 20,000 items to the ListWidget in GUI applications
- (6) Adding 5,000 nodes to the TreeWidget in GUI applications
- (7) Printing 10,000 messages to the terminal in Console applications

Also when we need more speed we can use C/C++ extensions!

Example:

```
? "Create list contains 100,000 items"
aList = 1:100000

? "Do 1000 search operation - Find the last item (Worst Case!)"
c = clock()

for t = 1 to 1000
    find(aList,100000)
next

? "Time: " + ( clock() - c ) / clockpersecond() + " seconds"
```

Output:

```
Create list contains 100,000 items
Do 1000 search operation - Find the last item (Worst Case!)
Time: 0.87 seconds
```

Example:

```

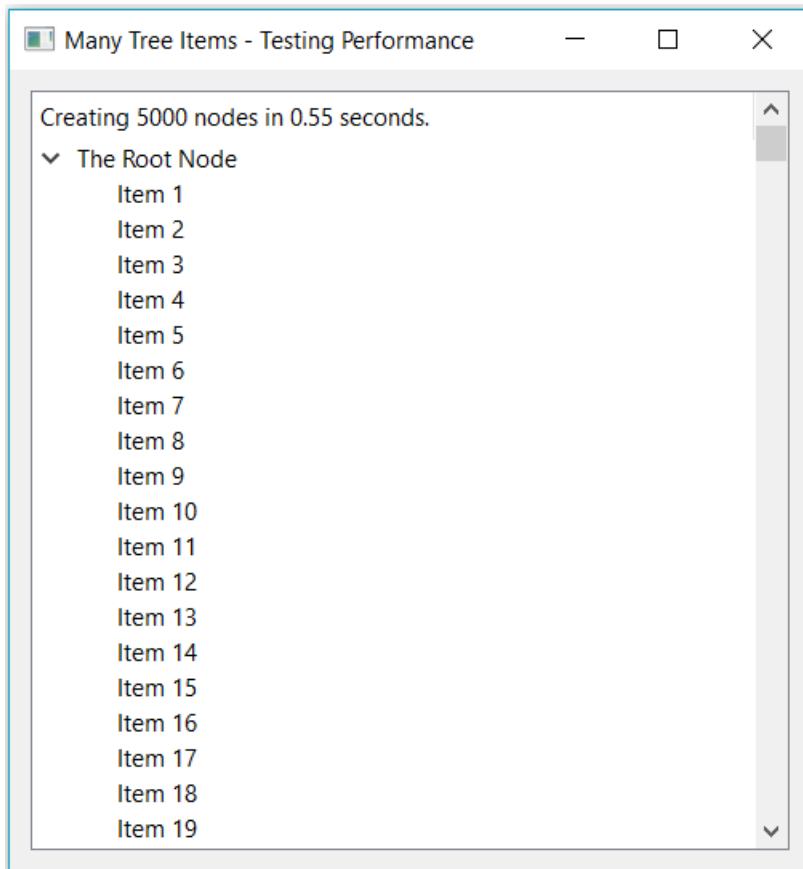
load "guilib.ring"

func main

new qApp {
    win = new QWidget() {
        move(100,100) resize(500,500)
        setWindowTitle("Many Tree Items - Testing Performance")
        tree = new QTreeWidget(win) {
            blockSignals(True) setUpdatesEnabled(False)
            root = new QTreeWidgetItem()
            root.setText(0,"The Root Node")
            t1 = clock()
            for t = 1 to 5000
                oItem = new QTreeWidgetItem()
                oItem.setText(0,"Item " + t)
                root.addChild(oItem)
            next
            cTime = (clock()-t1)/clockspersecond()
            setHeaderLabel("Creating 5000 nodes in " + cTime + " seconds.
←")
            addTopLevelItem(root)
            expandItem(root)
            blockSignals(False) setUpdatesEnabled(True)
        }
        oLayout = new QVBoxLayout() {
            addWidget(tree)
        }
        setLayout(oLayout)
        show()
    }
    exec()
}

```

Output:



61.2 Creating Lists

Example:

```
? "Create the list using the Range operator"
t1 = clock()
aList = 1:1000000
? "Time : " + ((clock()-t1)/clockspisecond()) + " seconds"

? "Create the list using the For loop"
t1 = clock()
aList = []
for x = 1 to 1000000
    aList + x
next
? "Time : " + ((clock()-t1)/clockspisecond()) + " seconds"

? "Create the list using the list() function and the For loop"
t1 = clock()
aList = list(1000000)
for x = 1 to 1000000
    aList[x] = x
next
? "Time : " + ((clock()-t1)/clockspisecond()) + " seconds"
```

Output:

```
Create the list using the Range operator
Time : 0.48 seconds
Create the list using the For loop
Time : 0.79 seconds
Create the list using the list() function and the For loop
Time : 1.56 seconds
```

Note: Creating lists using the Range operator is faster than using the For loop or the list() function

61.3 Arithmetic Operations

Example:

```
? "Using * operator"
t1 = clock()
for x = 1 to 1000000
    out = x * 2
next
? "Time : " + ((clock()-t1)/clockpersecond()) + " seconds"

? "Using *= operator"
t1 = clock()
for x = 1 to 1000000
    out = x
    out *= 2
next
? "Time : " + ((clock()-t1)/clockpersecond()) + " seconds"
```

Output:

```
Using * operator
Time : 1.34 seconds
Using *= operator
Time : 0.47 seconds
```

Note: Using the *= operator is faster than using the * operator

61.4 Using len() and For Loops

Example:

```
aList = 1:1000000

? "Using len() in the For loop"
t1 = clock()
for x = 1 to len(aList)
next
? "Time : " + ((clock()-t1)/clockpersecond()) + " seconds"
```

(continues on next page)

(continued from previous page)

```
? "Using len() before the For loop"
t1 = clock()
nMax = len(aList)
for x = 1 to nMax
next
? "Time : " + ((clock()-t1)/clocksperssecond()) + " seconds"
```

Output:

```
Using len() in the For loop
Time : 5.50 seconds
Using len() before the For loop
Time : 0.24 seconds
```

Note: Using len() before the For loop is faster than using len() in the For loop.

61.5 Calling Functions and Methods

Example:

```
? "calling 100000 functions"
t1 = clock()
for x = 1 to 100000
    test()
next
? "Time : " + ((clock()-t1)/clocksperssecond()) + " seconds"

o1 = new test

? "calling 100000 methods using the dot operator"
t1 = clock()
for x = 1 to 100000
    o1.test()
next
? "Time : " + ((clock()-t1)/clocksperssecond()) + " seconds"

? "calling 100000 methods using braces "
t1 = clock()
for x = 1 to 100000
    o1 { test() }
next
? "Time : " + ((clock()-t1)/clocksperssecond()) + " seconds"

func test

class test
    func test
```

Output:

```
calling 100000 functions
Time : 0.28 seconds
calling 100000 methods using the dot operator
Time : 0.36 seconds
calling 100000 methods using braces
Time : 1.19 seconds
```

Note: Calling functions is faster than calling methods but the difference is very small.

Note: Using the dot operator to call methods is faster than using braces.

CHAPTER
SIXTYTWO

COMMAND LINE OPTIONS

The ring language takes source code file (*.ring*) or the object file (*.ringo*) as input to execute, also the language provide other options like

Option	Description
-tokens	Print a list of tokens in the source code file
-rules	Print grammar rules applied on the tokens
-ic	Print the intermediate byte code (before execution)
-icfinal	Print the final byte code (after execution)
-cgi	Print http response header before error messages
-norun	Don't run the program after compiling
-ins	Print instruction operation code before execution
-performance	Print clock before and after program execution
-go	Generate Object File
-geo	Generate embedded object file (C source code)
-w	Display Warnings

62.1 Printing Tokens

Example:

```
Func Main
    See "Hello World" + nl
    for x = 1 to 10
        see x + nl
    next
    test()

func test
    see "welcome" + nl
    o1 = new point { x=10 y=20 z=30 }
    see o1

class point x y z
```

Command:

```
ring test.ring -tokens -norun
```

Output:

```
=====
Tokens - Generated by the Scanner
=====

  Keyword : FUNC
Identifier : main
  EndLine
  Keyword : SEE
    Literal : Hello World
  Operator : +
Identifier : nl
  EndLine
  Keyword : FOR
Identifier : x
  Operator : =
    Number : 1
  Keyword : TO
    Number : 10
  EndLine
  Keyword : SEE
Identifier : x
  Operator : +
Identifier : nl
  EndLine
  Keyword : NEXT
  EndLine
Identifier : test
  Operator : (
  Operator : )
  EndLine
  Keyword : FUNC
Identifier : test
  EndLine
  Keyword : SEE
    Literal : welcome
  Operator : +
Identifier : nl
  EndLine
Identifier : o1
  Operator : =
  Keyword : NEW
Identifier : point
  Operator : {
Identifier : x
  Operator : =
    Number : 10
Identifier : y
  Operator : =
    Number : 20
Identifier : z
  Operator : =
    Number : 30
  Operator : }
  EndLine
  Keyword : SEE
Identifier : o1
  EndLine
```

(continues on next page)

(continued from previous page)

```

Keyword : CLASS
Identifier : point
Identifier : x
Identifier : y
Identifier : z
EndLine
=====
```

62.2 Printing Rules

Command:

```
ring test.ring -rules -norun
```

Output:

```

=====
Grammar Rules Used by The Parser
=====

Rule : Program --> {Statement}

Line 1
Rule : Statement --> 'Func' Identifier [ParaList]

Line 2
Rule : Factor --> Literal
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : Factor --> Identifier [ {Mixer} | Assignment | PlusPlus | MinusMinus]
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : Arithmetic --> Arithmetic + Arithmetic
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> 'See' Expr

Line 3
Rule : Factor --> Number
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
```

(continues on next page)

(continued from previous page)

```

Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Factor --> Number
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> 'For' Identifier '=' Expr to Expr ['step' Expr]

Line 4
Rule : Factor --> Identifier [ {Mixer} | Assignment | PlusPlus | MinusMinus]
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : Factor --> Identifier [ {Mixer} | Assignment | PlusPlus | MinusMinus]
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : Arithmetic --> Arithmetic + Arithmetic
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> 'See' Expr

Line 5
Rule : Next --> 'Next'

Line 6
Rule : Mixer -> '(' [Expr { ',', Expr } ] ')'

Line 8
Rule : Factor --> Identifier [ {Mixer} | Assignment | PlusPlus | MinusMinus]
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> Expr
Rule : Statement --> 'Func' Identifier [ParaList]

Line 9

```

(continues on next page)

(continued from previous page)

```

Rule : Factor --> Literal
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : Factor --> Identifier [ {Mixer} | Assignment | PlusPlus | MinusMinus]
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : Arithmetic --> Arithmetic + Arithmetic
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> 'See' Expr

Line 10
Rule : Factor --> New Identifier {'.' Identifier }
Rule : Mixer --> '{' {Statement} BraceEnd
Rule : Factor --> Number
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Assignment -> '=' Expr
Rule : Factor --> Identifier [ {Mixer} | Assignment | PlusPlus | MinusMinus]
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> Expr
Rule : Factor --> Number
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Assignment -> '=' Expr

```

(continues on next page)

(continued from previous page)

```

Rule : Factor --> Identifier [ {Mixer} | Assignment | PlusPlus | MinusMinus]
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> Expr
Rule : Factor --> Number
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Assignment -> '=' Expr
Rule : Factor --> Identifier [ {Mixer} | Assignment | PlusPlus | MinusMinus]
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> Expr
Rule : BraceEnd --> '}'
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Assignment -> '=' Expr
Rule : Factor --> Identifier [ {Mixer} | Assignment | PlusPlus | MinusMinus]
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare

```

(continues on next page)

(continued from previous page)

```

Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> Expr

Line 11
Rule : Factor --> Identifier [ {Mixer} | Assignment | PlusPlus | MinusMinus]
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> 'See' Expr

Line 13
Rule : Statement --> 'Class' Identifier
Rule : Factor --> Identifier [ {Mixer} | Assignment | PlusPlus | MinusMinus]
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> Expr
Rule : Factor --> Identifier [ {Mixer} | Assignment | PlusPlus | MinusMinus]
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> Expr
Rule : Factor --> Identifier [ {Mixer} | Assignment | PlusPlus | MinusMinus]
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> Expr

```

(continues on next page)

(continued from previous page)

62.3 Printing Intermediate Code

Command:

```
ring test.ring -ic -norun
```

Output:

```
=====
Byte Code - Before Execution by the VM
=====

PC      OPCode          Data
1      ReturnNull
2      Func      main
3      NewLine     2
4      FuncExE
5      PushC      Hello World
6      LoadA      nl      0
7      PushV
8      SUM        0
9      Print
10     NewLine    3
11     ExitMark   29      28
12     LoadAFirst x
13     PushN      1.000000
14     BeforeEqual 0
15     Assignment
16     PushN      1.000000
17     StepNumber
18     JumpVarLENum x 10.000000 29
19     NewLine    4
20     FuncExE
21     LoadA      x      0
22     PushV
23     LoadA      nl      0
24     PushV
25     SUM        0
26     Print
27     NewLine    5
28     IncJump    x      18
29     POPExitMark
30     POPStep
31     NewLine    6
32     LoadFunc   test
33     Call        0
34     NoOperation
35     NewLine    8
36     PushV
37     FreeStack
38     ReturnNull
```

(continues on next page)

(continued from previous page)

```

39      Func    test
40      NewLine   9
41      FuncExE
42      PushC    welcome
43      LoadA    nl    0
44      PushV
45      SUM     0
46      Print
47      NewLine   10
48      LoadA    o1    0
49      AssignmentPointer
50          New    point
51      SetScope
52          PushV
53      BraceStart
54          LoadA   x    0    58
55      AssignmentPointer
56          PushN   10.000000
57      BeforeEqual  0
58      Assignment   0    0
59      FreeStack
60          LoadA   y    0    64
61      AssignmentPointer
62          PushN   20.000000
63      BeforeEqual  0
64      Assignment   0    0
65      FreeStack
66          LoadA   z    0    70
67      AssignmentPointer
68          PushN   30.000000
69      BeforeEqual  0
70      Assignment   0    0
71      FreeStack
72          LoadFunc  ismethod
73          LoadA    self   0
74          PushV
75          PushC    braceend
76          Call
77      NoOperation
78          PushV
79          JumpZ    85
80      LoadFunc  braceend
81          Call
82      NoOperation
83          PushV
84      FreeStack
85      BraceEnd
86      FreeStack
87          NewLine  11
88          FuncExE
89          LoadA    o1    0
90          PushV
91          Print
92          NewLine  13
93      ReturnNull
94          Class   point  006E8BC0
95      NewLabel

```

(continues on next page)

(continued from previous page)

```

96      LoadA      x      0
97      PushV
98      FreeStack
99      LoadA      y      0
100     PushV
101     FreeStack
102     LoadA      z      0
103     PushV
104     FreeStack
105     ReturnNull
=====
```

62.4 Printing Final Intermediate Code

Command:

```
ring test.ring -icfinal
```

Output:

```

Hello World
1
2
3
4
5
6
7
8
9
10
welcome
x: 10.000000
y: 20.000000
z: 30.000000
=====
```

```
Byte Code - After Execution by the VM
=====
```

PC	OPCode	Data
1	ReturnNull	
2	Func	main
3	NewLine	2
4	FuncExE	
5	PushC	Hello World
6	PushP	007D3670 0
7	PushV	
8	SUM	0
9	Print	
10	NewLine	3

(continues on next page)

(continued from previous page)

```

11   ExitMark      29     28
12   LoadAFirst    x
13       PushN 1.000000
14   BeforeEqual   0
15   Assignment
16       PushN 1.000000
17   StepNumber
18   JumpVarLPLENum      x 10.000000 29
19       NewLine 4
20       FuncExE
21   PushPLocal    x 0
22       PushV
23       PushP 007D3670 0
24       PushV
25       SUM 0
26       Print
27       NewLine 5
28   IncLPJump    x 18
29   POPExitMark
30   POPStep
31       NewLine 6
32   LoadFuncP test
33       Call 0
34   NoOperation
35       NewLine 8
36       PushV
37   FreeStack
38   ReturnNull
39       Func test
40       NewLine 9
41   FuncExE
42       PushC welcome
43       PushP 007D3670 0
44       PushV
45       SUM 0
46       Print
47       NewLine 10
48   PushPLocal o1 0
49   AssignmentPointer
50       New point
51       SetScope
52       PushV
53   BraceStart
54       LoadA x 0 58
55   AssignmentPointer
56       PushN 10.000000
57   BeforeEqual 0
58   SetProperty 0 106
59   FreeStack
60       LoadA y 0 64
61   AssignmentPointer
62       PushN 20.000000
63   BeforeEqual 0
64   SetProperty 0 141
65   FreeStack
66       LoadA z 0 70
67   AssignmentPointer

```

(continues on next page)

(continued from previous page)

```

68      PushN 30.000000
69  BeforeEqual 0
70  SetProperty 0 176
71  FreeStack
72  LoadFunc ismethod
73  LoadA self 0
74  PushV
75  PushC braceend
76  Call
77  NoOperation
78  PushV
79  JumpZ 85
80  LoadFunc braceend
81  Call
82  NoOperation
83  PushV
84  FreeStack
85  BraceEnd
86  FreeStack
87  NewLine 11
88  FuncExE
89  PushPLocal o1 0
90  PushV
91  Print
92  NewLine 13
93  ReturnNull
94  Class point 007D8470
95  NewLabel
96  LoadA x 0
97  PushV
98  FreeStack
99  LoadA y 0
100 PushV
101 FreeStack
102 LoadA z 0
103 PushV
104 FreeStack
105 ReturnNull
106 LoadFunc ismethod
107 LoadA ring_gettemp_var 0
108 PushV
109 PushC setx
110 Call 0
111 NoOperation
112 PushV
113 JumpZ 132
114 NewLine 2
115 LoadA ring_gettemp_var 0
116 LoadMethod setx
117 LoadA ring_settemp_var 0
118 PushV
119 Call 0 1
120 AfterCallMethod
121 PushV
122 FreeStack
123 NewLine 3
124 LoadA ring_tempflag_var 0 128

```

(continues on next page)

(continued from previous page)

```

125 AssignmentPointer
126     PushN 0.000000
127 BeforeEqual 0
128 Assignment 0 0
129 FreeStack
130     NewLine 4
131     Jump 140
132     NewLine 5
133     PushP 007D37D8 0 137
134 AssignmentPointer
135     PushN 1.000000
136 BeforeEqual 0
137 Assignment 0 0
138 FreeStack
139     NewLine 6
140     Return
141 LoadFunc ismethod
142     LoadA ring_gettemp_var 0
143     PushV
144     PushC sety
145     Call 0
146 NoOperation
147     PushV
148     JumpZ 167
149     NewLine 2
150     LoadA ring_gettemp_var 0
151 LoadMethod sety
152     LoadA ring_settemp_var 0
153     PushV
154     Call 0 1
155 AfterCallMethod
156     PushV
157 FreeStack
158     NewLine 3
159     LoadA ring_tempflag_var 0 163
160 AssignmentPointer
161     PushN 0.000000
162 BeforeEqual 0
163 Assignment 0 0
164 FreeStack
165     NewLine 4
166     Jump 175
167     NewLine 5
168     PushP 007D37D8 0 172
169 AssignmentPointer
170     PushN 1.000000
171 BeforeEqual 0
172 Assignment 0 0
173 FreeStack
174     NewLine 6
175     Return
176 LoadFunc ismethod
177     LoadA ring_gettemp_var 0
178     PushV
179     PushC setz
180     Call 0
181 NoOperation

```

(continues on next page)

(continued from previous page)

```

182      PushV
183      JumpZ      202
184      NewLine     2
185      LoadA      ring_gettemp_var      0
186      LoadMethod  setz
187      LoadA      ring_settemp_var      0
188      PushV
189      Call       0      1
190      AfterCallMethod
191      PushV
192      FreeStack
193      NewLine     3
194      LoadA      ring_tempflag_var      0      198
195      AssignmentPointer
196      PushN      0.000000
197      BeforeEqual   0
198      Assignment    0      0
199      FreeStack
200      NewLine     4
201      Jump       210
202      NewLine     5
203      PushP      007D37D8      0      207
204      AssignmentPointer
205      PushN      1.000000
206      BeforeEqual   0
207      Assignment    0      0
208      FreeStack
209      NewLine     6
210      Return
=====
```

62.5 CGI Support

Command:

```
ring test.ring -cgi
```

62.6 No Run

Command:

```
ring test.ring -norun
```

62.7 Printing Instruction Operation Code

Command:

```
ring test.ring -ins
```

Output:

```
=====
Operation : ReturnNull
PC       : 1
Line Number : 1 , File test.ring

SP (After) : 0 - FuncSP : 0
LineNumber 1
=====
.....
.....
.....
```

Tip: Output removed from the previous example because it's very large!

62.8 Performance

Command:

```
ring test.ring -performance
```

Output:

```
=====
Date  : 2015/09/15 Time : 15:56:17
Clock : 0
=====
Hello World
1
2
3
4
5
6
7
8
```

(continues on next page)

(continued from previous page)

```

9
10
welcome
x: 10.000000
y: 20.000000
z: 30.000000

=====
Date : 2015/09/15 Time : 15:56:17
Clock : 0
=====
```

62.9 Generate Object File

You can generate object file (*.ringo*) from your source code file (*.ring*) using -go option

Tip: You will get one object file to use for distributing/running your application which may contains one or many ring source files that you can keep or distribute based on the application (commercial or open source).

Command:

```
ring test.ring -go
```

To run the compiled object file

```
ring test.ringo
```

62.10 Generate Embedded Object File

You can generate embedded object file (C source code) from your source code file (*.ring) using -geo option

Command:

```
ring test.ring -geo
```

This command will generate at least three files

```
test.c
ringappcode.c
ringappcode.h
```

More files could be generated based on the project size

The generated files will pass the byte code to Ring VM to be executed

CHAPTER
SIXTYTHREE

DISTRIBUTING RING APPLICATIONS (MANUAL)

In this chapter we will learn about distributing Ring applications.

The next method is old and was used in Ring 1.5 and previous versions!

Starting from Ring 1.6 we have a nice tool called Ring2EXE

Using Ring2EXE we can distribute applications quickly for Windows, Linux and macOS

Check the Ring2EXE chapter for more information!

63.1 Distributing Applications for Microsoft Windows

Step 1:

```
Copy c:\ring\bin folder to be for example c:\myapp
```

Step 2:

```
Rename c:\myapp\ring.exe to c:\myapp\myapp.exe
```

Step 3:

```
Create a file c:\myapp\ring.ring
```

And write

```
Load "myapp.ring"
```

When you run myapp.exe the file ring.ring will be executed automatically

So your file myapp.ring will be called and executed

Or just rename myapp.ring to ring.ring

It's a fast way to distribute applications.

63.2 Protecting the Source Code

Step 1:

Execute the next command

```
ring myapp.ring -go
```

This will generate one object file (myapp.ringo) from the project files (*.ring)

Step 2:

```
Rename myapp.ringo to ring.ringo
```

When you run the executable file (ring.exe) or (myapp.exe) the file ring.ringo will be executed.

63.3 The files ring.ring and ring.ringo

Ring will run ring.ring or ring.ringo only when

- (1) The file exist in the current directory
- (2) No file is passed to (ring.exe) to execute

We added the support to ring.ring (and ring.ringo) for a way to distribute Ring apps (before Ring2EXE)

63.4 Creating Windows Installer

There are many tools that you can use to distribute your application.

Check : nullsoft scriptable install system

URL : http://nsis.sourceforge.net/Main_Page

63.5 Using C/C++ Compiler and Linker

Another method to distribute applications is to use a C/C++ compiler.

Ring can be embedded in C/C++ projects, We can create executable files using a C/C++ compiler by embedding the Ring language in our project.

Check the “Embedding Ring Language in C/C++ Programs” chapter.

Using this way we will avoid using ring.ring or ring.ringo files.

63.6 Distributing Applications and Games for Mobile

Ring can be embedded in a Qt projects or LibSDL projects to build Mobile applications and Games.

You can build the Qt project or the LibSDL project and get the Android package directly (*.apk)

Check Ring distributions for Mobile development using Qt or LibSDL.

CHAPTER
SIXTYFOUR

DISTRIBUTING RING APPLICATIONS USING RING2EXE

In this chapter we will learn about distributing Ring applications.

Starting from Ring 1.6 we have a nice tool called Ring2EXE (Written in Ring itself)

Using Ring2EXE we can distribute applications quickly for Windows, Linux, macOS, WebAssembly and Mobile devices

Note: We can use the Distribute Menu in the Ring Notepad application (More Easy)

64.1 Using Ring2EXE

```
ring2exe filename.ring [Options]
```

This will set filename.ring as input to the program

The next files will be generated

filename.ringo	(The Ring Object File - by Ring Compiler)
filename.c	(The C Source code file Contains the ringo file content Will be generated by this program)
filename_buildvc.bat	(Will be executed to build filename.c using Visual C/C++)
filename_buildgcc.bat	(Will be executed to build filename.c using GNU C/C++)
filename_buildclang.bat	(Will be executed to build filename.c using CLang C/C++)
filename.obj	(Will be generated by the Visual C/C++ compiler)
filename.exe	(Will be generated by the Visual C/C++ Linker)
filename	(Executable File - On Linux & Mac OS X platforms)

64.2 How Ring2EXE works?

At first the Ring compiler will be used to generate the Ring object file (*.ringo)

If we have a C compiler (optional), This object file will be embedded inside a C source code file

Then using the C compiler and the Ring library (Contains the Ring Virtual Machine) the executable file will be generated!

If we don't have a C compiler, the Ring executable will be copied and renamed to your application name

And your Ring object file (*.ringo) will become ring.ringo to be executed at startup of the executable file.

So it's better and easy to have a C compiler on your machine to be used by Ring2EXE.

64.3 Example

We have test.ring contains the next code

```
see "Hello, World!" + nl
```

To build th executable file for Windows, Linux or macOS

```
ring2exe test.ring
```

To run the program (Windows)

```
test
```

To run the program (Linux and macOS)

```
./test
```

64.4 Options

-keep	: Don't delete Temp. Files
-static	: Build Standalone Executable File (Don't use ring.dll/ring.so/ring.dylib)
-gui	: Build GUI Application (Hide the Console Window)
-dist	: Prepare application for distribution
-allruntime	: Include all libraries in distribution
-mobileqt	: Prepare Qt Project to distribute Ring Application for Mobile
-webassemblyqt → (WebAssembly)	: Prepare Qt Project to distribute Ring Application for the web
-noqt	: Remove RingQt from distribution
-noallegro	: Remove RingAllegro from distribution
-noopenssl	: Remove RingOpenSSL from distribution
-nolibcurl	: Remove RingLibCurl from distribution
-nomysql	: Remove RingMySQL from distribution
-noodbc	: Remove RingODBC from distribution
-nosqlite	: Remove RingSQLite from distribution
-noopengl	: Remove RingOpenGL from distribution
-nofreeglut	: Remove RingFreeGLUT from distribution
-nolibzip	: Remove RingLibZip from distribution
-noconsolecolors	: Remove RingConsoleColors from distribution
-nomurmurhash	: Remove RingMurmurHash from distribution
-nocruntime	: Remove C Runtime from distribution
-qt	: Add RingQt to distribution
-allegro	: Add RingAllegro to distribution
-openssl	: Add RingOpenSSL to distribution
-libcurl	: Add RingLibCurl to distribution
-mysql	: Add RingMySQL to distribution
-odbc	: Add RingODBC to distribution
-sqlite	: Add RingSQLite to distribution
-postgresql	: Add RingPostgreSQL to distribution
-opengl	: Add RingOpenGL to distribution

(continues on next page)

(continued from previous page)

```
-freeglut      : Add RingFreeGLUT to distribution
-libzip        : Add RingLibZip to distribution
-libuv         : Add RingLibuv to distribution
-consolecolors : Add RingConsoleColors to distribution
-murmurhash    : Add RingMurmurHash to distribution
-cruntime      : Add C Runtime to distribution
```

64.5 Building standalone console application

Using the “-static” option we can build executable console application

So we don’t have to use ring.dll, ring.so or ring.dylib

This avoid only the need to Ring dynamic link library

If you are using another libraries, You will need to include it with your application.

```
ring2exe test.ring -static
```

64.6 Distributing RingAllegro Applications

We have test2.ring contains the next code

```
# Just a simple program to test Ring2EXE Tool!
# Using RingAllegro

load "gameengine.ring"  # Give Control to the Game Engine

func main                # Called by the Game Engine

    oGame = New Game      # Create the Game Object
    {
        title = "My First Game"
    }
```

To build the executable file and prepare for distributing the Game

We use “-dist” option and “-allruntime” to include all libraries

```
ring2exe test2.ring -dist -allruntime
```

After executing the previous command

On Windows we will have : target/windows folder

On Linux we will have : target/linux folder

On macOS we will have : target/macos folder

The previous command will add all of the Ring runtime libraries to our distribution

But we may need only RingAllegro, So it’s better to use the next command

```
ring2exe test2.ring -dist -allegro -cruntime
```

This will produce smaller size distribution and will avoid the runtime files that we don't need!

Also we could use the “-gui” option to hide the console window

So it's better to use the next command

```
ring2exe test2.ring -dist -gui -allegro -cruntime
```

64.7 Distributing RingQt Applications

We have test3.ring contains the next code

```
# Just a simple program to test Ring2EXE Tool!
# Using RingQt

load "guilib.ring"

new qApp {
    new QWidget() {
        setWindowTitle("Hello, World!")
        resize(400,400)
        show()
    }
    exec()
}
```

To build the executable file and prepare for distributing the GUI application

We use “-dist” option and “-allruntime” to include all libraries

```
ring2exe test3.ring -dist -allruntime
```

After executing the previous command

On Windows we will have : target/windows folder

On Linux we will have : target/linux folder

On macOS we will have : target/macos folder

The previous command will add all of the Ring runtime libraries to our distribution

But we may need only RingQt, So it's better to use the next command

```
ring2exe test3.ring -dist -qt -cruntime
```

This will produce smaller size distribution and will avoid the runtime files that we don't need!

Also we could use the “-gui” option to hide the console window

So it's better to use the next command

```
ring2exe test3.ring -dist -gui -qt -cruntime
```

64.8 Distributing Applications for Mobile using RingQt

To prepare a Qt project for your RingQt application (test3.ring) use the “-mobileqt” option

Example :

```
ring2exe test3.ring -dist -mobileqt
```

After executing the previous command, We will have the Qt project in target/mobile/qtproject folder

The main project file will be project.pro which we can open using the Qt Creator IDE.

Also we will have the resource file : project.qrc

Another important file is our C++ main file : main.cpp

64.9 Distributing Applications for WebAssembly using RingQt

To prepare a Qt project (WebAssembly) for your RingQt application (myapp.ring) use the “-webassemblyqt” option

Example :

```
ring2exe myapp.ring -dist -webassemblyqt
```

After executing the previous command, We will have the Qt project in target/webassembly/qtproject folder

The main project file will be project.pro which we can open using the Qt Creator IDE.

Also we will have the resource file : project.qrc

Another important file is our C++ main file : main.cpp

64.10 Building the Cards Game for Mobile using RingQt

For a better example, consider building an Android package for the Cards game that comes with the Ring language in this folder : ring/application/cards

The Cards game folder contains three files

cards.ring : The Game source code

cards.jpg : The image file used by the game

project.qrc : Resource file to be used with the Qt project

The resource file contains the next content

```
<RCC>
    <qresource>
        <file>cards.ringo</file>
        <file>cards.jpg</file>
    </qresource>
</RCC>
```

We have two files in the resource file

The first file is cards.ringo (The Ring Object File) and the second file is cards.jpg (The image file)

As a start, Ring2EXE will generate this resource file in target/mobile/qtproject/project.qrc
 But this file will contains only cards.ringo (That Ring2EXE will generate by calling Ring compiler)
 We need to update this resource file to add the image file : cards.jpg
 After this update, we copy the resource file to the main application folder
 So when we use Ring2EXE again, Our updated resource file will be used!
 Now to build the cards game for Mobile

(1) Run the next command

```
ring2exe cards.ringo -dist -mobileqt
```

- (2) Open target/mobile/qtproject/project.pro using Qt creator
- (3) Build and Run using Qt Creator

How the Cards game will find the image file ?

RingQt comes with a simple function : AppFile() that we can use to determine the files that we may access on Desktop or Mobile platforms

The next code from cards.ring

```
mypic = new QPixmap(AppFile("cards.jpg"))
```

So all what you need is using AppFile() function around your image files!

64.11 Building the Weight History Application for Mobile using RingQt

Another example to distribute your application for Mobile Devices using Ring2EXE and Qt consider building an Android package for the Weight History application that comes with the Ring language in this folder : ring/application/weighthistory

The Weight History application folder contains four files

weighthistory.ring : The application source code

weighthistory.db : The SQLite database

project.qrc : The resource file for the Qt project

main.cpp : The main C++ source file for the Qt project

To build the Weight History application for Mobile

(1) Run the next command

```
ring2exe weighthistory.ring -dist -mobileqt
```

- (2) Open target/mobile/qtproject/project.pro using Qt creator
- (3) Build and Run using Qt Creator

The resource file (project.qrc) contains two files

```
<RCC>
    <qresource>
        <file>weighthistory.ringo</file>
        <file>weighthistory.db</file>
    </qresource>
</RCC>
```

The first file is weighthistory.ringo (Ring Object File - Generated by Ring2EXE by calling Ring compiler)

The database file : weighthistory.db

The main.cpp contains the next little update, To copy the database file from resources to a writable location on the mobile device

```
QString path3 ;
path3 = path+"/weighthistory.db";
QFile::copy(":/weighthistory.db",path3);
```

You will need to do this with database files only!

When we use Ring2EXE, the tool will check for project.qrc and main.cpp, if they exist then your updated files will be used in target/mobile/qtproject instead of the default version generated by Ring2EXE

So Use Ring2EXE to generate these files, Then copy them to your application folder when you update them.

64.12 Building the Form Designer for Mobile using RingQt

To build the Form Designer application (ring/tools/formdesigner) for Mobile

(1) Run the next command

```
ring2exe formdesigner.ring -dist -mobileqt
```

(2) Open target/mobile/qtproject/project.pro using Qt creator

(3) Build and Run using Qt Creator

in the folder ring/application/formdesigner You will find the resource file : project.qrc

It will be used automatically by Ring2EXE

```
<RCC>
    <qresource>
        <file>formdesigner.ringo</file>
        <file>image/allevents.png</file>
        <file>image/checkbox.png</file>
        <file>image/close.png</file>
        <file>image/combobox.bmp</file>
        <file>image/datetimepicker.bmp</file>
        <file>image/dial.png</file>
        <file>image/formdesigner.png</file>
        <file>image/frame.png</file>
        <file>image/grid.bmp</file>
        <file>image/hyperlink.png</file>
        <file>image/image.png</file>
        <file>image/label.png</file>
        <file>image/layout.png</file>
```

(continues on next page)

(continued from previous page)

```

<file>image/lcdnumber.png</file>
<file>image/listview.png</file>
<file>image/lock.png</file>
<file>image/new.png</file>
<file>image/open.png</file>
<file>image/progressbar.png</file>
<file>image/project.png</file>
<file>image/pushbutton.png</file>
<file>image/radiobutton.png</file>
<file>image/save.png</file>
<file>image/saveas.png</file>
<file>image/select.png</file>
<file>image/slider.png</file>
<file>image/spinner.bmp</file>
<file>image/statusbar.png</file>
<file>image/tab.png</file>
<file>image/textarea.png</file>
<file>image/textfield.png</file>
<file>image/timer.png</file>
<file>image/toolbar.png</file>
<file>image/tree.bmp</file>
<file>image/videowidget.png</file>
<file>image/webview.png</file>
</qresource>
</RCC>
```

As we did in the Cards game, The Form Designer will use the AppFile() function to determine the name of the Image files.

The next code from ring/tools/formdesigner/mainwindow/formdesignerview.ring

```

func CreateToolBar
    aBtns = [
        new qtoolbutton(win) {
            setbtnimage(self,AppFile("image/new.png"))
            setclickevent(Method(:NewAction))
            settooltip("New File")
        },
        new qtoolbutton(win) {
            setbtnimage(self,AppFile("image/open.png"))
            setclickevent(Method(:OpenAction))
            settooltip("Open File")
        },
        new qtoolbutton(win) {
            setbtnimage(self,AppFile("image/save.png"))
            setclickevent(Method(:SaveAction))
            settooltip("Save")
        },
        new qtoolbutton(win) {
            setbtnimage(self,AppFile("image/saveas.png"))
            setclickevent(Method(:SaveAsAction))
            settooltip("Save As")
        },
        new qtoolbutton(win) {
            setbtnimage(self,AppFile("image/close.png"))
            setclickevent(Method(:ExitAction))
            settooltip("Exit")
        }
    ]
}
```

(continues on next page)

(continued from previous page)

```

        }
    ]

tool1 = win.addtoolbar("files") {
    for x in aBtns { addwidget(x) addseparator() }
}

```

From this example, We know that we can use sub folders for images.

64.13 Creating the Qt resource file using Folder2qrc

When we have large RingQt project that contains a lot of images and files, We need to add these files to the resource file (*.qrc) when distributing applications for Mobile devices.

Instead of adding these files one by one, Ring 1.6 comes with a simple tool that save our time, It's called Folder2qrc.

Example:

```
folder2qrc formdesigner.ring
```

We determine the main source file while we are in the application folder, and Folder2qrc will check all of the files in the current folder and sub folders, Then add them to the resource file after the mainfile.ringo (In our example this will be formdesigner.ringo)

The output file will be : project.qrc

You can open it and remove the files that you don't need in the resources!

64.14 Important Information about Ring2EXE

- Using Ring2EXE to prepare distribution will delete all of the files in the old distribution
for example, if you have target/windows folder then used

```
ring2exe test3.ring -dist -allruntime
```

The files in target/windows will be deleted before adding the files again

This is important when you prepare a distribution for Mobile devices

```
ring2exe test3.ring -dist -mobileqt
```

If you modified the resource file : project.qrc or the main file : main.cpp

Don't forget to copy them to the application folder!

So Ring2EXE can use the updated version if you tried the previous command again!

- Ring2EXE is written in Ring, and you can read the source code from

<https://github.com/ring-lang/ring/blob/master/tools/ring2exe/ring2exe.ring>

- The libraries information are stored in a separated files, So these files can be updated in the future automatically to support new libraries

<https://github.com/ring-lang/ring/blob/master/tools/ring2exe/libs>

CHAPTER
SIXTYFIVE

THE RING PACKAGE MANAGER (RINGPM)

In this chapter we will learn about using the Ring Package Manager (RingPM)
RingPM is a tool for discovering, installing and updating Ring packages.

65.1 Features

The Package Manager uses Semantic Versioning to check compatibility between packages
The Package Manager comes with the next options

```
Usage   : ringpm [command]
Command : search  [keywords...]
Command : refresh : Update the Registry (Packages List)
Command : install [ <packagename> [from <UserName>] [branch <branchname>] ]
Command : list    [-u : check updates]
Command : run     [packagename]
Command : update  <packagename>
Command : remove  <packagename>
Command : format  : Delete All Packages
Command : new     <packagename>
Command : package : Create package in the current folder
```

65.2 Discovering Packages

We can discover new packages using the Search command

Using this command we can search in the RingPM Registry (Packages Index)

The RingPM Registry is a local copy of all registered packages.

```
ringpm search [keywords...]
```

Example:

```
ringpm search notepad
```

Output:

```
Package : ringnotepad (Ring Notepad)
Package : notepadppeditorextension (Notepad++ Editor Extension package)
```

To print all packages in the RingPM Registry, use the search command without keywords.

Example:

```
ringpm search
```

65.3 Updating the RingPM Registry

The RingPM Registry is a local copy of all registered packages.

We can update the local copy using the Refresh command

Example:

```
ringpm refresh
```

Output:

```
No updates to the Registry, Nothing to do!
```

Or

```
The Registry is updated from revision 110 (2019/01/13) to revision 112 (2019/01/15)
```

65.4 Installing Packages

We can install new packages using the Install command

```
ringpm install [ <packagename> [from <UserName>] [branch <branchname>] ]
```

We can type only the package name to get the package information from the RingPM Registry or we can determine the user name (GitHub) and the branch name of the github project (optional).

If the current folder is a package folder then we don't need to write the package name.

Example (1) :

```
ringpm install ringnotepad
```

Example (2) :

```
ringpm install goldmagic800
```

Example (3) :

```
ringpm install gameoflife
```

If the package is not added to the RingPM Registry, We can install it directly from the GitHub user

Example (4) :

```
ringpm install firstpackage from mahmoudfayed
```

To run the package after installation

```
ringpm run firstpackage
```

To install a package in the current folder

Example (5) :

```
ringpm install
```

65.5 Printing List of Installed Packages

We can know the installed packages using the List command

```
ringpm list [-u : check updates]
```

Example

```
ringpm list
```

Output

(analogclock)	:	The AnalogClock Package [master]	-- (1.0.0)
(androidringlibsdl)	:	The AndroidRingLibSDL Package [master]	-- (1.0.0)
(androidringqt)	:	The AndroidRingQt Package [master]	-- (1.0.0)
(atomeditorextension)	:	The AtomEditorExtension Package [master]	-- (1.0.0)
(bignumbers)	:	The BigNumber Package [master]	-- (1.0.0)
(calculator)	:	The Calculator Package [master]	-- (1.0.0)
(cards)	:	The Cards Package [master]	-- (1.0.0)
(checkers)	:	The Checkers Package [master]	-- (1.0.0)
(chess)	:	The Chess Package [master]	-- (1.0.0)
....			

To check for new updates

```
ringpm list -u
```

65.6 Run Package

After installing a package, we can run it using the Run command.

```
ringpm run [packagename]
```

Example(1):

```
ringpm run ringnotepad
```

Example(2):

```
ringpm run goldmagic800
```

Example(3):

```
ringpm run gameoflife
```

To run a package in the current folder

Example(4):

```
ringpm run
```

65.7 Update Package

We can update a package using the Update command

```
ringpm update <packagename>
```

Example:

```
ringpm update ringnotepad
```

65.8 Remove Package

We can remove a package using the Remove command

```
ringpm remove <packagename>
```

Example:

```
ringpm remove ringnotepad
```

65.9 Deleting All Packages

We can delete all packages using the Format command

Example:

```
ringpm format
```

65.10 Creating New Package

We can create new package using the New command

```
ringpm new <packagename>
```

Example:

```
ringpm new myapp
```

This will create new folder called my myapp

The new folder will contains the next file

- package.ring : The package description and files

- main.ring : main program (used by the Run command)
- lib.ring : library file for the package

File : main.ring

```
# The Main File

load "lib.ring"

func main

? "Hello, World!"
```

File : lib.ring

```
# The Library File
```

File : package.ring

```
aPackageInfo = [
    :name = "The myapp Package",
    :description = "Our myapp package using the Ring programming language",
    :folder = "myapp",
    :developer = "",
    :email = "",
    :license = "MIT License",
    :version = "1.0.0",
    :ringversion = "1.10",
    :versions = [
        [
            :version = "1.0.0",
            :branch = "master"
        ]
    ],
    :libs = [
        [
            :name = "",
            :version = "",
            :providerusername = ""
        ]
    ],
    :files = [
        "lib.ring",
        "main.ring"
    ],
    :ringfolderfiles = [
        [
            ...
        ],
        :windowsfiles = [
            ...
        ],
        :linuxfiles = [
            ...
        ],
        :ubuntufiles = [
            ...
        ],
        :fedorafiles = [
            ...
        ]
    ]
]
```

(continues on next page)

(continued from previous page)

```

],
:macosfiles =      [
],
:windowsringfolderfiles =      [
],
:linuxringfolderfiles =      [
],
:ubunturingfolderfiles =      [
],
:fedoraringfolderfiles =      [
],
:macosringfolderfiles =      [
],
:run = "ring main.ring",
:windowsrun = "",
:linuxrun = "",
:macosrun = "",
:ubunturun = "",
:fedorarun = "",
:setup = "",
:windowssetup = "",
:linuxsetup = "",
:macossetup = "",
:ubuntusetup = "",
:fedorasetup = "",
:remove = "",
:windowsremove = "",
:linuxremove = "",
:macosremove = "",
:ubunturemove = "",
:fedoraremove = "
]

```

65.11 The Package Description File

The package description file contains the package information defined in the list aPackageInfo

Attribute	Description
Name	Package Name
Description	Package Description
Folder	The Folder Name (Will be created in ring/ringpm/packages)
Developer	The Package Developer Name
Email	The Package Developer Email
License	The Package License
Version	The Current Version of the Package (Latest Release)

continues on next page

Table 1 – continued from previous page

Attribute	Description
RingVersion	The Required Ring Language Version (Minimum Version)
Versions	List of different versions provided by different branches in the GitHub project
Libs	List of dependencies (Defined by name, version & GitHub user name)
Files	List of files (will be installed in ring/ringpm/packages/[Folder])
RingFolderFiles	List of files (will be installed in ring folder)
WindowsFiles	Like (Files) but for Microsoft Windows Only
LinuxFiles	Like (Files) but for Linux Only
MacOSFiles	Like (Files) but for macOS Only
UbuntuFiles	Like (Files) but for Ubuntu Only
FedoraFiles	Like (Files) but for Fedora Only
WindowsRingFolderFiles	Like (RingFolderFiles) but for Microsoft Windows Only
LinuxRingFolderFiles	Like (RingFolderFiles) but for Linux Only
MacOSRingFolderFiles	Like (RingFolderFiles) but for macOS Only
UbuntuRingFolderFiles	Like (RingFolderFiles) but for Ubuntu Only
FedoraRingFolderFiles	Like (RingFolderFiles) but for Fedora Only
Run	System Command (Command prompt or Terminal) to run the package
WindowsRun	Like (Run) but for Microsoft Windows Only
LinuxRun	Like (Run) but for Linux Only
MacOSRun	Like (Run) but for macOS Only
UbuntuRun	Like (Run) but for Ubuntu Only
FedoraRun	Like (Run) but for Fedora Only
Setup	System Command (Command prompt or Terminal) after downloading the package files
WindowsSetup	Like (Setup) but for Microsoft Windows Only
LinuxSetup	Like (Setup) but for Linux Only
MacOSSetup	Like (Setup) but for macOS Only
UbuntuSetup	Like (Setup) but for Ubuntu Only
FedoraSetup	Like (Setup) but for Fedora Only
Remove	System Command (Command prompt or Terminal) before removing the package files
WindowsRemove	Like (Remove) but for Microsoft Windows Only
LinuxRemove	Like (Remove) but for Linux Only
MacOSRemove	Like (Remove) but for macOS Only
UbuntuRemove	Like (Remove) but for Ubuntu Only
FedoraRemove	Like (Remove) but for Fedora Only

65.12 Create Package in the Current Folder

To create a package for an application that already exists, go to the application folder then type

```
ringpm package
```

This will create the package definition file (package.ring) and will add all of the application files to the package definition.

Each RingPM package contains the package definition file (package.ring)

The package definition file is a list that describe the package information and files.

Example :

The package definition file for the Ring Notepad package

```

aPackageInfo = [
    :name = "The RingNotepad Package",
    :description = "Our RingNotepad package using the Ring programming language",
    :folder = "ringnotepad",
    :developer = "Mahmoud Fayed",
    :email = "msfclipper@yahoo.com",
    :license = "MIT License",
    :version = "1.0.0",
    :ringversion = "1.10",
    :versions = [
        [
            :version = "1.0.0",
            :branch = "master"
        ]
    ],
    :libs = [
        [
            :name = "stdlib",
            :version = "1.0",
            :providerusername = ""
        ],
        [
            :name = "ringqt",
            :version = "1.0",
            :providerusername = ""
        ],
        [
            :name = "findinfiles",
            :version = "1.0",
            :providerusername = ""
        ],
        [
            :name = "formdesigner",
            :version = "1.0",
            :providerusername = ""
        ],
        [
            :name = "libdepwin_apache",
            :version = "1.0",
            :providerusername = ""
        ]
    ],
    :files = [
        "main.ring",
        "README.md"
    ],
    :ringfolderfiles = [
        "applications/rnote/batch/killwebserver.bat",
        "applications/rnote/batch/run.bat",
        "applications/rnote/batch/run2.bat",
        "applications/rnote/image/back.jpg",
        "applications/rnote/image/back2.jpg",
        "applications/rnote/image/close.png",
        "applications/rnote/image/colors.png",
        "applications/rnote/image/copy.png",
        "applications/rnote/image/cut.png",
        "applications/rnote/image/debug.png",
        "applications/rnote/image/icon.png"
    ]
]

```

(continues on next page)

(continued from previous page)

```

"applications/rnote/image/font.png",
"applications/rnote/image/formdesigner.png",
"applications/rnote/image/new.png",
"applications/rnote/image/notepad.png",
"applications/rnote/image/open.png",
"applications/rnote/image/paste.png",
"applications/rnote/image/print.png",
"applications/rnote/image/project.png",
"applications/rnote/image/richtext.png",
"applications/rnote/image/run.png",
"applications/rnote/image/rungui.png",
"applications/rnote/image/save.png",
"applications/rnote/image/saveas.png",
"applications/rnote/image/search.png",
"applications/rnote/image/source.png",
"applications/rnote/image/undo.png",
"applications/rnote/image/web.png",
"applications/rnote/README.md",
"applications/rnote/rnote.ring",
"applications/rnote/rnoteactivefile.ring",
"applications/rnote/rnoteactivefolder.ring",
"applications/rnote/rnoteautocomplete.ring",
"applications/rnote/rnotebase.ring",
"applications/rnote/rnotecontroller.ring",
"applications/rnote/rnotedistribute.ring",
"applications/rnote/rnoteeditmenu.ring",
"applications/rnote/rnoteeditorevents.ring",
"applications/rnote/rnotefilenumenu.ring",
"applications/rnote/rnotefiles.ring",
"applications/rnote/rnotefiletabs.ring",
"applications/rnote/rnotefind.ring",
"applications/rnote/rnotefindinfiles.ring",
"applications/rnote/rnoteformdesigner.ring",
"applications/rnote/rnotegoto.ring",
"applications/rnote/rnotehelp.ring",
"applications/rnote/rnotelists.ring",
"applications/rnote/rnotemainfiletoolbar.ring",
"applications/rnote/rnotemainwindow.ring",
"applications/rnote/rnotemode.ring",
"applications/rnote/rnoteoutputwindow.ring",
"applications/rnote/rnoteprogrammenu.ring",
"applications/rnote/rnoterun.ring",
"applications/rnote/rnotesettings.ring",
"applications/rnote/rnotestyle.ring",
"applications/rnote/rnotetabwidth.ring",
"applications/rnote/rnotetools.ring",
"applications/rnote/rnotetreeviewevents.ring",
"applications/rnote/rnoteviewmenu.ring",
"applications/rnote/rnotewebbrowser.ring"
],
:run = "ring main.ring"
]

```

65.13 The RingPM Registry File

The RingPM Registry is a local copy of all registered packages.

```
aPackagesRegistry = [
    [ :name = "ringpresentation",
      :description = "Powerpoint presentation for the Ring programming language",
      :ProviderUserName = "ringpackages"
    ]
    # ...
]
```

Each package is defined using a list that determine

- Package Name
- Package Description
- Provider User Name (GitHub User Name)

We can register new packages by updating the registry file then sending a Pull Request

URL : <https://github.com/ring-lang/ring/blob/master/tools/ringpm/registry.ring>

USING ZEROLIB

In this chapter we will learn how to use the ZeroLib library.

66.1 Introduction

ZeroLib is a simple library written in Ring.

The library provides classes for Lists and String where the index starts from 0.

66.2 Z() function

Syntax:

```
Z(String|List) ---> New Object (ZeroBasedString|ZeroBasedList)
```

66.3 ZeroBasedList Class

Simple class provide a List where the index starts from zero.

Methods:

Method	Description/Output
Init(List)	
Add(Value)	Add item to the list
Insert(nIndex,Value)	Inset Item after nIndex
Find(Value)	Find item
Delete(nIndex)	Delete item from the list
Item(nIndex)	Get item from the list
First()	Get the first item in the list
Last()	Get the last item in the list
Set(nIndex,Value)	Set item value
FindInColumn(nCol,Value)	Find item in a column
Sort()	Sort items - return new list
Reverse()	Reverse items - return new list
Swap(nIndex1,nIndex2)	Swap two items

Example:

```

load "zerolib.ring"

? "Using List - Index start from 0"
List = Z( [1,2,3] )
List.Add(4)
List.Add(5)
? List[0]
? List[1]
? List[2]
? List[3]
? List[4]
nIndex = List.find(2)
? "Find(2) = " + nIndex
List.delete(0)
? "After deleting the first item : List[0]"
? "Now List[0] = " + List[0]

```

Output:

```

Using List - Index start from 0
1
2
3
4
5
Find(2) = 1
After deleting the first item : List[0]
Now List[0] = 2

```

66.4 ZeroBasedString Class

Simple class provide a String where the index starts from zero.

Method	Description/Output
Init(String Number)	
Lower()	New String - Lower case characters
Upper()	New String - Upper case characters
Left(x)	New String - contains x characters from the left
Right(x)	New String - contains x characters from the right
Lines()	Number - Lines count
Trim()	New String - Remove Spaces
Copy(x)	New String - repeat string x times
strcmp(cString)	Compare string with cString
tolist()	List (String Lines to String Items)
tofile(cFileName)	Write string to file
mid(nPos1,nPos2)	New String - from nPos1 to nPos2
getfrom(nPos1)	New String - from nPos1 to the end of the string
replace(cStr1,cStr2,lCase)	New String - Replace cStr1 with cStr2 , lCase (True=Match Case)
split()	List - Each Word as list item
startswith(substring)	Return true if the start starts with a substring
endswith(substring)	Return true if the start ends with a substring

Example:

```
load "zerolib.ring"

? "Using String - Index start from 0"
String = Z( "Welcome" )
? String[0]
? String[1]
? String[2]
? String[3]
? String[4]
? String[5]
? String[6]
```

Output:

```
Using String - Index start from 0
W
e
l
c
o
m
e
```

66.5 Source Code

We can find the library source code in this folder

URL : <https://github.com/ring-lang/ring/tree/master/libraries/zerolib>

CHAPTER
SIXTYSEVEN

FOXRING FUNCTIONS REFERENCE

A class contains functions similar to FoxPro functions.

67.1 FoxRing functions

Function Name	Description
frAbs()	Returns the absolute value of the specified numeric expression.
frAddBs()	Adds a backslash (if needed) to a path expression.
frALines()	Creates an Array with the content of the specified string.
frAllTrim()	Removes all leading and trailing spaces of the specified string.
frAsc()	Returns the ANSI value for the leftmost character in a character expression.
frAt()	Searches a character expression for the occurrence of another character expression.
frAtC()	Searches a character expression for the occurrence of another character expression without regard for the case of these two expressions.
frBetween()	Determines whether the value of an expression is inclusively between the values of two expressions of the same type.
frChr()	Returns the character associated with the specified numeric ANSI code.
frEmpty()	Determines whether an expression evaluates to empty.
frFile()	Checks if a file exists on disk.
frFileToStr()	Returns the contents of a file as a character string.
frForceExt()	Returns a string with the old file name extension replaced by a new extension.
frForcePath()	Returns a file name with a new path name substituted for the old one.
frIif()	Returns one of two values depending on the value of a logical expression.
frInList()	Determines whether an expression matches another expression in a list.
frInt()	Evaluates a numeric expression and returns the integer portion of the expression.
frJustDrive()	Returns the drive letter from a complete path.
frJustExt()	Returns the characters of a file extension from a complete path.
frJustFName()	Returns the file name portion of a complete path and file name.
frJustPath()	Returns the path portion of a complete path and file name.
frJustStem()	Returns the stem name (the file name before the extension) from a complete path and file name.
frLen()	Determines the number of characters in a character expression, indicating the length of the expression.
frListToString()	Creates a string with the string elements of an Array.
frLTrim()	Removes all leading spaces or parsing characters from the specified character expression.
frPadL()	Returns a string from an expression, padded with spaces or characters to a

continues on next page

Table 1 – continued from previous page

Function Name	Description
	specified length on the left side.
frPadR()	Returns a string from an expression, padded with spaces or characters to a specified length on the right side.
frProper()	Returns from a character expression a string capitalized as appropriate for proper names.
frReplicate()	Returns a character string that contains a specified character expression repeated a specified number of times.
frRTrim()	Removes all trailing spaces or parsing characters from the specified character expression.
frSetIfEmpty()	Set a Value into a variable if the variable value is empty, null or zero.
frSetSeparatorTo()	Specifies the character for the numeric place separator.
frSpace()	Returns a character string composed of a specified number of spaces.
frStr()	Returns the character equivalent of a numeric expression.
frStringToList()	Creates a List with the content of the specified string.
frStrTran()	Searches a character expression for a second character expression and replaces each occurrence with a third character expression.
frStuff()	Returns a new character string replaced by a specified number of characteres in a character expression with another character expression.
frSubStr()	Returns a character string from the given character expression, starting at a specified position in the character expression and continuing for a specified number of characters.
frTransform()	Returns a character string from an expression in a format determined by a format code.
frVal()	Returns a numeric value from a character expression composed of numbers.
frVarType()	Returns the data type of an expression.

67.2 frAbs() function

```
* Syntax      : lnReturnValue = frAbs(tnExpression)
* Description : Returns the absolute value of the specified numeric expression.
*           :
* Arguments   : <tnExpression>
*           : Specifies the numeric expression whose absolute value frAbs()
*           : returns.
* Returns     : <lnReturnValue>
*           : Returns the absolute value of the specified numeric expression.
```

67.3 frAsc() function

```
* Syntax      : lnReturnValue = frAsc(tcExpression)
* Description : Returns the ANSI value for the leftmost character in
*           : a character expression.
* Arguments   : <tcExpression>
*           : Specifies the character expression containing the character
*           : whose ANSI value frAsc()
*           : returns. Any characters after the first character in
*           : tcExpression are ignored by frAsc().
```

(continues on next page)

(continued from previous page)

* Returns : <lnReturnValue>
* : returns the position of the character in the character
* : table of the current code page.
* : Every character has a unique ANSI value in the
* : range from 0 to 255.

67.4 frAddBs() function

* Syntax : lcReturnValue = frAddBs(tcPath)
* Description : Adds a backslash (if needed) to a path expression.
* :
* Arguments : <tcPath>
* : Specifies the path name to which to add the backslash.
* :
* Returns : <lcReturnValue> The path with the backslash.

67.5 frAt() function

* Syntax : lnPos = frAt(tcToSearch, tcString, tnOccurrence)
* Description : Searches a character expression for the occurrence of
* : another character expression.
* : The search performed by frAt() is case-sensitive.
* :
* Arguments : <tcToSearch>
* : Specifies the character expression to search
* : for in <tcString>.
* : <tcString>
* : Specifies the character expression to search
* : for <tcToSearch>.
* : <tnOccurrence>
* : Specifies which occurrence, first, second, third,
* : and so on, of <tcToSearch> to search for
* : in <tcString>.
* : By default, frAt() searches for the first occurrence
* : of <tcToSearch> (tnOccurrence = 1).
* Returns : Numeric. frAt() returns an integer indicating the
* : position of the first character for a
* : character expression or memo field within another
* : character expression or memo field,
* : beginning from the leftmost character. If the
* : expression or field is not found, or if
* : <tnOccurrence> is greater than the number of
* : times <tcToSearch> occurs in <tcString>, frAt()
* : returns 0.

67.6 frAtC() function

```

* Syntax      : lnPos = frAtC(tcToSearch, tcString, tnOccurrence)
* Description : Searches a character expression for the occurrence
*               : of another character expression
*               : without regard for the case of these two expressions.
*
*               :
* Arguments   : <tcToSearch>
*               : Specifies the character expression to search
*               : for in <tcString>.
*               : <tcString>
*               : Specifies the character expression to search
*               : for <tcToSearch>.
*               : <tnOccurrence>
*               : Specifies which occurrence, first, second, third,
*               : and so on, of <tcToSearch> to search for
*               : in tcString.
*               : By default, frAtC() searches for the first occurrence
*               : of <tcToSearch> (tnOccurrence = 1).
* Returns     : Numeric. frAtC() returns an integer indicating the
*               : position of the first character for a
*               : character expression or memo field within
*               : another character expression or memo field,
*               : beginning from the leftmost character. If the
*               : expression or field is not found, or if
*               : <tnOccurrence> is greater than the number of
*               : times <tcToSearch> occurs in <tcString>, frAtC()
*               : returns 0.

```

67.7 frChr() function

```

* Syntax      : lcReturnValue = frChr(tnExpression)
* Description : Returns the character associated with the specified numeric
*               : ANSI code.
* Arguments   : <tnExpression>
*               : Specifies a number between 0 and 255 whose equivalent ANSI
*               : character frChr() returns.
* Returns     : <lcReturnValue>
*               : Returns a single character corresponding to the numeric
*               : position of the character in the
*               : character table of the current code page.
*
*               :
* Remarks     : tnExpression must be between 0 and 255

```

67.8 frEmpty() function

```
* Syntax      : llReturnValue = frEmpty(tuExpression)
* Description : Determines whether an expression evaluates to empty.
*
*          :
* Arguments   : <tuExpression>
*          : Specifies the expression that EMPTY() evaluates.
*          : You can specify an expression with Character,
*          : Numeric, or logical type.
*
*          :
* Returns     : <llReturnValue> Logical
```

67.9 frFile() function

```
* Syntax      : llReturnValue = frFile(tcFileName, tnFlag)
* Description : Checks if the specified file exists on disk.
*
*          :
* Arguments   : <tcFileName>
*          : Specifies the name of the file to check.
*          : tcFileName must include
*          : the file extension. You can include a path with
*          : the file name to
*          : search for a file in a directory or on a drive
*          : other than the current directory or drive.
*
*          :
*          : <tnFlag>
*          : tnFlag was included for future compatibility.
*          : In this version, It always returns true whenever
*          : the file exists on disk.
* Returns     : <llReturnValue> Logical
*          : True if file exists on disk.
*          : False if file doesn't exist on disk.
```

67.10 frFileToStr() function

```
* Syntax      : lcReturnValue = frFileToStr(tcFileName)
* Description : Returns the contents of a file as a character string.
*
*          :
* Arguments   : <tcFileName>
*          : Specifies the name of the file whose contents are
*          : returned as a character
*          : string. If the file is in a directory other than
*          : the current default directory,
*          : include a path with the file name.
*
*          :
* Returns     : <lcReturnValue>
*          : A character string with the content of the specified file.
*          :
```

67.11 frStr() function

```

* Syntax      : lcReturnValue = frStr(tnValue, tnLen, tnDec)
* Description : Returns the character equivalent of a numeric expression.
*
*           :
* Arguments   : <tnValue>
*           : Specifies the numeric expression to evaluate.
*
*           :
*           : <tnLen>
*           : Specifies the length of the character string returned.
*           : If tnLen is 0, tnLen defaults to 10 characters.
*           : If tnLen < 0 returns one string with same length as the number.
*
*           : Note
*           : If the expression contains a decimal point,
*           : the length includes one character for
*           : the decimal point and one character
*           : for each digit in the character string.
*
*           :
*           : <tnDec>
*           : Specifies the number of decimal places in the
*           : character string returned.
*           : To specify the number of decimal places using
*           : tnDec, you must include nLength. If nDecimalPlaces is omitted,
*           : the number of decimal places defaults to zero (0).
*
*           :
* Returns     : Character data type. frStr() returns a character string
*           : equivalent to the specified numeric expression.
*           : Depending on certain conditions, frStr() can return the following:
*           : If you specify fewer decimal places than exist in tnValue,
*           : the return value is rounded up. To round results to the nearest
*           : decimal place instead of upward, include the ROUND( ) function.
*           : For more information, see ROUND( ) Function.
*           : If nExpression is an integer, and nLength is less than
*           : the number of digits in nExpression, frStr( ) returns a string of
*           : asterisks, indicating numeric overflow.
*           : If nExpression contains a decimal point, and nLength is equal
*           : to or less than the number of digits to the left of the decimal
*           : point, frStr( ) returns a string of asterisks,
*           : indicating numeric overflow.
*           : If nLength is greater than the length of the value evaluated
*           : by nExpression, frStr( ) returns a character string padded with
*           : leading spaces.
*           : If nExpression has Numeric or Float type, and nLength
*           : is less than the number of digits in nExpression, and , frStr( )
*           : returns a value using scientific notation.

```

67.12 frSetIfEmpty() function

```
* Syntax      : tuReturnValue = frSetIfEmpty(tuValue, tunewValue)
* Description : Set a Value into a variable if the variable
*               : value is empty, null or zero.
* Arguments   : <tuValue>
*               : The value to evaluate.
*               :
*               :
*               : <tunewValue>
*               : The value to set if tuValue is empty.
*               :
* Returns    : tunewValue if tuValue is empty, otherwise
*               : returns the original value.
* Remarks    : This function doesn't exist in VFP.
```

67.13 frSpace() function

```
* Syntax      : lcReturnValue = frSpace(tnSpaces)
* Description : Returns a character string composed of a
*               : specified number of spaces.
* Arguments   : <tnSpaces>
*               : Specifies the number of spaces that frSpace() returns.
*               :
* Returns    : <lcReturnValue>
*               : Character
```

67.14 frInList() function

```
* Syntax      : llReturnValue = frInList(tuExpression, taList)
* Description : Determines whether an expression matches another
*               : expression in a set of expressions.
* Arguments   : <tuExpression>
*               : Specifies the expression frInList() searches for in the List.
*               :
*               : <taList>
*               : Specifies the List of expressions to search.
*               : You must include at least one element in the list.
*               : The expressions in the list of expressions needn't to be
*               : of the same data type.
*               :
* Returns    : <luReturnValue> Null or logical value.
```

67.15 frForcePath() function

```
* Syntax      : lcReturnValue = frForcePath(tcFileName, tcPath)
* Description : Returns a file name with a new path name
*           : substituted for the old one.
* Arguments   : <tcFileName>
*           : Specifies the file name (with or without a path or extension),
*           : which will get a new path.
*           : <tcPath>
*           : Specifies the new path for tcFileName.
*           :
* Returns    : <lcReturnValue>
*           : Returns a file name with a new path name
*           : substituted for the old one.
```

67.16 frAllTrim() function

```
Syntax : lcReturnValue = frAllTrim(tcExpression, tcCharacter)
```

67.17 frLTrim() function

```
Syntax : lcRet = frLTrim(tcExpression, tcCharacter)
```

67.18 frJustDrive() function

```
* Syntax      : lcReturnValue = frJustDrive(tcPath)
* Description : Returns the drive letter from a complete path.
*           :
* Arguments   : <tcPath>
*           : Specifies the complete path name for
*           : which you want only the drive.
* Returns    : <lcReturnValue>
*           : Returns the drive letter from a complete path.
```

67.19 frJustExt() function

```
* Syntax      : lcReturnValue = frJustExt(tcPath)
* Description : Returns the characters of a file extension
*           : from a complete path.
* Arguments   : <tcPath>
*           : Specifies the name, which may include the full path,
*           : of the file for which you want only the extension.
* Returns    : <lcReturnValue>
*           : Returns the drive characters of a file extension
*           : from a complete path.
```

67.20 frJustStem() function

```
* Syntax      : lcReturnValue = frJustStem(tcPath)
* Description : Returns the stem name (the file name before the extension)
*              : from a complete path and file name.
* Arguments   : <tcPath>
*              : Specifies the name (including path) of the file
*              : for which you want only the stem.
* Returns     : <lcReturnValue>
*              : Returns the stem name of a file from a complete path.
```

67.21 frRTrim() function

```
Syntax : lcRet = frRTrim(tcExpression, tcCharacter)
```

67.22 frJustPath() function

```
Syntax : tcReturnValue = frJustPath(tcExpression)
```

67.23 frForceExt() function

```
Syntax : tcReturnValue = frForceExt(tcFileName, tcNewExtension)
```

67.24 frALines() function

```
Syntax : tnReturnValue = frALines(taList, tcExpression, tcSeparator)
```

67.25 frJustFName() function

```
Syntax : tcReturnValue = frJustFName(tcExpression)
```

67.26 frPadL() function

```
Syntax : tcReturnValue = frPadL(tcString, tnLen, tcChar)
```

67.27 frPadR() function

```
Syntax : tcReturnValue = frPadR(tcString, tnLen, tcChar)
```

67.28 frProper() function

```
* Syntax      : tcReturnValue = frProper(tcExpression)
* Description : Returns from a character expression a string
*               : capitalized as appropriate for proper names.
* Arguments   : <tcExpression>
*               : Specifies the character expression from which
*               : frProper() returns a capitalized character string.
* Returns     : <tcReturnValue>
```

67.29 frReplicate() function

```
Syntax : tcReturnValue = frReplicate(tcString, tnTimes)
```

67.30 frLen() function

```
Syntax : tnReturnValue = frLen(tcString)
```

67.31 frStuff() function

```
* Syntax      : tcReturnValue = frStuff(tcExpression, tnStartRep,
                                         tnCharRep, tcToReplace)
* Description : Returns a new character string replaced by a
*               : specified number of characters in a character
*               : expression with another character expression.
*               :
* Arguments   : <tcExpression>
*               : Specify the character expression in which the replacement occurs.
*               :
*               : <tnStartRep>
*               : Specify the position in <tcExpression> where the replacement begins.
*               :
*               : <tnCharRep>
*               : Specifies the number of characters to be replaced.
*               : If <tnCharRep> is 0, the replacement string
*               : <tcToReplace> is inserted into <tcExpression>.
*               :
*               : <tcToReplace>
*               : Specifies the replacement character expression.
*               : If <tcToReplace> is an empty string, the number of
*               : characters specified by <tnCharRep> are removed from <tcExpression>.
```

(continues on next page)

(continued from previous page)

* :
* Returns : Character

67.32 frSubStr() function

Syntax : tcReturnValue = frSubStr(tcString, tnInitialPosition, tnNumberBytes)
--

67.33 frStrTran() function

Syntax : tcReturnValue = frStrTran(tcString, tcOldString, tcNewString)

67.34 frListToString() function

* Syntax : lcRet = frListToString(taList)
* Remarks : This function doesn't exist in VFP.

67.35 frInt() function

Syntax : lnInt = frInt(tnExpression)

67.36 frStringToList() function

* Syntax : laList = frStringToList(tcExpression)
* Remarks : This function doesn't exist in VFP.

67.37 frIIf() function

* Syntax : luReturnValue = frIIf(tlExpression, tuReturnIfTrue, tuReturnIfFalse)
* Description : Returns one of two values depending on the
* : value of a logical expression.
* Arguments : <tlExpression>
* : Specifies the logical expression that frIIf() evaluates.
* :
* : <tuReturnTrue>, <tuReturnFalse>
* : If tlExpression evaluates to True, tuReturnIfTrue is
* : returned and tuReturnIfFalse is not evaluated.
* : If tlExpression evaluates to False or Null, tuReturnIfFalse is
* : returned and tuReturnIfTrue is not evaluated.
* :
* Returns : <luReturnValue> Defined by <tuReturnIfTrue> or <tuReturnIfFalse>

67.38 frVal() function

```
* Syntax      : luReturnValue = frVal(tcExpression)
* Description : Returns a numeric value from a character expression
*             : composed of numbers
* Arguments   : <tcExpression>
*             : Specifies a character expression composed of up to 16 numbers.
*             :
*             :
* Returns    : <tnValue>
*             : Return a numeric value.
```

67.39 frBetween() function

```
* Syntax      : luReturnValue = frBetween(tuTestValue, tuLowValue, tuHighValue)
* Description : Determines whether the value of an expression
*             : is inclusively between the
*             : values of two expressions of the same type.
*             :
*             :
* Arguments   : <tuTestValue>
*             : Specifies an expression to evaluate.
*             :
*             :
*             : <tuLowValue>
*             : Specifies the lower value in the range.
*             :
*             :
*             : <tuHighValue>
*             : Specifies the higher value in the range.
*             :
*             :
* Returns    : <luReturnValue>
*             : Returns a logical oder null value.
```

67.40 frSetSeparatorTo() function

```
* Syntax      : frSetSeparatorTo(tuExpression)
* Description : Specifies the character for the numeric place separator.
*             :
*             :
* Arguments   : <tuExpression>
*             : Specifies the character for the numeric place separator.
*             :
*             :
*             : Use frSetSeparatorTo() to change the numeric place
*             : separator from de default, for example space " " or a comma ",".
*             : Issue frSetSeparatorTo(Null) to reset the value to its default.
*             :
*             :
* Returns    : None
```

67.41 frTransform() function

```

* Syntax      : tcReturnValue = frTransform(tuExpression, tcFormatCodes)
* Description : Returns a character string from an expression in a
*               : format determined by a format code.
* Arguments   : <tuExpression>
*               : Specifies the expression to format.
*               :
*               : <tcFormatCodes>
*               : Specifies one or more format codes that determine how to
*               : format the expression.
*               :
* Returns    : <tcReturnValue>

```

The following table lists the available format codes for tcFormatCodes.

Format Code	Description
@!	Converts an entire character string to uppercase.
@T	Trims leading and trailing spaces from character values.
@B	Left-justifies Numeric data within the display region.
@L	Pads numeric and string data with leading zeros.
@C	Appends CR to positive numeric values to indicate a credit.
@X	Appends DB to negative numeric values to indicate a debit.

67.42 frVarType() function

```

* Syntax      : lcRet = frVarType(tuExpression)
* Description : Returns the data type of an expression.
*               :
* Arguments   : <tuExpression>
*               : Expecifies the expression for which the data type is returned.
*               : frVartype() returns a
*               : single character indicating the data type of the expression.
*               : The following table lists the characteres that frVarType()
*               : returns for each data type.
*               :
*               : -----
*               : Return Value      Data Type
*               : -----
*               : C                Character
*               : N                Numeric
*               : A                List
*               : O                Object
*               : U                Undefined type
*               : -----
*               :
* Returns    : Character

```

67.43 Example

```

Load "foxring.ring"

mf = new frFunctions

/*-----*/
* frProper() samples
/*-----*/

lcStr1 = "ring is a good language"
?mf.frProper(lcStr1)
?mf.frProper(Upper(lcStr1))

/*-----*/
* frStuff() samples
/*-----*/

lcStr1 = "abcdefghijklm"
lcStr2 = "12345"

// insert
?mf.frStuff(lcStr1, 4, 0, lcStr2)
// replace
?mf.frStuff(lcStr1, 4, 3, lcStr2)
// delete
?mf.frStuff(lcStr1, 4, 6, "")
// replace and insert
?mf.frStuff(lcStr1, 4, 1, lcStr2)
// replace and delete
?mf.frStuff(lcStr1, 4, 4, lcStr2)
// replace, delete rest
?mf.frStuff(lcStr1, 4, Len(lcStr1), lcStr2)

/*-----*/
?mf.frAbs(-45)
?mf.frAbs(10-30)
?mf.frAbs(30-10)

lcNumber1 = 40
lcNumber2 = 2

?mf.frAbs(lcNumber2-lcNumber1)

lcCompletableFuture = "C:\ring\docs\source\contribute.txt"

?mf.frFile(lcCompletableFuture, Null)
if mf.frFile(lcCompletableFuture, Null) {
    ?mf.frFileToStr(lcCompletableFuture)
}

```

(continues on next page)

(continued from previous page)

```
else
    ?"File does not exist"
}

lcNewPath = "C:\ring_2\docs\source\
?mf.frJustExt(lcCompletFileName)
?mf.frJustDrive(lcCompletFileName)
?mf.frJustStem(lcCompletFileName)
?mf.frForcePath(lcCompletFileName, lcNewPath)
?mf.frTransform("    Ring is a good language      ",
               "@! !!!!!!!!!!!!!!!!!!!!!!!")
?mf.frAllTrim("    Ring is a good language      ", Null)
?mf._version
lnValue = 3125.54
?mf.frTransform(lnValue, "@B") + "Euros"
?mf.frTransform(lnValue, "@C 9999,999,999,999.999")
mf.frSetSeparatorTo(" ")
?mf.frTransform(lnValue, "9999,999,999,999.999")
?mf.frInt(lnValue)
?mf.frForceExt("teste", "dbf")
// Format "@L" Added into frTransform() function
?mf.frTransform("123", "@L 999999")
?mf.frTransform(123, "@L 999999")
```

CHAPTER
SIXTYEIGHT

BIGNUMBER LIBRARY

In this chapter we will learn about using the Big Number library.

68.1 Loading the library

Before using the next function load the bignumber.ring library

```
load "bignumber.ring"
# Use Big Number library functions
```

68.2 Examples

Using the BigNumber library we can do arithmetic operations on huge numbers.

Example:

```
load "bignumber.ring"

num1 = "62345678901234567891678345123456789"      ### Big
num2 = "1237894567890123419871236545"               ### Small
num3 = "64"                                              ### Divide Small
num4 = "765432"                                         ### Power
num5 = "3"                                               ### Power

? "Add big numbers:"
a1 = new BigNumber(num1)          a1.Print()
a2 = new BigNumber(num2)          a2.Print()
a3 = a1 + a2                   a3.Print() ? nl

? "Subtract big numbers:"
a1 = new BigNumber(num1)          a1.Print()
a2 = new BigNumber(num2)          a2.Print()
a3 = a1 - a2                   a3.Print() ? nl

? "Multiply big numbers:"
a1 = new BigNumber(num1)          a1.print()
a2 = new BigNumber(num2)          a2.print()
a3 = a1 * a2                   a3.print() ? nl

? "Divide big numbers:"
```

(continues on next page)

(continued from previous page)

```

a1 = new BigNumber(num1)      a1.print()
a2 = new BigNumber(num2)      a2.print()
a3 = a1 / a2                a3.print() ? nl

? "Divide big numbers: by very small number"
a1 = new BigNumber(num1)      a1.print()
a2 = new BigNumber(num3)      a2.print()
a3 = a1 / a2                a3.print() ? nl

? "Power of big number:"
a1 = new BigNumber(num1)      a1.print()
a2 = new BigNumber(num5)      a2.print()
a3 = a1 ^ a2                a3.print() ? nl

```

Output:

```

Add big numbers:
62345678901234567891678345123456789
1237894567890123419871236545
62345680139129135781801764994693334

Substract big numbers:
62345678901234567891678345123456789
1237894567890123419871236545
52345687663340000001554925252220244

Multiply big numbers:
62345678901234567891678345123456789
1237894567890123419871236545
77177377243260150103462178714197454736432472780119682305154005

Divide big numbers:
62345678901234567891678345123456789
1237894567890123419871236545
50364288

Divide big numbers: by very small number
62345678901234567891678345123456789
64
974151232831790123307474142554012

Power of big number:
62345678901234567891678345123456789
3
242336636261471172092347146031727004 (Output continue in next line)
371698195628343934238988256152289508 (Output continue in next line)
493964611043228971692389860897069

```

68.3 BigNumber Functions

The library contains the next functions

```
FuncAdd(num1, num2)
FuncSubtract(num1, num2)
FuncCompare(num1, num2)
FuncDivide(num1, num2)
FuncMultiply(num1, num2)
FuncPower(num1, num2)
FuncBinaryToDecimal(num1)
FuncDecimalToBinary(num1)
printBinaryDigits(binList)
printDecimalDigits(decList)
```

68.4 BigNumber Class

The library contains the next class

```
class BigNumber
    func init aPara
    func operator cOperator, Para
    func print
    func value
```

68.5 Library Source Code

You can see the library source code in : ring/libraries/bignumber folder

Source Code : <https://github.com/ring-lang/ring/blob/master/libraries/bignumber/bignumber.ring>

USING RINGLIBCURL

In this chapter we will learn about using RingLibCurl

69.1 Get Request

Example:

```
load "libcurl.ring"

curl = curl_easy_init()

curl_easy_setopt(curl, CURLOPT_FOLLOWLOCATION, 1)
curl_easy_setopt(curl, CURLOPT_URL, "http://ring-lang.sf.net")

curl_easy_perform(curl)

curl_easy_cleanup(curl)
```

69.2 Post Request

Example:

```
load "libcurl.ring"

curl = curl_easy_init()

cPostThis = "page=4&Number1=4&Number2=5"
curl_easy_setopt(curl, CURLOPT_URL, "http://localhost/ringapp/index.ring?page=3")
curl_easy_setopt(curl, CURLOPT_POSTFIELDS, cPostThis)

curl_easy_perform(curl)

curl_easy_cleanup(curl)
```

69.3 Facebook Login

Example:

```

load "libcurl.ring"

see "Enter Email : " give $login_email
See "Enter Password : " give $login_pass

curl = curl_easy_init()

curl_easy_setopt(curl, CURLOPT_URL, 'https://www.facebook.com/login.php')
curl_easy_setopt(curl, CURLOPT_POSTFIELDS,'charset_test=j u s t a t e s t'+
' &email='+urlencode($login_email)+'&pass='+
urlencode($login_pass)+'&login=Login')
curl_easy_setopt(curl, CURLOPT_POST, 1)
curl_easy_setopt(curl, CURLOPT_HEADER, 0)
curl_easy_setopt(curl, CURLOPT_FOLLOWLOCATION, 1)
curl_easy_setopt(curl, CURLOPT_COOKIEJAR, "cookies.txt")
curl_easy_setopt(curl, CURLOPT_COOKIEFILE, "cookies.txt")
curl_easy_setopt(curl, CURLOPT_USERAGENT, "Mozilla/5.0 (Windows; U;"+
" Windows NT 5.1; en-US; rv:1.8.1.3) Gecko/20070309 Firefox/2.0.0.3")
curl_easy_setopt(curl, CURLOPT_REFERER, "http://www.facebook.com")
curl_easy_setopt(curl, CURLOPT_SSL_VERIFYPEER, FALSE)
curl_easy_setopt(curl, CURLOPT_SSL_VERIFYHOST, 2)

mylist = curl_slist_append(NULL, 'Accept-Charset: utf-8')
curl_slist_append(mylist, 'Accept-Language: en-us,en;q=0.7,bn-bd;q=0.3')
curl_slist_append(mylist, 'Accept: text/xml,application/xml,'+
'application/xhtml+xml,text/html;q=0.9,text/plain;q=0.8,image/png,*/*;q=0.5')
curl_easy_setopt(curl, CURLOPT_HTTPHEADER, mylist)

curl_easy_setopt(curl, CURLOPT_COOKIESESSION, false)

curl_easy_perform(curl)

curl_easy_cleanup(curl)

Func URLEncode cStr
    cOut = ""
    for x in cStr
        if isalnum(x)
            cOut += x
        but x = " "
            cOut += "+"
        else
            cOut += "%" +str2hex(x)
        ok
    next
    return cOut

```

69.4 Save Output to String

Example:

```
load "libcurl.ring"

curl = curl_easy_init()

curl_easy_setopt(curl, CURLOPT_FOLLOWLOCATION, 1)
curl_easy_setopt(curl, CURLOPT_URL, "http://ring-lang.sf.net")

cOutput = curl_easy_perform_silent(curl)

See "Output:" + nl
see cOutput

curl_easy_cleanup(curl)
```

69.5 Get Stock Data From Yahoo

Example:

```
Load "libcurl.ring"

### Part 1 --- Get Crumb and Cookie -----
See "Start curl_easy_init(): "+ nl
curl = curl_easy_init()                      ### >>> HANDLE >>> 01006BD0  CURL  0

curl_easy_setopt(curl, CURLOPT_FOLLOWLOCATION, 1)
curl_easy_setopt(curl, CURLOPT_COOKIEJAR, "cookies.txt")
curl_easy_setopt(curl, CURLOPT_COOKIEFILE, "cookies.txt")
curl_easy_setopt(curl, CURLOPT_URL, "https://finance.yahoo.com/quote/AMZN/
↪history")

### HTML Data >>> STDOUT Window, Use curl_easy_perform_silent >>> String
cOutput = curl_easy_perform_silent(curl)      ### GO Get Data >>> String

### Extract Crumb from data
### "CrumbStore":{"crumb":"abcdefgijk"},

if cOutput != NULL

    newStr1      = substr(cOutput, substr(cOutput, '"CrumbStore":{"crumb":"' ), 48_
↪
    nPosS      = substr(newStr1, ':"' ) ; ### Start of crumb -2
    nPosE      = substr(newStr1, '"}' ) ; ### End   of crumb
    nCount     = nPosE - nPosS - 2           ### size   of crumb
    myCrumb    = substr(newStr1, nPosS +2, nCount)

See "myCrumb.: |"+ myCrumb +"| " +nl

### UniCode "\u002F" replace it with "/"
```

(continues on next page)

(continued from previous page)

```

if substr( myCrumb, "\u002F")
    myCrumb = substr( myCrumb, "\u002F", "/")
    See "myCrumb2: |"+ myCrumb +"| "+ nl
    ok

else
    See "No Connectivity to Yahoo. Looking for Cookie and Crumb." +nl +nl
ok

### Part 2 --- Send URL with Crumb, and Cookie -----
↔--

    ### Send URL+Crumb to Yahoo to fetch 1st stock history data,

    $url = "https://query1.finance.yahoo.com/v7/finance/download/AMZN"+
        "?period1=1277856000&period2=1498777545&interval=1wk" +
        "&events=history&crumb=" + myCrumb

    curl_easy_setopt(curl, CURLOPT_URL, $url);
    cStr = curl_easy_perform_silent(curl)
    See cStr

curl_easy_cleanup(curl)  ### REMEMBER to CLOSE CURL

```

Output:

```

myCrumb.: |sEEeW97mxvN|
Date,Open,High,Low,Close,Adj Close,Volume
2010-07-05,110.650002,117.480003,109.000000,117.260002,117.260002,21000400
2010-07-12,117.809998,124.879997,117.320000,118.489998,118.489998,29407300
2010-07-19,118.379997,121.250000,105.800003,118.870003,118.870003,74252100

```

RINGLIBCURL FUNCTIONS REFERENCE

70.1 Introduction

In this chapter we have a list of the supported functions by this extension

70.2 Reference

- CURL_GLOBAL_ALL
- CURL_GLOBAL_SSL
- CURL_GLOBAL_WIN32
- CURL_GLOBAL NOTHING
- CURL_GLOBAL_DEFAULT
- CURL_GLOBAL_ACK_EINTR
- CURLOPT_VERBOSE
- CURLOPT_HEADER
- CURLOPT_NOPROGRESS
- CURLOPT_NOSIGNAL
- CURLOPT_WILDCARDMATCH
- CURLOPT_WRITEFUNCTION
- CURLOPT_WRITEDATA
- CURLOPT_READFUNCTION
- CURLOPT_READDATA
- CURLOPT_IOCTLFUNCTION
- CURLOPT_IOCTLDATA
- CURLOPT_SEEKFUNCTION
- CURLOPT_SEEKDATA
- CURLOPT_SOCKOPTFUNCTION
- CURLOPT_SOCKOPTDATA
- CURLOPT_OPENSOCKETFUNCTION

- CURLOPT_OPENSOCKETDATA
- CURLOPT_CLOSESOCKETFUNCTION
- CURLOPT_CLOSESOCKETDATA
- CURLOPT_PROGRESSFUNCTION
- CURLOPT_PROGRESSDATA
- CURLOPT_HEADERFUNCTION
- CURLOPT_HEADERDATA
- CURLOPT_DEBUGFUNCTION
- CURLOPT_DEBUGDATA
- CURLOPT_SSL_CTX_FUNCTION
- CURLOPT_SSL_CTX_DATA
- CURLOPT_CONV_TO_NETWORK_FUNCTION
- CURLOPT_CONV_FROM_NETWORK_FUNCTION
- CURLOPT_CONV_FROM_UTF8_FUNCTION
- CURLOPT_INTERLEAVEFUNCTION
- CURLOPT_INTERLEAVEDATA
- CURLOPT_CHUNK_BGN_FUNCTION
- CURLOPT_CHUNK_END_FUNCTION
- CURLOPT_CHUNK_DATA
- CURLOPT_FNMATCH_FUNCTION
- CURLOPT_FNMATCH_DATA
- CURLOPT_ERRORBUFFER
- CURLOPT_STDERR
- CURLOPT_FAILONERROR
- CURLOPT_URL
- CURLOPT_PROTOCOLS
- CURLOPT_REDIR_PROTOCOLS
- CURLOPT_PROXY
- CURLOPT_PROXYPORT
- CURLOPT_PROXYTYPE
- CURLOPT_NOPROXY
- CURLOPT_HTTPPROXYTUNNEL
- CURLOPT SOCKS5_GSSAPI_SERVICE
- CURLOPT SOCKS5_GSSAPI_NEC
- CURLOPT_INTERFACE
- CURLOPT_LOCALPORT

- CURLOPT_LOCALPORTRANGE
- CURLOPT_DNS_CACHE_TIMEOUT
- CURLOPT_DNS_USE_GLOBAL_CACHE
- CURLOPT_BUFFERSIZE
- CURLOPT_PORT
- CURLOPT_TCP_NODELAY
- CURLOPT_ADDRESS_SCOPE
- CURLOPT_NETRC
- CURLOPT_NETRC_FILE
- CURLOPT_USERPWD
- CURLOPT_PROXYUSERPWD
- CURLOPT_USERNAME
- CURLOPT_PASSWORD
- CURLOPT_PROXYUSERNAME
- CURLOPT_PROXYPASSWORD
- CURLOPT_HTTPAUTH
- CURLOPT_TLSAUTH_USERNAME
- CURLOPT_TLSAUTH_PASSWORD
- CURLOPT_TLSAUTH_TYPE
- CURLOPT_PROXYAUTH
- CURLOPT_AUTOREFERER
- CURLOPT_ACCEPT_ENCODING
- CURLOPT_TRANSFER_ENCODING
- CURLOPT_FOLLOWLOCATION
- CURLOPT_UNRESTRICTED_AUTH
- CURLOPT_MAXREDIRS
- CURLOPT_POSTREDIR
- CURLOPT_PUT
- CURLOPT_POST
- CURLOPT_POSTFIELDS
- CURLOPT_POSTFIELDSIZE
- CURLOPT_POSTFIELDSIZE_LARGE
- CURLOPT_COPYPOSTFIELDS
- CURLOPT_HTTPPOST
- CURLOPT_REFERER
- CURLOPT_USERAGENT

- CURLOPT_HTTPHEADER
- CURLOPT_HTTP200ALIASES
- CURLOPT_COOKIE
- CURLOPT_COOKIEFILE
- CURLOPT_COOKIEJAR
- CURLOPT_COOKIESSESSION
- CURLOPT_COOKIELIST
- CURLOPT_HTTPGET
- CURLOPT_HTTP_VERSION
- CURLOPT_IGNORE_CONTENT_LENGTH
- CURLOPT_HTTP_CONTENT_DECODING
- CURLOPT_HTTP_TRANSFER_DECODING
- CURLOPT_MAIL_FROM
- CURLOPT_MAIL_RCPT
- CURLOPT_TFTP_BLKSIZE
- CURLOPT_FTPPORT
- CURLOPT_QUOTE
- CURLOPT_POSTQUOTE
- CURLOPT_PREQUOTE
- CURLOPT_APPEND
- CURLOPT_FTP_USE_EPRT
- CURLOPT_FTP_USE_EPSV
- CURLOPT_FTP_USE_PRET
- CURLOPT_FTP_CREATE_MISSING_DIRS
- CURLOPT_FTP_RESPONSE_TIMEOUT
- CURLOPT_FTP_ALTERNATIVE_TO_USER
- CURLOPT_FTP_SKIP_PASV_IP
- CURLOPT_FTPSSLAUTH
- CURLOPT_FTP_SSL_CCC
- CURLOPT_FTP_ACCOUNT
- CURLOPT_FTP_FILEMETHOD
- CURLOPT_RTSP_REQUEST
- CURLOPT_RTSP_SESSION_ID
- CURLOPT_RTSP_STREAM_URI
- CURLOPT_RTSP_TRANSPORT
- CURLOPT_RTSP_CLIENT_CSEQ

- CURLOPT_RTSP_SERVER_CSEQ
- CURLOPT_TRANSFERTEXT
- CURLOPT_PROXY_TRANSFER_MODE
- CURLOPT_CRLF
- CURLOPT_RANGE
- CURLOPT_RESUME_FROM
- CURLOPT_RESUME_FROM_LARGE
- CURLOPT_CUSTOMREQUEST
- CURLOPT_FILETIME
- CURLOPT_DIRLISTONLY
- CURLOPT_NOBODY
- CURLOPT_INFILESIZE
- CURLOPT_INFILESIZE_LARGE
- CURLOPT_UPLOAD
- CURLOPT_MAXFILESIZE
- CURLOPT_MAXFILESIZE_LARGE
- CURLOPT_TIMECONDITION
- CURLOPT_TIMEVALUE
- CURLOPT_TIMEOUT
- CURLOPT_TIMEOUT_MS
- CURLOPT_LOW_SPEED_LIMIT
- CURLOPT_LOW_SPEED_TIME
- CURLOPT_MAX_SEND_SPEED_LARGE
- CURLOPT_MAX_RECV_SPEED_LARGE
- CURLOPT_MAXCONNECTS
- CURLOPT_FRESH_CONNECT
- CURLOPT_FORBID_REUSE
- CURLOPT_CONNECTTIMEOUT
- CURLOPT_CONNECTTIMEOUT_MS
- CURLOPT_IPRESOLVE
- CURLOPT_CONNECT_ONLY
- CURLOPT_USE_SSL
- CURLOPT_RESOLVE
- CURLOPT_SSLCERT
- CURLOPT_SSLCERTTYPE
- CURLOPT_SSLKEY

- CURLOPT_SSLKEYTYPE
- CURLOPT_KEYPASSWD
- CURLOPT_SSLENGINE
- CURLOPT_SSLENGINE_DEFAULT
- CURLOPT_SSLVERSION
- CURLOPT_SSL_VERIFYHOST
- CURLOPT_SSL_VERIFYPEER
- CURLOPT_CAINFO
- CURLOPT_ISSUERCERT
- CURLOPT_CAPATH
- CURLOPT_CRLFILE
- CURLOPT_CERTINFO
- CURLOPT_RANDOM_FILE
- CURLOPT_EGDSOCKET
- CURLOPT_SSL_CIPHER_LIST
- CURLOPT_SSL_SESSIONID_CACHE
- CURLOPT_KRBLEVEL
- CURLOPT_GSSAPI_DELEGATION
- CURLOPT_SSH_AUTH_TYPES
- CURLOPT_SSH_HOST_PUBLIC_KEY_MD5
- CURLOPT_SSH_PUBLIC_KEYFILE
- CURLOPT_SSH_PRIVATE_KEYFILE
- CURLOPT_SSH_KNOWNHOSTS
- CURLOPT_SSH_KEYFUNCTION
- CURLOPT_SSH_KEYDATA
- CURLOPT_PRIVATE
- CURLOPT_SHARE
- CURLOPT_NEW_FILE_PERMS
- CURLOPT_NEW_DIRECTORY_PERMS
- CURLOPT_TELNETOPTIONS
- CURLE_OK
- CURLE_UNKNOWN_OPTION
- CURLE_NOT_BUILT_IN
- CURLINFO_EFFECTIVE_URL
- CURLINFO_RESPONSE_CODE
- CURLINFO_HTTP_CONNECTCODE

- CURLINFO_FILETIME
- CURLINFO_TOTAL_TIME
- CURLINFO_NAMELOOKUP_TIME
- CURLINFO_CONNECT_TIME
- CURLINFO_APPCONNECT_TIME
- CURLINFO_PRETRANSFER_TIME
- CURLINFO_STARTTRANSFER_TIME
- CURLINFO_REDIRECT_TIME
- CURLINFO_REDIRECT_COUNT
- CURLINFO_REDIRECT_URL
- CURLINFO_SIZE_UPLOAD
- CURLINFO_SIZE_DOWNLOAD
- CURLINFO_SPEED_DOWNLOAD
- CURLINFO_SPEED_UPLOAD
- CURLINFO_HEADER_SIZE
- CURLINFO_REQUEST_SIZE
- CURLINFO_SSL_VERIFYRESULT
- CURLINFO_SSL_ENGINES
- CURLINFO_CONTENT_LENGTH_DOWNLOAD
- CURLINFO_CONTENT_LENGTH_UPLOAD
- CURLINFO_CONTENT_TYPE
- CURLINFO_PRIVATE
- CURLINFO_HTTPAUTH_AVAIL
- CURLINFO_PROXYAUTH_AVAIL
- CURLINFO_OS_ERRNO
- CURLINFO_NUM_CONNECTS
- CURLINFO_PRIMARY_IP
- CURLINFO_PRIMARY_PORT
- CURLINFO_LOCAL_IP
- CURLINFO_LOCAL_PORT
- CURLINFO_COOKIELIST
- CURLINFO_LASTSOCKET
- CURLINFO_FTP_ENTRY_PATH
- CURLINFO_CERTINFO
- CURLINFO_CONDITION_UNMET
- CURLINFO_RTSP_SESSION_ID

- CURLINFO_RTSP_CLIENT_CSEQ
- CURLINFO_RTSP_SERVER_CSEQ
- CURLINFO_RTSP_CSEQ_RECV
- CURLFORM_COPYNAME
- CURLFORM_PTRNAME
- CURLFORM_COPYCONTENTS
- CURLFORM_PTRCONTENTS
- CURLFORM_CONTENTSLENGTH
- CURLFORM_FILECONTENT
- CURLFORM_FILE
- CURLFORM_CONTENTTYPE
- CURLFORM_FILENAME
- CURLFORM_BUFFER
- CURLFORM_BUFFERPTR
- CURLFORM_BUFFERLENGTH
- CURLFORM_STREAM
- CURLFORM_ARRAY
- CURLFORM_CONTENTHEADER
- CURLcode curl_global_init(long flags)
- CURL *curl_easy_init(void)
- void curl_easy_cleanup(CURL * handle)
- CURLcode curl_easy_setopt_1(CURL *handle, CURLoption option, int)
- CURLcode curl_easy_setopt_2(CURL *handle, CURLoption option, const char *)
- CURLcode curl_easy_setopt_3(CURL *handle, CURLoption option, void *)
- CURLcode curl_easy_setopt_4(CURL *handle, CURLoption option, CURLLIST *)
- CURLcode curl_easy_perform(CURL * easy_handle)
- String *curl_easy_perform_silent(CURL * easy_handle)
- CURLcode curl_easy_getinfo_1(CURL *handle, CURLINFO info, char **urlp)
- CURLcode curl_easy_getinfo_2(CURL *handle, CURLINFO info, long *codep)
- CURLcode curl_easy_getinfo_3(CURL *handle, CURLINFO info, double *timep)
- CURLcode curl_easy_getinfo_4(CURL *handle, CURLINFO info, CURLLIST **engine_list)
- CURLcode curl_easy_getinfo_5(CURL *handle, CURLINFO info, struct curl_certinfo *chainp)
- CURLcode curl_easy_getinfo_6(CURL *handle, CURLINFO info, struct curl_tlsSessionInfo **session)
- char *curl_version(void)
- time_t curl_getdate(char * datestring , time_t *now)

- CURLFORMcode curl_formadd_1(struct curl_httppost **firstitem, struct curl_httppost **lastitem, CURLformoption, const char *, CURLformoption, const char *, CURLformoption)
- CURLFORMcode curl_formadd_2(struct curl_httppost **firstitem, struct curl_httppost **lastitem, CURLformoption, const char *, CURLformoption, const char *, CURLformoption, const char *, CURLformoption)
- CURLFORMcode curl_formadd_3(struct curl_httppost **firstitem, struct curl_httppost **lastitem, CURLformoption, const char *, CURLformoption, void *, CURLformoption)
- CURLFORMcode curl_formadd_4(struct curl_httppost **firstitem, struct curl_httppost **lastitem, CURLformoption, const char *, CURLformoption, void *, CURLformoption, long , CURLformoption)
- CURLFORMcode curl_formadd_5(struct curl_httppost **firstitem, struct curl_httppost **lastitem, CURLformoption, const char , CURLformoption, void *, CURLformoption, long , CURLformoption, const char , CURLformoption)
- CURLFORMcode curl_formadd_6(struct curl_httppost **firstitem, struct curl_httppost **lastitem, CURLformoption, const char *, CURLformoption, const char *, CURLformoption, void * , CURLformoption, long , CURLformoption)
- CURLFORMcode curl_formadd_7(struct curl_httppost **firstitem, struct curl_httppost **lastitem, CURLformoption, const char *, CURLformoption, struct curl_forms [], CURLformoption)
- void curl_formfree(struct curl_httppost * form)
- CURLLIST *curl_slist_append(CURLLIST * list, const char * string)
- void curl_slist_free_all(CURLLIST * list)
- char *curl_easy_escape(CURL * curl , const char * string , int length)
- char *curl_easy_unescape(CURL * curl , const char * url , int inlength , int * outlength)

CHAPTER
SEVENTYONE

USING RINGZIP

In this chapter we will learn about using RingZip

71.1 Create Zip File

Example : Create myfile.zip contains 4 files

```
load "ziplib.ring"
oZip = zip_openfile("myfile.zip", 'w')
zip_addfile(oZip, "test.c")
zip_addfile(oZip, "zip.c")
zip_addfile(oZip, "zip.h")
zip_addfile(oZip, "miniz.h")
zip_close(oZip)
```

71.2 Extract Zip File

Example : Extract myfile.zip to myfolder folder.

```
load "ziplib.ring"
zip_extract_allfiles("myfile.zip", "myfolder")
```

71.3 Print Files in Zip file

Example : Print file names in the myfile.zip

```
load "ziplib.ring"
oZip = zip_openfile("myfile.zip", 'r')
for x=1 to zip_filecount(oZip)
    see zip_getfilenamebyindex(oZip,x) + nl
next
zip_close(oZip)
```

71.4 Using RingZip Classes

The RingZip library comes with two classes. The Zip class and the ZipEntry class.

Example (1):

```
load "ziplib.ring"

new Zip {
    setFileName("myfile.zip")
    open("w")
    newEntry() {
        open("test.c")
        writefile("test.c")
        close()
    }
    close()
}
```

Example (2):

```
load "ziplib.ring"

new Zip {
    SetFileName("myfile.zip")
    Open("w")
    AddFile("test.c")
    AddFile("zip.c")
    AddFile("zip.h")
    AddFile("miniz.h")
    Close()
}
```

Example (3):

```
load "ziplib.ring"

new zip {
    SetFileName("myfile.zip")
    ExtractAllFiles("myfolder")
}
```

Example (4):

```
load "ziplib.ring"

new Zip {
    SetFileName("myfile.zip")
    Open("r")
    see FilesCount()
    Close()
}
```

Example (5):

```
load "ziplib.ring"
```

(continues on next page)

(continued from previous page)

```
new Zip {
    SetFileName("myfile.zip")
    Open("r")
    for x = 1 to filescount()
        See GetFileNameByIndex(x) + nl
    next
    Close()
}
```

71.5 Zip Class Reference

Methods:

Method	Description/Output
SetFileName(cName)	Set the Zip file name
GetFileName()	Return the Zip file name
Open(cMode)	Open File, cMode = "a", "w" or "r"
Close()	Close the Zip File
AddFile(cFileName)	Add file to the Zip file
ExtractAllFiles(cFolder)	Extract all files from the Zip file
FilesCount()	Return files count in the Zip file
GetFileNameByIndex(nIndex)	Return file name in the Zip file by file index
NewEntry()	Create new ZipEntry object

71.6 ZipEntry Class Reference

Methods:

Method	Description/Output
Open(cFileName)	Open new Entry
WriteFile(cFileName)	Write File to the Entry
WriteString(cString)	Write String to the Entry
Close()	Close the Entry

CHAPTER
SEVENTYTWO

RINGLIBZIP FUNCTIONS REFERENCE

72.1 Introduction

In this chapter we have a list of the supported functions by this extension

72.2 Reference

- ZIP_T *zip_openfile(const char *, const char *)
- int zip_entry_open(ZIP_T*, const char *)
- int zip_entry_write(ZIP_T*, const char *,int)
- int zip_entry_fwrite(ZIP_T*, const char *)
- int zip_entry_read(ZIP_T*, void *, size_t *)
- int zip_entry_fread(ZIP_T*, const char *cFile)
- int zip_entry_close(ZIP_T*)
- void zip_extract_allfiles(const char *cFile, const char *cFolder)
- void zip_close(ZIP_T*)
- int zip_filecount(ZIP_T *)
- const char *zip_getfilenamebyindex(ZIP_T *pZip,int index)
- void zip_extract_file(const char *cZIPFile,const char *cFile)

CHAPTER
SEVENTYTHREE

RINGMURMURHASH FUNCTIONS REFERENCE

Murmurhash extension is an extension written to implement a full implementation for the MurmurHash library.

73.1 MurmurHash1 functions

```
uint32_t murmurhash1(string key, int seed, [bool return_type]);  
uint32_t murmurhash1_aligned(string key, int seed, [bool return_type]);
```

73.2 MurmurHash2 functions

```
uint32_t murmurhash2(string key, int seed, [bool return_type]);  
uint32_t murmurhash2a(string key, int seed, [bool return_type]);  
uint64_t murmurhash64a(string key, int seed, [bool return_type]);  
uint64_t murmurhash64b(string key, int seed, [bool return_type]);  
uint32_t murmurhash_neutral2(string key, int seed, [bool return_type]);  
uint32_t murmurhash_aligned2(string key, int seed, [bool return_type]);
```

73.3 MurmurHash3 functions

```
uint32_t murmurhash3_x86_32(string key, int seed, [bool return_type]);  
list murmurhash3_x86_128(string key, int seed, [bool return_type]);  
list murmurhash3_x64_128(string key, int seed, [bool return_type]);
```

The third optional parameter is to set the type of the returned value, this parameter accepts a bool value [true, false], true will return a Hex value, while false will return a integer value.

73.4 Example

```
load "murmurhashlib.ring"

key = "Ring Language"

see murmurhash3_x86_32(key, 0, 0) + nl // Output: 1894444853
see murmurhash3_x86_32(key, 0, 1) + nl // Output: 70eaef35
```

RINGCONSOLECOLORS FUNCTIONS REFERENCE

74.1 Introduction

In this chapter we have a list of the supported functions by this extension

74.2 Reference

- CC_FG_NONE
- CC_FG_BLACK
- CC_FG_DARK_RED
- CC_FG_DARK_GREEN
- CC_FG_DARK_YELLOW
- CC_FG_DARK_BLUE
- CC_FG_DARK_MAGENTA
- CC_FG_DARK_CYAN
- CC_FG_GRAY
- CC_FG_DARK_GRAY
- CC_FG_RED
- CC_FG_GREEN
- CC_FG_YELLOW
- CC_FG_BLUE
- CC_FG_MAGENTA
- CC_FG_CYAN
- CC_FG_WHITE
- CC_BG_NONE
- CC_BG_BLACK
- CC_BG_DARK_RED
- CC_BG_DARK_GREEN
- CC_BG_DARK_YELLOW

- CC_BG_DARK_BLUE
- CC_BG_DARK_MAGENTA
- CC_BG_DARK_CYAN
- CC_BG_GRAY
- CC_BG_DARK_GRAY
- CC_BG_RED
- CC_BG_GREEN
- CC_BG_YELLOW
- CC_BG_BLUE
- CC_BG_MAGENTA
- CC_BG_CYAN
- CC_BG_WHITE
- void cc_print(int color,const char *string)

CHAPTER
SEVENTYFIVE

RINGALLEGRO FUNCTIONS REFERENCE

75.1 Introduction

In this chapter we have a list of the supported functions by this extension

75.2 Reference

- void al_exit(void)
- void al_run_main(void)
- int al_init(void)
- ALLEGRO_CONFIG *al_create_config(void)
- void al_destroy_config(ALLEGRO_CONFIG *config)
- ALLEGRO_CONFIG *al_load_config_file(const char *filename)
- ALLEGRO_CONFIG *al_load_config_file_f(ALLEGRO_FILE *file)
- bool al_save_config_file(const char *filename, const ALLEGRO_CONFIG *config)
- bool al_save_config_file_f(ALLEGRO_FILE *file, const ALLEGRO_CONFIG *config)
- void al_add_config_section(ALLEGRO_CONFIG *config, const char *name)
- void al_add_config_comment(ALLEGRO_CONFIG *config, const char *section, const char *comment)
- const char *al_get_config_value(const ALLEGRO_CONFIG *config, const char *section, const char *key)
- void al_set_config_value(ALLEGRO_CONFIG *config, const char *section, const char *key, const char *value)
- char const *al_get_first_config_section(ALLEGRO_CONFIG const *config, ALLEGRO_CONFIG_SECTION **iterator)
- char const *al_get_next_config_section(ALLEGRO_CONFIG SECTION **iterator)
- char const *al_get_first_config_entry(ALLEGRO_CONFIG const *config, char const *section, ALLEGRO_CONFIG_ENTRY **iterator)
- char const *al_get_next_config_entry(ALLEGRO_CONFIG_ENTRY **iterator)
- ALLEGRO_CONFIG *al_merge_config(const ALLEGRO_CONFIG *cfg1, const ALLEGRO_CONFIG *cfg2)
- void al_merge_config_into(ALLEGRO_CONFIG *master, const ALLEGRO_CONFIG *add)
- ALLEGRO_DISPLAY *al_create_display(int w, int h)

- void al_destroy_display(ALLEGRO_DISPLAY *display)
- int al_get_new_display_flags(void)
- void al_set_new_display_flags(int flags)
- int al_get_new_display_option(int option, int *importance)
- void al_set_new_display_option(int option, int value, int importance)
- void al_reset_new_display_options(void)
- void al_get_new_window_position(int *x, int *y)
- void al_set_new_window_position(int x, int y)
- int al_get_new_display_refresh_rate(void)
- void al_set_new_display_refresh_rate(int refresh_rate)
- ALLEGRO_EVENT_SOURCE *al_get_display_event_source(ALLEGRO_DISPLAY *display)
- ALLEGRO_BITMAP *al_get_backbuffer(ALLEGRO_DISPLAY *display)
- void al_flip_display(void)
- void al_update_display_region(int x, int y, int width, int height)
- bool al_wait_for_vsync(void)
- int al_get_display_width(ALLEGRO_DISPLAY *display)
- int al_get_display_height(ALLEGRO_DISPLAY *display)
- bool al_resize_display(ALLEGRO_DISPLAY *display, int width, int height)
- bool al_acknowledge_resize(ALLEGRO_DISPLAY *display)
- void al_get_window_position(ALLEGRO_DISPLAY *display, int *x, int *y)
- void al_set_window_position(ALLEGRO_DISPLAY *display, int x, int y)
- int al_get_display_flags(ALLEGRO_DISPLAY *display)
- bool al_set_display_flag(ALLEGRO_DISPLAY *display, int flag, bool onoff)
- int al_get_display_option(ALLEGRO_DISPLAY *display, int option)
- int al_get_display_format(ALLEGRO_DISPLAY *display)
- int al_get_display_refresh_rate(ALLEGRO_DISPLAY *display)
- void al_set_window_title(ALLEGRO_DISPLAY *display, const char *title)
- void al_set_display_icon(ALLEGRO_DISPLAY *display, ALLEGRO_BITMAP *icon)
- void al_set_display_icons(ALLEGRO_DISPLAY *display, int num_icons, ALLEGRO_BITMAP *icons[])
- bool al_inhibit_screensaver(bool inhibit)
- void al_acknowledge_drawing_halt(ALLEGRO_DISPLAY *display)
- void al_acknowledge_drawing_resume(ALLEGRO_DISPLAY *display)
- int al_get_display_orientation(ALLEGRO_DISPLAY *display)
- void al_set_display_option(ALLEGRO_DISPLAY *display, int option, int value)
- bool al_get_window_constraints(ALLEGRO_DISPLAY *display, int *min_w, int *min_h, int *max_w, int *max_h)

- `bool al_set_window_constraints(ALLEGRO_DISPLAY *display,int min_w, int min_h, int max_w, int max_h)`
- `ALLEGRO_EVENT_QUEUE *al_create_event_queue(void)`
- `void al_destroy_event_queue(ALLEGRO_EVENT_QUEUE *queue)`
- `void al_register_event_source(ALLEGRO_EVENT_QUEUE *queue,ALLEGRO_EVENT_SOURCE *source)`
- `void al_unregister_event_source(ALLEGRO_EVENT_QUEUE *queue,ALLEGRO_EVENT_SOURCE *source)`
- `bool al_is_event_queue_empty(ALLEGRO_EVENT_QUEUE *queue)`
- `bool al_get_next_event(ALLEGRO_EVENT_QUEUE *queue, ALLEGRO_EVENT *ret_event)`
- `bool al_peek_next_event(ALLEGRO_EVENT_QUEUE *queue, ALLEGRO_EVENT *ret_event)`
- `bool al_drop_next_event(ALLEGRO_EVENT_QUEUE *queue)`
- `void al_flush_event_queue(ALLEGRO_EVENT_QUEUE *queue)`
- `void al_wait_for_event(ALLEGRO_EVENT_QUEUE *queue, ALLEGRO_EVENT *ret_event)`
- `bool al_wait_for_event_timed(ALLEGRO_EVENT_QUEUE *queue,ALLEGRO_EVENT *ret_event, float secs)`
- `bool al_wait_for_event_until(ALLEGRO_EVENT_QUEUE *queue,ALLEGRO_EVENT *ret_event, ALLEGRO_TIMEOUT *timeout)`
- `void al_init_user_event_source(ALLEGRO_EVENT_SOURCE *src)`
- `void al_destroy_user_event_source(ALLEGRO_EVENT_SOURCE *src)`
- `intptr_t al_get_event_source_data(const ALLEGRO_EVENT_SOURCE *source)`
- `void al_set_event_source_data(ALLEGRO_EVENT_SOURCE *source, intptr_t data)`
- `ALLEGRO_FILE *al_fopen(const char *path, const char *mode)`
- `ALLEGRO_FILE *al_fopen_interface(const ALLEGRO_FILE_INTERFACE *drv,const char *path, const char *mode)`
- `ALLEGRO_FILE *al_fopen_slice(ALLEGRO_FILE *fp, size_t initial_size, const char *mode)`
- `void al_fclose(ALLEGRO_FILE *f)`
- `size_t al_fread(ALLEGRO_FILE *f, void *ptr, size_t size)`
- `size_t al_fwrite(ALLEGRO_FILE *f, const void *ptr, size_t size)`
- `bool al_fflush(ALLEGRO_FILE *f)`
- `int64_t al_ftell(ALLEGRO_FILE *f)`
- `bool al_fseek(ALLEGRO_FILE *f, int64_t offset, int whence)`
- `bool al_feof(ALLEGRO_FILE *f)`
- `bool al_ferror(ALLEGRO_FILE *f)`
- `void al_fclearerr(ALLEGRO_FILE *f)`
- `int al_fungetc(ALLEGRO_FILE *f, int c)`
- `int64_t al_fsize(ALLEGRO_FILE *f)`
- `int al_fgetc(ALLEGRO_FILE *f)`
- `int al_fputc(ALLEGRO_FILE *f, int c)`

- `int16_t al_fread16le(ALLEGRO_FILE *f)`
- `int16_t al_fread16be(ALLEGRO_FILE *f)`
- `size_t al_fwrite16le(ALLEGRO_FILE *f, int16_t w)`
- `size_t al_fwrite16be(ALLEGRO_FILE *f, int16_t w)`
- `int32_t al_fread32le(ALLEGRO_FILE *f)`
- `int32_t al_fread32be(ALLEGRO_FILE *f)`
- `size_t al_fwrite32le(ALLEGRO_FILE *f, int32_t l)`
- `size_t al_fwrite32be(ALLEGRO_FILE *f, int32_t l)`
- `char *al_fgets(ALLEGRO_FILE *f, char * const buf, size_t max)`
- `ALLEGRO_USTR *al_fget_ustr(ALLEGRO_FILE *f)`
- `int al_fputs(ALLEGRO_FILE *f, char const *p)`
- `ALLEGRO_FILE *al_fopen_fd(int fd, const char *mode)`
- `ALLEGRO_FILE *al_make_temp_file(const char *template, ALLEGRO_PATH **ret_path)`
- `void al_set_new_file_interface(const ALLEGRO_FILE_INTERFACE *file_interface)`
- `void al_set_standard_file_interface(void)`
- `const ALLEGRO_FILE_INTERFACE *al_get_new_file_interface(void)`
- `ALLEGRO_FILE *al_create_file_handle(const ALLEGRO_FILE_INTERFACE *drv, void *userdata)`
- `void *al_get_file_userdata(ALLEGRO_FILE *f)`
- `ALLEGRO_FS_ENTRY *al_create_fs_entry(const char *path)`
- `void al_destroy_fs_entry(ALLEGRO_FS_ENTRY *fh)`
- `const char *al_get_fs_entry_name(ALLEGRO_FS_ENTRY *e)`
- `bool al_update_fs_entry(ALLEGRO_FS_ENTRY *e)`
- `uint32_t al_get_fs_entry_mode(ALLEGRO_FS_ENTRY *e)`
- `time_t al_get_fs_entry_atime(ALLEGRO_FS_ENTRY *e)`
- `time_t al_get_fs_entry_ctime(ALLEGRO_FS_ENTRY *e)`
- `time_t al_get_fs_entry_mtime(ALLEGRO_FS_ENTRY *e)`
- `off_t al_get_fs_entry_size(ALLEGRO_FS_ENTRY *e)`
- `bool al_fs_entry_exists(ALLEGRO_FS_ENTRY *e)`
- `bool al_remove_fs_entry(ALLEGRO_FS_ENTRY *e)`
- `bool al_filename_exists(const char *path)`
- `bool al_remove_filename(const char *path)`
- `bool al_open_directory(ALLEGRO_FS_ENTRY *e)`
- `ALLEGRO_FS_ENTRY *al_read_directory(ALLEGRO_FS_ENTRY *e)`
- `bool al_close_directory(ALLEGRO_FS_ENTRY *e)`
- `char *al_get_current_directory(void)`
- `bool al_change_directory(const char *path)`

- bool al_make_directory(const char *path)
- ALLEGRO_FILE *al_open_fs_entry(ALLEGRO_FS_ENTRY *e, const char *mode)
- void al_set_fs_interface(const ALLEGRO_FS_INTERFACE *fs_interface)
- void al_set_standard_fs_interface(void)
- const ALLEGRO_FS_INTERFACE *al_get_fs_interface(void)
- al_fixed al_itofix(int x);
- int al_fixtoi(al_fixed x);
- int al_fixfloor(al_fixed x);
- int al_fixceil(al_fixed x);
- al_fixed al_ftofix(double x);
- double al_fixtof(al_fixed x);
- al_fixed al_fixmul(al_fixed x, al_fixed y);
- al_fixed al_fixdiv(al_fixed x, al_fixed y);
- al_fixed al_fixadd(al_fixed x, al_fixed y);
- al_fixed al_fixsub(al_fixed x, al_fixed y);
- al_fixed al_fixsin(al_fixed x);
- al_fixed al_fixcos(al_fixed x);
- al_fixed al_fixtan(al_fixed x);
- al_fixed al_fixasin(al_fixed x);
- al_fixed al_fixacos(al_fixed x);
- al_fixed al_fixatan(al_fixed x)
- al_fixed al_fixatan2(al_fixed y, al_fixed x)
- al_fixed al_fixsqrt(al_fixed x)
- al_fixed al_fixhypot(al_fixed x, al_fixed y)
- ALLEGRO_DISPLAY_MODE *al_get_display_mode(int index, ALLEGRO_DISPLAY_MODE *mode)
- int al_get_num_display_modes(void)
- ALLEGRO_COLOR al_map_rgb(unsigned char r, unsigned char g, unsigned char b)
- ALLEGRO_COLOR al_map_rgb_f(float r, float g, float b)
- ALLEGRO_COLOR al_map_rgba(unsigned char r, unsigned char g, unsigned char b, unsigned char a)
- ALLEGRO_COLOR al_map_rgba_f(float r, float g, float b, float a)
- void al_unmap_rgb(ALLEGRO_COLOR color,unsigned char *r, unsigned char *g, unsigned char *b)
- void al_unmap_rgb_f(ALLEGRO_COLOR color, float *r, float *g, float *b)
- void al_unmap_rgba(ALLEGRO_COLOR color,unsigned char *r, unsigned char *g, unsigned char *b, unsigned char *a)
- void al_unmap_rgba_f(ALLEGRO_COLOR color,float *r, float *g, float *b, float *a)
- int al_get_pixel_size(int format)

- int al_get_pixel_format_bits(int format)
- ALLEGRO_LOCKED_REGION *al_lock_bitmap(ALLEGRO_BITMAP *bitmap,int format, int flags)
- ALLEGRO_LOCKED_REGION *al_lock_bitmap_region(ALLEGRO_BITMAP *bitmap,int x, int y, int width, int height, int format, int flags)
- void al_unlock_bitmap(ALLEGRO_BITMAP *bitmap)
- ALLEGRO_BITMAP *al_create_bitmap(int w, int h)
- ALLEGRO_BITMAP *al_create_sub_bitmap(ALLEGRO_BITMAP *parent,int x, int y, int w, int h)
- ALLEGRO_BITMAP *al_clone_bitmap(ALLEGRO_BITMAP *bitmap)
- void al_destroy_bitmap(ALLEGRO_BITMAP *bitmap)
- int al_get_new_bitmap_flags(void)
- int al_get_new_bitmap_format(void)
- void al_set_new_bitmap_flags(int flags)
- void al_add_new_bitmap_flag(int flag)
- void al_set_new_bitmap_format(int format)
- int al_get_bitmap_flags(ALLEGRO_BITMAP *bitmap)
- int al_get_bitmap_format(ALLEGRO_BITMAP *bitmap)
- int al_get_bitmap_height(ALLEGRO_BITMAP *bitmap)
- int al_get_bitmap_width(ALLEGRO_BITMAP *bitmap)
- ALLEGRO_COLOR al_get_pixel(ALLEGRO_BITMAP *bitmap, int x, int y)
- bool al_is_bitmap_locked(ALLEGRO_BITMAP *bitmap)
- bool al_is_compatible_bitmap(ALLEGRO_BITMAP *bitmap)
- bool al_is_sub_bitmap(ALLEGRO_BITMAP *bitmap)
- ALLEGRO_BITMAP *al_get_parent_bitmap(ALLEGRO_BITMAP *bitmap)
- void al_clear_to_color(ALLEGRO_COLOR color)
- void al_draw_bitmap(ALLEGRO_BITMAP *bitmap, float dx, float dy, int flags)
- void al_draw_tinted_bitmap(ALLEGRO_BITMAP *bitmap, ALLEGRO_COLOR tint,float dx, float dy, int flags)
- void al_draw_bitmap_region(ALLEGRO_BITMAP *bitmap,float sx, float sy, float sw, float sh, float dx, float dy, int flags)
- void al_draw_tinted_bitmap_region(ALLEGRO_BITMAP *bitmap,ALLEGRO_COLOR tint,float sx, float sy, float sw, float sh, float dx, float dy,int flags)
- void al_draw_pixel(float x, float y, ALLEGRO_COLOR color)
- void al_draw_rotated_bitmap(ALLEGRO_BITMAP *bitmap,float cx, float cy, float dx, float dy, float angle, int flags)
- void al_draw_tinted_rotated_bitmap(ALLEGRO_BITMAP *bitmap,ALLEGRO_COLOR tint,float cx, float cy, float dx, float dy, float angle, int flags)
- void al_draw_scaled_rotated_bitmap(ALLEGRO_BITMAP *bitmap,float cx, float cy, float dx, float dy, float xscale, float yscale,float angle, int flags)

- void al_draw_tinted_scaled_rotated_bitmap(ALLEGRO_BITMAP *bitmap, ALLEGRO_COLOR tint, float cx, float cy, float dx, float dy, float xscale, float yscale, float angle, int flags)
- void al_draw_tinted_scaled_rotated_bitmap_region(ALLEGRO_BITMAP *bitmap, float sx, float sy, float sw, float sh, ALLEGRO_COLOR tint, float cx, float cy, float dx, float dy, float xscale, float yscale, float angle, int flags)
- void al_draw_scaled_bitmap(ALLEGRO_BITMAP *bitmap, float sx, float sy, float sw, float sh, float dx, float dy, float dw, float dh, int flags)
- void al_draw_tinted_scaled_bitmap(ALLEGRO_BITMAP *bitmap, ALLEGRO_COLOR tint, float sx, float sy, float sw, float sh, float dx, float dy, float dw, float dh, int flags)
- ALLEGRO_BITMAP *al_get_target_bitmap(void)
- void al_put_pixel(int x, int y, ALLEGRO_COLOR color)
- void al_put_blended_pixel(int x, int y, ALLEGRO_COLOR color)
- void al_set_target_bitmap(ALLEGRO_BITMAP *bitmap)
- void al_set_target_backbuffer(ALLEGRO_DISPLAY *display)
- ALLEGRO_DISPLAY *al_get_current_display(void)
- void al_get_blender(int *op, int *src, int *dst)
- void al_get_separate_blender(int *op, int *src, int *dst, int *alpha_op, int *alpha_src, int *alpha_dst)
- void al_set_blender(int op, int src, int dst)
- void al_set_separate_blender(int op, int src, int dst, int alpha_op, int alpha_src, int alpha_dst)
- void al_get_clipping_rectangle(int *x, int *y, int *w, int *h)
- void al_set_clipping_rectangle(int x, int y, int width, int height)
- void al_reset_clipping_rectangle(void)
- void al_convert_mask_to_alpha(ALLEGRO_BITMAP *bitmap, ALLEGRO_COLOR mask_color)
- void al_hold_bitmap_drawing(bool hold)
- bool al_is_bitmap_drawing_held(void)
- ALLEGRO_BITMAP *al_load_bitmap_f(ALLEGRO_FILE *fp, const char *ident)
- bool al_save_bitmap(const char *filename, ALLEGRO_BITMAP *bitmap)
- bool al_save_bitmap_f(ALLEGRO_FILE *fp, const char *ident, ALLEGRO_BITMAP *bitmap)
- bool al_install_joystick(void)
- void al_uninstall_joystick(void)
- bool al_is_joystick_installed(void)
- bool al_reconfigure_joysticks(void)
- int al_get_num_joysticks(void)
- ALLEGRO_JOYSTICK * al_get_joystick(int num)
- void al_release_joystick(ALLEGRO_JOYSTICK *joy)
- bool al_get_joystick_active(ALLEGRO_JOYSTICK *joy)
- const char *al_get_joystick_name(ALLEGRO_JOYSTICK *joy)
- const char *al_get_joystick_stick_name(ALLEGRO_JOYSTICK *joy, int stick)

- `const char *al_get_joystick_axis_name(ALLEGRO_JOYSTICK *joy, int stick, int axis)`
- `const char *al_get_joystick_button_name(ALLEGRO_JOYSTICK *joy, int button)`
- `int al_get_joystick_stick_flags(ALLEGRO_JOYSTICK *joy, int stick)`
- `int al_get_joystick_num_sticks(ALLEGRO_JOYSTICK *joy)`
- `int al_get_joystick_num_axes(ALLEGRO_JOYSTICK *joy, int stick)`
- `int al_get_joystick_num_buttons(ALLEGRO_JOYSTICK *joy)`
- `void al_get_joystick_state(ALLEGRO_JOYSTICK *joy, ALLEGRO_JOYSTICK_STATE *ret_state)`
- `ALLEGRO_EVENT_SOURCE *al_get_joystick_event_source(void)`
- `bool al_install_keyboard(void)`
- `bool al_is_keyboard_installed(void)`
- `void al_uninstall_keyboard(void)`
- `void al_get_keyboard_state(ALLEGRO_KEYBOARD_STATE *ret_state)`
- `bool al_key_down(const ALLEGRO_KEYBOARD_STATE *state, int keycode)`
- `const char *al_keycode_to_name(int keycode)`
- `bool al_set_keyboard_leds(int leds)`
- `ALLEGRO_EVENT_SOURCE *al_get_keyboard_event_source(void)`
- `void *al_malloc_with_context(size_t n,int line, const char *file, const char *func)`
- `void al_free_with_context(void *ptr, int line, const char *file, const char *func)`
- `void *al_realloc_with_context(void *ptr, size_t n,int line, const char *file, const char *func)`
- `void *al_calloc_with_context(size_t count, size_t n,int line, const char *file, const char *func)`
- `void al_set_memory_interface(ALLEGRO_MEMORY_INTERFACE *memory_interface)`
- `int al_get_new_display_adapter(void)`
- `void al_set_new_display_adapter(int adapter)`
- `bool al_get_monitor_info(int adapter, ALLEGRO_MONITOR_INFO *info)`
- `int al_get_num_video_adapters(void)`
- `bool al_install_mouse(void)`
- `bool al_is_mouse_installed(void)`
- `void al_uninstall_mouse(void)`
- `unsigned int al_get_mouse_num_axes(void)`
- `unsigned int al_get_mouse_num_buttons(void)`
- `void al_get_mouse_state(ALLEGRO_MOUSE_STATE *ret_state)`
- `int al_get_mouse_state_axis(const ALLEGRO_MOUSE_STATE *state, int axis)`
- `bool al_mouse_button_down(const ALLEGRO_MOUSE_STATE *state, int button)`
- `bool al_set_mouse_xy(ALLEGRO_DISPLAY *display, int x, int y)`
- `bool al_set_mouse_z(int z)`
- `bool al_set_mouse_w(int w)`

- `bool al_set_mouse_axis(int which, int value)`
- `ALLEGRO_EVENT_SOURCE *al_get_mouse_event_source(void)`
- `ALLEGRO_MOUSE_CURSOR *al_create_mouse_cursor(ALLEGRO_BITMAP *bmp, int x_focus, int y_focus)`
- `void al_destroy_mouse_cursor(ALLEGRO_MOUSE_CURSOR *cursor)`
- `bool al_set_mouse_cursor(ALLEGRO_DISPLAY *display, ALLEGRO_MOUSE_CURSOR *cursor)`
- `bool al_set_system_mouse_cursor(ALLEGRO_DISPLAY *display, ALLEGRO_SYSTEM_MOUSE_CURSOR cursor_id)`
- `bool al_get_mouse_cursor_position(int *ret_x, int *ret_y)`
- `bool al_hide_mouse_cursor(ALLEGRO_DISPLAY *display)`
- `bool al_show_mouse_cursor(ALLEGRO_DISPLAY *display)`
- `bool al_grab_mouse(ALLEGRO_DISPLAY *display)`
- `bool al_ungrab_mouse(void)`
- `ALLEGRO_PATH *al_create_path(const char *str)`
- `ALLEGRO_PATH *al_create_path_for_directory(const char *str)`
- `void al_destroy_path(ALLEGRO_PATH *path)`
- `ALLEGRO_PATH *al_clone_path(const ALLEGRO_PATH *path)`
- `bool al_join_paths(ALLEGRO_PATH *path, const ALLEGRO_PATH *tail)`
- `bool al_rebase_path(const ALLEGRO_PATH *head, ALLEGRO_PATH *tail)`
- `const char *al_get_path_drive(const ALLEGRO_PATH *path)`
- `int al_get_path_num_components(const ALLEGRO_PATH *path)`
- `const char *al_get_path_component(const ALLEGRO_PATH *path, int i)`
- `const char *al_get_path_tail(const ALLEGRO_PATH *path)`
- `const char *al_get_path_filename(const ALLEGRO_PATH *path)`
- `const char *al_get_path_basename(const ALLEGRO_PATH *path)`
- `const char *al_get_path_extension(const ALLEGRO_PATH *path)`
- `void al_set_path_drive(ALLEGRO_PATH *path, const char *drive)`
- `void al_append_path_component(ALLEGRO_PATH *path, const char *s)`
- `void al_insert_path_component(ALLEGRO_PATH *path, int i, const char *s)`
- `void al_replace_path_component(ALLEGRO_PATH *path, int i, const char *s)`
- `void al_remove_path_component(ALLEGRO_PATH *path, int i)`
- `void al_drop_path_tail(ALLEGRO_PATH *path)`
- `void al_set_path_filename(ALLEGRO_PATH *path, const char *filename)`
- `bool al_set_path_extension(ALLEGRO_PATH *path, char const *extension)`
- `const char *al_path_cstr(const ALLEGRO_PATH *path, char delim)`
- `bool al_make_path_canonical(ALLEGRO_PATH *path)`
- `void al_restore_state(ALLEGRO_STATE const *state)`

- void al_store_state(ALLEGRO_STATE *state, int flags)
- int al_get_errno(void)
- void al_set_errno(int errnum)
- void al_uninstall_system(void)
- bool al_is_system_installed(void)
- uint32_t al_get_allegro_version(void)
- ALLEGRO_PATH *al_get_standard_path(int id)
- void al_set_exe_name(char const *path)
- void al_set_app_name(const char *app_name)
- void al_set_org_name(const char *org_name)
- const char *al_get_app_name(void)
- const char *al_get_org_name(void)
- ALLEGRO_CONFIG *al_get_system_config(void)
- ALLEGRO_THREAD *al_create_thread(void)
- void al_run_detached_thread(void)
- void al_start_thread(ALLEGRO_THREAD *thread)
- void al_join_thread(ALLEGRO_THREAD *thread, void **ret_value)
- void al_set_thread_should_stop(ALLEGRO_THREAD *thread)
- bool al_get_thread_should_stop(ALLEGRO_THREAD *thread)
- void al_destroy_thread(ALLEGRO_THREAD *thread)
- ALLEGRO_MUTEX *al_create_mutex(void)
- ALLEGRO_MUTEX *al_create_mutex_recursive(void)
- void al_lock_mutex(ALLEGRO_MUTEX *mutex)
- void al_unlock_mutex(ALLEGRO_MUTEX *mutex)
- void al_destroy_mutex(ALLEGRO_MUTEX *mutex)
- ALLEGRO_COND *al_create_cond(void)
- void al_destroy_cond(ALLEGRO_COND *cond)
- void al_wait_cond(ALLEGRO_COND *cond, ALLEGRO_MUTEX *mutex)
- int al_wait_cond_until(ALLEGRO_COND *cond, ALLEGRO_MUTEX *mutex, const ALLEGRO_TIMEOUT *timeout)
- void al_broadcast_cond(ALLEGRO_COND *cond)
- void al_signal_cond(ALLEGRO_COND *cond)
- double al_get_time(void)
- void al_init_timeout(ALLEGRO_TIMEOUT *timeout, double seconds)
- void al_rest(double seconds)
- ALLEGRO_TIMER *al_create_timer(double speed_secs)

- void al_start_timer(ALLEGRO_TIMER *timer)
- void al_stop_timer(ALLEGRO_TIMER *timer)
- bool al_get_timer_started(const ALLEGRO_TIMER *timer)
- void al_destroy_timer(ALLEGRO_TIMER *timer)
- int64_t al_get_timer_count(const ALLEGRO_TIMER *timer)
- void al_set_timer_count(ALLEGRO_TIMER *timer, int64_t new_count)
- void al_add_timer_count(ALLEGRO_TIMER *timer, int64_t diff)
- double al_get_timer_speed(const ALLEGRO_TIMER *timer)
- void al_set_timer_speed(ALLEGRO_TIMER *timer, double new_speed_secs)
- ALLEGRO_EVENT_SOURCE *al_get_timer_event_source(ALLEGRO_TIMER *timer)
- void al_copy_transform(ALLEGRO_TRANSFORM *dest, const ALLEGRO_TRANSFORM *src)
- void al_use_transform(const ALLEGRO_TRANSFORM *trans)
- const ALLEGRO_TRANSFORM *al_get_current_transform(void)
- void al_invert_transform(ALLEGRO_TRANSFORM *trans)
- int al_check_inverse(const ALLEGRO_TRANSFORM *trans, float tol)
- void al_identity_transform(ALLEGRO_TRANSFORM *trans)
- void al_build_transform(ALLEGRO_TRANSFORM *trans, float x, float y, float sx, float sy, float theta)
- void al_translate_transform(ALLEGRO_TRANSFORM *trans, float x, float y)
- void al_rotate_transform(ALLEGRO_TRANSFORM *trans, float theta)
- void al_scale_transform(ALLEGRO_TRANSFORM *trans, float sx, float sy)
- void al_transform_coordinates(const ALLEGRO_TRANSFORM *trans, float *x, float *y)
- void al_compose_transform(ALLEGRO_TRANSFORM *trans, const ALLEGRO_TRANSFORM *other)
- ALLEGRO_USTR *al_ustr_new(const char *s)
- ALLEGRO_USTR *al_ustr_new_from_buffer(const char *s, size_t size)
- void al_ustr_free(ALLEGRO_USTR *us)
- const char *al_cstr(const ALLEGRO_USTR *us)
- void al_ustr_to_buffer(const ALLEGRO_USTR *us, char *buffer, int size)
- char *al_cstr_dup(const ALLEGRO_USTR *us)
- ALLEGRO_USTR *al_ustr_dup(const ALLEGRO_USTR *us)
- ALLEGRO_USTR *al_ustr_dup_substr(const ALLEGRO_USTR *us, int start_pos, int end_pos)
- const ALLEGRO_USTR *al_ustr_empty_string(void)
- const ALLEGRO_USTR *al_ref_cstr(ALLEGRO_USTR_INFO *info, const char *s)
- const ALLEGRO_USTR *al_ref_buffer(ALLEGRO_USTR_INFO *info, const char *s, size_t size)
- const ALLEGRO_USTR *al_ref_ustr(ALLEGRO_USTR_INFO *info, const ALLEGRO_USTR *us, int start_pos, int end_pos)
- size_t al_ustr_size(const ALLEGRO_USTR *us)

- `size_t al_ustr_length(const ALLEGRO_USTR *us)`
- `int al_ustr_offset(const ALLEGRO_USTR *us, int index)`
- `bool al_ustr_next(const ALLEGRO_USTR *us, int *pos)`
- `bool al_ustr_prev(const ALLEGRO_USTR *us, int *pos)`
- `int32_t al_ustr_get(const ALLEGRO_USTR *ub, int pos)`
- `int32_t al_ustr_get_next(const ALLEGRO_USTR *us, int *pos)`
- `int32_t al_ustr_prev_get(const ALLEGRO_USTR *us, int *pos)`
- `bool al_ustr_insert(ALLEGRO_USTR *us1, int pos, const ALLEGRO_USTR *us2)`
- `bool al_ustr_insert_cstr(ALLEGRO_USTR *us, int pos, const char *s)`
- `size_t al_ustr_insert_chr(ALLEGRO_USTR *us, int pos, int32_t c)`
- `bool al_ustr_append(ALLEGRO_USTR *us1, const ALLEGRO_USTR *us2)`
- `bool al_ustr_append_cstr(ALLEGRO_USTR *us, const char *s)`
- `size_t al_ustr_append_chr(ALLEGRO_USTR *us, int32_t c)`
- `bool al_ustr_remove_chr(ALLEGRO_USTR *us, int pos)`
- `bool al_ustr_remove_range(ALLEGRO_USTR *us, int start_pos, int end_pos)`
- `bool al_ustr_truncate(ALLEGRO_USTR *us, int start_pos)`
- `bool al_ustr_ltrim_ws(ALLEGRO_USTR *us)`
- `bool al_ustr_rtrim_ws(ALLEGRO_USTR *us)`
- `bool al_ustr_trim_ws(ALLEGRO_USTR *us)`
- `bool al_ustr_assign(ALLEGRO_USTR *us1, const ALLEGRO_USTR *us2)`
- `bool al_ustr_assign_substr(ALLEGRO_USTR *us1, const ALLEGRO_USTR *us2, int start_pos, int end_pos)`
- `bool al_ustr_assign_cstr(ALLEGRO_USTR *us1, const char *s)`
- `size_t al_ustr_set_chr(ALLEGRO_USTR *us, int start_pos, int32_t c)`
- `bool al_ustr_replace_range(ALLEGRO_USTR *us1, int start_pos1, int end_pos1, const ALLEGRO_USTR *us2)`
- `int al_ustr_find_chr(const ALLEGRO_USTR *us, int start_pos, int32_t c)`
- `int al_ustr_rfind_chr(const ALLEGRO_USTR *us, int end_pos, int32_t c)`
- `int al_ustr_find_set(const ALLEGRO_USTR *us, int start_pos, const ALLEGRO_USTR *accept)`
- `int al_ustr_find_set_cstr(const ALLEGRO_USTR *us, int start_pos, const char *accept)`
- `int al_ustr_find_cset(const ALLEGRO_USTR *us, int start_pos, const ALLEGRO_USTR *reject)`
- `int al_ustr_find_cset_cstr(const ALLEGRO_USTR *us, int start_pos, const char *reject)`
- `int al_ustr_find_str(const ALLEGRO_USTR *haystack, int start_pos, const ALLEGRO_USTR *needle)`
- `int al_ustr_find_cstr(const ALLEGRO_USTR *haystack, int start_pos, const char *needle)`
- `int al_ustr_rfind_str(const ALLEGRO_USTR *haystack, int end_pos, const ALLEGRO_USTR *needle)`
- `int al_ustr_rfind_cstr(const ALLEGRO_USTR *haystack, int end_pos, const char *needle)`
- `bool al_ustr_find_replace(ALLEGRO_USTR *us, int start_pos, const ALLEGRO_USTR *find, const ALLEGRO_USTR *replace)`

- `bool al_ustr_find_replace_cstr(ALLEGRO_USTR *us, int start_pos,const char *find, const char *replace)`
- `int al_ustr_compare(const ALLEGRO_USTR *us1, const ALLEGRO_USTR *us2)`
- `int al_ustr_ncompare(const ALLEGRO_USTR *us1, const ALLEGRO_USTR *us2, int n)`
- `bool al_ustr_equal(const ALLEGRO_USTR *us1, const ALLEGRO_USTR *us2)`
- `bool al_ustr_has_prefix(const ALLEGRO_USTR *us1, const ALLEGRO_USTR *us2)`
- `bool al_ustr_has_prefix_cstr(const ALLEGRO_USTR *us1, const char *s2)`
- `bool al_ustr_has_suffix(const ALLEGRO_USTR *us1, const ALLEGRO_USTR *us2)`
- `bool al_ustr_has_suffix_cstr(const ALLEGRO_USTR *us1, const char *s2)`
- `ALLEGRO_USTR *al_ustr_new_from_utf16(uint16_t const *s)`
- `size_t al_ustr_size_utf16(const ALLEGRO_USTR *us)`
- `size_t al_ustr_encode_utf16(const ALLEGRO_USTR *us, uint16_t *s,size_t n)`
- `size_t al_utf8_width(int c)`
- `size_t al_utf8_encode(char s[], int32_t c)`
- `size_t al_utf16_width(int c)`
- `LPDIRECT3DDEVICE9 al_get_d3d_device(ALLEGRO_DISPLAY *display)`
- `LPDIRECT3DTEXTURE9 al_get_d3d_system_texture(ALLEGRO_BITMAP *bitmap)`
- `LPDIRECT3DTEXTURE9 al_get_d3d_video_texture(ALLEGRO_BITMAP *bitmap)`
- `bool al_have_d3d_non_pow2_texture_support(void)`
- `bool al_have_d3d_non_square_texture_support(void)`
- `void al_get_d3d_texture_position(ALLEGRO_BITMAP *bitmap, int *u, int *v)`
- `bool al_is_d3d_device_lost(ALLEGRO_DISPLAY *display)`
- `ALLEGRO_OGL_EXT_LIST *al_get_opengl_extension_list(void)`
- `void *al_get_opengl_proc_address(const char *name)`
- `GLuint al_get_opengl_texture(ALLEGRO_BITMAP *bitmap)`
- `void al_get_opengl_texture_size(ALLEGRO_BITMAP *bitmap, int *w, int *h)`
- `void al_get_opengl_texture_position(ALLEGRO_BITMAP *bitmap, int *u, int *v)`
- `GLuint al_get_opengl_fbo(ALLEGRO_BITMAP *bitmap)`
- `void al_remove_opengl_fbo(ALLEGRO_BITMAP *bitmap)`
- `bool al_have_opengl_extension(const char *extension);`
- `uint32_t al_get_opengl_version(void)`
- `int al_get_opengl_variant(void)`
- `void al_set_current_opengl_context(ALLEGRO_DISPLAY *display)`
- `bool al_install_audio(void)`
- `void al_uninstall_audio(void)`
- `bool al_is_audio_installed(void)`
- `bool al_reserve_samples(int reserve_samples)`

- `uint32_t al_get_allegro_audio_version(void)`
- `size_t al_get_audio_depth_size(ALLEGRO_AUDIO_DEPTH depth)`
- `size_t al_get_channel_count(ALLEGRO_CHANNEL_CONF conf)`
- `ALLEGRO_VOICE *al_create_voice(unsigned int freq, ALLEGRO_AUDIO_DEPTH depth, ALLEGRO_CHANNEL_CONF chan_conf)`
- `void al_destroy_voice(ALLEGRO_VOICE *voice)`
- `void al_detach_voice(ALLEGRO_VOICE *voice)`
- `bool al_attach_audio_stream_to_voice(ALLEGRO_AUDIO_STREAM *stream, ALLEGRO_VOICE *voice)`
- `bool al_attach_mixer_to_voice(ALLEGRO_MIXER *mixer, ALLEGRO_VOICE *voice)`
- `bool al_attach_sample_instance_to_voice(ALLEGRO_SAMPLE_INSTANCE *spl, ALLEGRO_VOICE *voice)`
- `unsigned int al_get_voice_frequency(const ALLEGRO_VOICE *voice)`
- `ALLEGRO_CHANNEL_CONF al_get_voice_channels(const ALLEGRO_VOICE *voice)`
- `ALLEGRO_AUDIO_DEPTH al_get_voice_depth(const ALLEGRO_VOICE *voice)`
- `bool al_get_voice_playing(const ALLEGRO_VOICE *voice)`
- `bool al_set_voice_playing(ALLEGRO_VOICE *voice, bool val)`
- `unsigned int al_get_voice_position(const ALLEGRO_VOICE *voice)`
- `bool al_set_voice_position(ALLEGRO_VOICE *voice, unsigned int val)`
- `ALLEGRO_SAMPLE *al_create_sample(void *buf, unsigned int samples, unsigned int freq, ALLEGRO_AUDIO_DEPTH depth, ALLEGRO_CHANNEL_CONF chan_conf, bool free_buf)`
- `void al_destroy_sample(ALLEGRO_SAMPLE *spl)`
- `bool al_play_sample(ALLEGRO_SAMPLE *spl, float gain, float pan, float speed, int loop, ALLEGRO_SAMPLE_ID *ret_id)`
- `void al_stop_sample(ALLEGRO_SAMPLE_ID *spl_id)`
- `void al_stop_samples(void)`
- `ALLEGRO_CHANNEL_CONF al_get_sample_channels(const ALLEGRO_SAMPLE *spl)`
- `ALLEGRO_AUDIO_DEPTH al_get_sample_depth(const ALLEGRO_SAMPLE *spl)`
- `unsigned int al_get_sample_frequency(const ALLEGRO_SAMPLE *spl)`
- `unsigned int al_get_sample_length(const ALLEGRO_SAMPLE *spl)`
- `void *al_get_sample_data(const ALLEGRO_SAMPLE *spl)`
- `ALLEGRO_SAMPLE_INSTANCE *al_create_sample_instance(ALLEGRO_SAMPLE *sample_data)`
- `void al_destroy_sample_instance(ALLEGRO_SAMPLE_INSTANCE *spl)`
- `bool al_play_sample_instance(ALLEGRO_SAMPLE_INSTANCE *spl)`
- `bool al_stop_sample_instance(ALLEGRO_SAMPLE_INSTANCE *spl)`
- `ALLEGRO_CHANNEL_CONF al_get_sample_instance_channels(const ALLEGRO_SAMPLE_INSTANCE *spl)`
- `ALLEGRO_AUDIO_DEPTH al_get_sample_instance_depth(const ALLEGRO_SAMPLE_INSTANCE *spl)`
- `unsigned int al_get_sample_instance_frequency(const ALLEGRO_SAMPLE_INSTANCE *spl)`

- `unsigned int al_get_sample_instance_length(const ALLEGRO_SAMPLE_INSTANCE *spl)`
- `bool al_set_sample_instance_length(ALLEGRO_SAMPLE_INSTANCE *spl,unsigned int val)`
- `unsigned int al_get_sample_instance_position(const ALLEGRO_SAMPLE_INSTANCE *spl)`
- `bool al_set_sample_instance_position(ALLEGRO_SAMPLE_INSTANCE *spl,unsigned int val)`
- `float al_get_sample_instance_speed(const ALLEGRO_SAMPLE_INSTANCE *spl)`
- `bool al_set_sample_instance_speed(ALLEGRO_SAMPLE_INSTANCE *spl, float val)`
- `float al_get_sample_instance_gain(const ALLEGRO_SAMPLE_INSTANCE *spl)`
- `bool al_set_sample_instance_gain(ALLEGRO_SAMPLE_INSTANCE *spl, float val)`
- `float al_get_sample_instance_pan(const ALLEGRO_SAMPLE_INSTANCE *spl)`
- `bool al_set_sample_instance_pan(ALLEGRO_SAMPLE_INSTANCE *spl, float val)`
- `float al_get_sample_instance_time(const ALLEGRO_SAMPLE_INSTANCE *spl)`
- `ALLEGRO_PLAYMODE al_get_sample_instance_playmode(const ALLEGRO_SAMPLE_INSTANCE *spl)`
- `bool al_set_sample_instance_playmode(ALLEGRO_SAMPLE_INSTANCE *spl,ALLEGRO_PLAYMODE val)`
- `bool al_get_sample_instance_playing(const ALLEGRO_SAMPLE_INSTANCE *spl)`
- `bool al_set_sample_instance_playing(ALLEGRO_SAMPLE_INSTANCE *spl, bool val)`
- `bool al_get_sample_instance_attached(const ALLEGRO_SAMPLE_INSTANCE *spl)`
- `bool al_detach_sample_instance(ALLEGRO_SAMPLE_INSTANCE *spl)`
- `ALLEGRO_SAMPLE *al_get_sample(ALLEGRO_SAMPLE_INSTANCE *spl)`
- `bool al_set_sample(ALLEGRO_SAMPLE_INSTANCE *spl, ALLEGRO_SAMPLE *data)`
- `ALLEGRO_MIXER *al_create_mixer(unsigned int freq,ALLEGRO_AUDIO_DEPTH depth, ALLEGRO_CHANNEL_CONF chan_conf)`
- `void al_destroy_mixer(ALLEGRO_MIXER *mixer)`
- `ALLEGRO_MIXER *al_get_default_mixer(void)`
- `bool al_set_default_mixer(ALLEGRO_MIXER *mixer)`
- `bool al_restore_default_mixer(void)`
- `bool al_attach_mixer_to_mixer(ALLEGRO_MIXER *stream, ALLEGRO_MIXER *mixer)`
- `bool al_attach_sample_instance_to_mixer(ALLEGRO_SAMPLE_INSTANCE *spl,ALLEGRO_MIXER *mixer)`
- `bool al_attach_audio_stream_to_mixer(ALLEGRO_AUDIO_STREAM *stream, ALLEGRO_MIXER *mixer)`
- `unsigned int al_get_mixer_frequency(const ALLEGRO_MIXER *mixer)`
- `bool al_set_mixer_frequency(ALLEGRO_MIXER *mixer, unsigned int val)`
- `ALLEGRO_CHANNEL_CONF al_get_mixer_channels(const ALLEGRO_MIXER *mixer)`
- `ALLEGRO_AUDIO_DEPTH al_get_mixer_depth(const ALLEGRO_MIXER *mixer)`
- `float al_get_mixer_gain(const ALLEGRO_MIXER *mixer)`
- `bool al_set_mixer_gain(ALLEGRO_MIXER *mixer, float new_gain)`
- `ALLEGRO_MIXER_QUALITY al_get_mixer_quality(const ALLEGRO_MIXER *mixer)`

- bool al_set_mixer_quality(ALLEGRO_MIXER *mixer, ALLEGRO_MIXER_QUALITY new_quality)
- bool al_get_mixer_playing(const ALLEGRO_MIXER *mixer)
- bool al_set_mixer_playing(ALLEGRO_MIXER *mixer, bool val)
- bool al_get_mixer_attached(const ALLEGRO_MIXER *mixer)
- bool al_detach_mixer(ALLEGRO_MIXER *mixer)
- void al_destroy_audio_stream(ALLEGRO_AUDIO_STREAM *stream)
- ALLEGRO_EVENT_SOURCE *al_get_audio_stream_event_source(ALLEGRO_AUDIO_STREAM *stream)
- void al_drain_audio_stream(ALLEGRO_AUDIO_STREAM *stream)
- bool al_rewind_audio_stream(ALLEGRO_AUDIO_STREAM *stream)
- unsigned int al_get_audio_stream_frequency(const ALLEGRO_AUDIO_STREAM *stream)
- ALLEGRO_CHANNEL_CONF al_get_audio_stream_channels(const ALLEGRO_AUDIO_STREAM *stream)
- ALLEGRO_AUDIO_DEPTH al_get_audio_stream_depth(const ALLEGRO_AUDIO_STREAM *stream)
- unsigned int al_get_audio_stream_length(const ALLEGRO_AUDIO_STREAM *stream)
- float al_get_audio_stream_speed(const ALLEGRO_AUDIO_STREAM *stream)
- bool al_set_audio_stream_speed(ALLEGRO_AUDIO_STREAM *stream, float val)
- float al_get_audio_stream_gain(const ALLEGRO_AUDIO_STREAM *stream)
- bool al_set_audio_stream_gain(ALLEGRO_AUDIO_STREAM *stream, float val)
- float al_get_audio_stream_pan(const ALLEGRO_AUDIO_STREAM *stream)
- bool al_set_audio_stream_pan(ALLEGRO_AUDIO_STREAM *stream, float val)
- bool al_get_audio_stream_playing(const ALLEGRO_AUDIO_STREAM *stream)
- bool al_set_audio_stream_playing(ALLEGRO_AUDIO_STREAM *stream, bool val)
- ALLEGRO_PLAYMODE al_get_audio_stream_playmode(const ALLEGRO_AUDIO_STREAM *stream)
- bool al_set_audio_stream_playmode(ALLEGRO_AUDIO_STREAM *stream, ALLEGRO_PLAYMODE val)
- bool al_get_audio_stream_attached(const ALLEGRO_AUDIO_STREAM *stream)
- bool al_detach_audio_stream(ALLEGRO_AUDIO_STREAM *stream)
- void *al_get_audio_stream_fragment(const ALLEGRO_AUDIO_STREAM *stream)
- bool al_set_audio_stream_fragment(ALLEGRO_AUDIO_STREAM *stream, void *val)
- unsigned int al_get_audio_stream_fragments(const ALLEGRO_AUDIO_STREAM *stream)
- unsigned int al_get_available_audio_stream_fragments(const ALLEGRO_AUDIO_STREAM *stream)
- bool al_seek_audio_stream_secs(ALLEGRO_AUDIO_STREAM *stream, double time)
- double al_get_audio_stream_position_secs(ALLEGRO_AUDIO_STREAM *stream)
- double al_get_audio_stream_length_secs(ALLEGRO_AUDIO_STREAM *stream)
- bool al_set_audio_stream_loop_secs(ALLEGRO_AUDIO_STREAM *stream, double start, double end)
- ALLEGRO_SAMPLE *al_load_sample(const char *filename)
- ALLEGRO_SAMPLE al_load_sample_f(ALLEGRO_FILE fp, const char *ident)

- ALLEGRO_AUDIO_STREAM *al_load_audio_stream(const char *filename, size_t buffer_count, unsigned int samples)
- ALLEGRO_AUDIO_STREAM *al_load_audio_stream_f(ALLEGRO_FILE fp, const char *ident, size_t buffer_count, unsigned int samples)*
- bool al_save_sample(const char *filename, ALLEGRO_SAMPLE *spl)
- bool al_save_sample_f(ALLEGRO_FILE *fp, const char *ident, ALLEGRO_SAMPLE *spl)
- bool al_init_acodec_addon(void)
- uint32_t al_get_allegro_acodec_version(void)
- ALLEGRO_COLOR al_color_cmyk(float c, float m, float y, float k)
- void al_color_cmyk_to_rgb(float cyan, float magenta, float yellow, float key, float *red, float *green, float *blue)
- ALLEGRO_COLOR al_color_hsl(float h, float s, float l)
- void al_color_hsl_to_rgb(float hue, float saturation, float lightness, float *red, float *green, float *blue)
- ALLEGRO_COLOR al_color_hsv(float h, float s, float v)
- void al_color_hsv_to_rgb(float hue, float saturation, float value, float *red, float *green, float *blue)
- ALLEGRO_COLOR al_color_html(char const *string)
- void al_color_html_to_rgb(char const *string, float *red, float *green, float *blue)
- void al_color_rgb_to_html(float red, float green, float blue, char *string)
- ALLEGRO_COLOR al_color_name(char const *name)
- bool al_color_name_to_rgb(char const *name, float *r, float *g, float *b)
- void al_color_rgb_to_cmyk(float red, float green, float blue, float *cyan, float *magenta, float *yellow, float *key)
- void al_color_rgb_to_hsl(float red, float green, float blue, float *hue, float *saturation, float *lightness)
- void al_color_rgb_to_hsv(float red, float green, float blue, float *hue, float *saturation, float *value)
- char const *al_color_rgb_to_name(float r, float g, float b)
- void al_color_rgb_to_yuv(float red, float green, float blue, float *y, float *u, float *v)
- ALLEGRO_COLOR al_color_yuv(float y, float u, float v)
- void al_color_yuv_to_rgb(float y, float u, float v, float *red, float *green, float *blue)
- uint32_t al_get_allegro_color_version(void)
- void al_init_font_addon(void)
- void al_shutdown_font_addon(void)
- ALLEGRO_FONT *al_load_font(char const *filename, int size, int flags)
- void al_destroy_font(ALLEGRO_FONT *f)
- int al_get_font_ascent(const ALLEGRO_FONT *f)
- int al_get_font_descent(const ALLEGRO_FONT *f)
- int al_get_text_width(const ALLEGRO_FONT *f, const char *str)
- int al_get_ustr_width(const ALLEGRO_FONT *f, ALLEGRO_USTR const *ustr)

- void al_draw_text(const ALLEGRO_FONT *font,ALLEGRO_COLOR color, float x, float y, int flags,char const *text)
- void al_draw_ustr(const ALLEGRO_FONT *font,ALLEGRO_COLOR color, float x, float y, int flags,const ALLEGRO_USTR *ustr)
- void al_draw_justified_text(const ALLEGRO_FONT *font,ALLEGRO_COLOR color, float x1, float x2,float y, float diff, int flags, const char *text)
- void al_draw_justified_ustr(const ALLEGRO_FONT *font,ALLEGRO_COLOR color, float x1, float x2,float y, float diff, int flags, const ALLEGRO_USTR *ustr)
- void al_get_text_dimensions(const ALLEGRO_FONT *f,char const *text,int *bbx, int *bby, int *bbw, int *bbh)
- void al_get_ustr_dimensions(const ALLEGRO_FONT *f,ALLEGRO_USTR const *ustr,int *bbx, int *bby, int *bbw, int *bbh)
- uint32_t al_get_allegro_font_version(void)
- ALLEGRO_FONT *al_grab_font_from_bitmap(ALLEGRO_BITMAP *bmp,int ranges_n, const int ranges[])
- ALLEGRO_FONT *al_load_bitmap_font(const char *fname)
- ALLEGRO_FONT *al_create_builtin_font(void)
- bool al_init_ttf_addon(void)
- void al_shutdown_ttf_addon(void)
- ALLEGRO_FONT *al_load_ttf_font(char const *filename, int size, int flags)
- ALLEGRO_FONT *al_load_ttf_font_f(ALLEGRO_FILE *file,char const *filename, int size, int flags)
- ALLEGRO_FONT *al_load_ttf_font_stretch(char const *filename, int w, int h,int flags)
- ALLEGRO_FONT *al_load_ttf_font_stretch_f(ALLEGRO_FILE *file,char const *filename, int w, int h, int flags)
- uint32_t al_get_allegro_ttf_version(void)
- bool al_init_image_addon(void)
- void al_shutdown_image_addon(void)
- uint32_t al_get_allegro_image_version(void)
- ALLEGRO_FILE *al_open_memfile(void *mem, int64_t size, const char *mode)
- uint32_t al_get_allegro_memfile_version(void)
- bool al_init_native_dialog_addon(void)
- void al_shutdown_native_dialog_addon(void)
- ALLEGRO_FILECHOOSEN *al_create_native_file_dialog(char const *initial_path,char const *title,char const *patterns,int mode)
- bool al_show_native_file_dialog(ALLEGRO_DISPLAY *display,ALLEGRO_FILECHOOSEN *dialog)
- int al_get_native_file_dialog_count(const ALLEGRO_FILECHOOSEN *dialog)
- const char *al_get_native_file_dialog_path(const ALLEGRO_FILECHOOSEN *dialog, size_t i)
- void al_destroy_native_file_dialog(ALLEGRO_FILECHOOSEN *dialog)
- int al_show_native_message_box(ALLEGRO_DISPLAY *display,char const *title, char const *heading, char const *text,char const *buttons, int flags)
- ALLEGRO_TEXTLOG *al_open_native_text_log(char const *title, int flags)

- void al_close_native_text_log(ALLEGRO_TEXTLOG *textlog)
- uint32_t al_get_allegro_native_dialog_version(void)
- void al_set_physfs_file_interface(void)
- uint32_t al_get_allegro_physfs_version(void)
- uint32_t al_get_allegro_primitives_version(void)
- bool al_init_primitives_addon(void)
- void al_shutdown_primitives_addon(void)
- void al_draw_line(float x1, float y1, float x2, float y2, ALLEGRO_COLOR color, float thickness)
- void al_draw_triangle(float x1, float y1, float x2, float y2, float x3, float y3, ALLEGRO_COLOR color, float thickness)
- void al_draw_filled_triangle(float x1, float y1, float x2, float y2, float x3, float y3, ALLEGRO_COLOR color)
- void al_draw_rectangle(float x1, float y1, float x2, float y2, ALLEGRO_COLOR color, float thickness)
- void al_draw_filled_rectangle(float x1, float y1, float x2, float y2, ALLEGRO_COLOR color)
- void al_draw_rounded_rectangle(float x1, float y1, float x2, float y2, float rx, float ry, ALLEGRO_COLOR color, float thickness)
- void al_draw_filled_rounded_rectangle(float x1, float y1, float x2, float y2, float rx, float ry, ALLEGRO_COLOR color)
- void al_calculate_arc(float* dest, int stride, float cx, float cy, float rx, float ry, float start_theta, float delta_theta, float thickness, int num_points)
- void al_draw_pieslice(float cx, float cy, float r, float start_theta, float delta_theta, ALLEGRO_COLOR color, float thickness)
- void al_draw_filled_pieslice(float cx, float cy, float r, float start_theta, float delta_theta, ALLEGRO_COLOR color)
- void al_draw_ellipse(float cx, float cy, float rx, float ry, ALLEGRO_COLOR color, float thickness)
- void al_draw_filled_ellipse(float cx, float cy, float rx, float ry, ALLEGRO_COLOR color)
- void al_draw_circle(float cx, float cy, float r, ALLEGRO_COLOR color, float thickness)
- void al_draw_filled_circle(float cx, float cy, float r, ALLEGRO_COLOR color)
- void al_draw_arc(float cx, float cy, float r, float start_theta, float delta_theta, ALLEGRO_COLOR color, float thickness)
- void al_draw_elliptical_arc(float cx, float cy, float rx, float ry, float start_theta, float delta_theta, ALLEGRO_COLOR color, float thickness)
- void al_draw_ribbon(const float *points, int points_stride, ALLEGRO_COLOR color, float thickness, int num_segments)
- int al_draw_prim(const void* vtxs, const ALLEGRO_VERTEX_DECL* decl, ALLEGRO_BITMAP* texture, int start, int end, int type)
- int al_draw_indexed_prim(const void* vtxs, const ALLEGRO_VERTEX_DECL* decl, ALLEGRO_BITMAP* texture, const int* indices, int num_vtx, int type)
- ALLEGRO_VERTEX_DECL* al_create_vertex_decl(const ALLEGRO_VERTEX_ELEMENT* elements, int stride)
- void al_destroy_vertex_decl(ALLEGRO_VERTEX_DECL* decl)

- ALLEGRO_SHADER *al_create_shader(ALLEGRO_SHADER_PLATFORM platform)
- bool al_attach_shader_source(ALLEGRO_SHADER *shader, ALLEGRO_SHADER_TYPE type,const char *source)
- bool al_attach_shader_source_file(ALLEGRO_SHADER *shader,ALLEGRO_SHADER_TYPE type, const char *filename)
- bool al_build_shader(ALLEGRO_SHADER *shader)
- const char *al_get_shader_log(ALLEGRO_SHADER *shader)
- ALLEGRO_SHADER_PLATFORM al_get_shader_platform(ALLEGRO_SHADER *shader)
- bool al_use_shader(ALLEGRO_SHADER *shader)
- void al_destroy_shader(ALLEGRO_SHADER *shader)
- bool al_set_shader_sampler(const char *name,ALLEGRO_BITMAP *bitmap, int unit)
- bool al_set_shader_matrix(const char *name,const ALLEGRO_TRANSFORM *matrix)
- bool al_set_shader_int(const char *name, int i)
- bool al_set_shader_float(const char *name, float f)
- bool al_set_shader_bool(const char *name, bool b)
- bool al_set_shader_int_vector(const char *name,int num_components, const int *i, int num_elems)
- bool al_set_shader_float_vector(const char *name,int num_components, const float *f, int num_elems)
- char const *al_get_default_shader_source(ALLEGRO_SHADER_PLATFORM platform,ALLEGRO_SHADER_TYPE type)

CHAPTER
SEVENTYSIX

USING RINGLIBSDL

In this chapter we will learn about using RingLibSDL to create games based on the LibSDL, SDLImage, SDLTTF and SDLMixer libraries.

Tip: RingLibSDL is not distributed with the binary releases for desktop which uses RingAllegro

Note: To use RingLibSDL, Check ring/android/ringlibsdl folder.

76.1 Create Window

Example:

```
Load "libsdl.ring"

SDL_Init(SDL_INIT_EVERYTHING)
win = SDL_CreateWindow("Hello World!", 100, 100, 640, 480, SDL_WINDOW_SHOWN)
SDL_Delay(2000)
SDL_DestroyWindow(win)
SDL_Quit()
```

76.2 Display Image

Example:

```
Load "libsdl.ring"

SDL_Init(SDL_INIT_EVERYTHING)
win = SDL_CreateWindow("Hello World!", 100, 100, 640, 480, SDL_WINDOW_SHOWN)
ren = SDL_CreateRenderer(win, -1, SDL_RENDERER_ACCELERATED | SDL_RENDERER_
    PRESENTVSYNC )
bmp = SDL_LoadBMP("hello.bmp")
tex = SDL_CreateTextureFromSurface(ren, bmp)
SDL_FreeSurface(bmp)
SDL_RenderClear(ren)
SDL_RenderCopy2(ren, tex)
SDL_RenderPresent(ren)
```

(continues on next page)

(continued from previous page)

```
SDL_Delay(2000)
SDL_DestroyTexture(tex)
SDL_DestroyRenderer(ren)
SDL_DestroyWindow(win)
SDL_Quit()
```

76.3 Switch between two images

Example:

```
Load "libsdl.ring"

SDL_Init(SDL_INIT_EVERYTHING)
win = SDL_CreateWindow("Hello World!", 100, 100, 640, 480, SDL_WINDOW_SHOWN)
ren = SDL_CreateRenderer(win, -1, SDL_RENDERER_ACCELERATED | SDL_RENDERER_
↪PRESENTVSYNC )
bmp = SDL_LoadBMP("hello.bmp")
tex = SDL_CreateTextureFromSurface(ren, bmp)
SDL_FreeSurface(bmp)
bmp = SDL_LoadBMP("hello2.bmp")
tex2 = SDL_CreateTextureFromSurface(ren, bmp)
SDL_FreeSurface(bmp)

for x = 1 to 10 showtex(tex) showtex(tex2) next

SDL_DestroyTexture(tex)
SDL_DestroyTexture(tex2)
SDL_DestroyRenderer(ren)
SDL_DestroyWindow(win)
SDL_Quit()

func showtex oTex
    SDL_RenderClear(ren)
    SDL_RenderCopy2(ren,oTex)
    SDL_RenderPresent(ren)
    SDL_Delay(200)
```

76.4 Draw Rectangle

Example:

```
Load "libsdl.ring"

SDL_Init(SDL_INIT_EVERYTHING)
win = SDL_CreateWindow("Hello World!", 100, 100, 640, 480, SDL_WINDOW_SHOWN)
ren = SDL_CreateRenderer(win, -1, SDL_RENDERER_ACCELERATED | SDL_RENDERER_
↪PRESENTVSYNC )
SDL_RenderClear(ren)
rect = sdl_new_sdl_rect()
sdl_set_sdl_rect_x(rect,10)
sdl_set_sdl_rect_y(rect,10)
```

(continues on next page)

(continued from previous page)

```
sdl_set_sdl_rect_w(rect, 100)
sdl_set_sdl_rect_h(rect, 100)
SDL_SetRenderDrawColor(ren, 255, 255, 255, 255)
SDL_RenderDrawRect(ren, rect)
sdl_destroy_sdl_rect(rect)
SDL_RenderPresent(ren)
SDL_Delay(2000)
SDL_DestroyRenderer(ren)
SDL_DestroyWindow(win)
SDL_Quit()
```

76.5 Display PNG Images

Example:

```
Load "libsdl.ring"

SDL_Init(SDL_INIT_EVERYTHING)
win = SDL_CreateWindow("Hello World!", 100, 100, 640, 480, SDL_WINDOW_SHOWN)
ren = SDL_CreateRenderer(win, -1, SDL_RENDERER_ACCELERATED | SDL_RENDERER_
↪PRESENTVSYNC )
bmp = IMG_Load("hello3.png")
tex = SDL_CreateTextureFromSurface(ren, bmp)
SDL_FreeSurface(bmp)
SDL_RenderClear(ren)
SDL_RenderCopy2(ren, tex)
SDL_RenderPresent(ren)
SDL_Delay(2000)
SDL_DestroyTexture(tex)
SDL_DestroyRenderer(ren)
SDL_DestroyWindow(win)
SDL_Quit()
```

76.6 Use TTF Fonts

Example:

```
Load "libsdl.ring"

SDL_Init(SDL_INIT_EVERYTHING)
win = SDL_CreateWindow("Hello World!", 100, 100, 640, 480, SDL_WINDOW_SHOWN)
ren = SDL_CreateRenderer(win, -1, SDL_RENDERER_ACCELERATED | SDL_RENDERER_
↪PRESENTVSYNC )
SDL_RenderClear(ren)

TTF_Init()
font = TTF_OpenFont("pirulen.ttf", 16)
color = sdl_new_sdl_color()
sdl_set_sdl_color_r(color, 0)
sdl_set_sdl_color_g(color, 255)
sdl_set_sdl_color_b(color, 0)
```

(continues on next page)

(continued from previous page)

```

text = TTF_RenderText_Solid(font, "Welcome to the Ring language", color)
surface = SDL_GetWindowSurface(win)
SDL_BlitSurface(text, nullpointer(), surface, nullpointer())
SDL_UpdateWindowSurface(win)
SDL_Delay(2000)

SDL_Destroy	SDL_Color(color)
SDL_FreeSurface(text)
TTF_CloseFont(font)
SDL_DestroyRenderer(ren)
SDL_DestroyWindow(win)
SDL_Quit()

```

76.7 Display Transparent Images

Example:

```

Load "libsdl.ring"

SDL_Init(SDL_INIT_EVERYTHING)

flags = IMG_INIT_JPG | IMG_INIT_PNG
IMG_Init(flags)

win = SDL_CreateWindow("Hello World!", 100, 100, 800, 600, SDL_WINDOW_SHOWN)
ren = SDL_CreateRenderer(win, -1, SDL_RENDERER_ACCELERATED | SDL_RENDERER_
↪PRESENTVSYNC )

bmp = IMG_Load("stars.jpg")
tex = SDL_CreateTextureFromSurface(ren, bmp)
SDL_FreeSurface(bmp)
SDL_RenderClear(ren)
SDL_RenderCopy(ren, tex, nullpointer(), nullpointer())
SDL_DestroyTexture(tex)

bmp = IMG_Load("player.png")
# Image - Set Transparent color (white)
myformat = sdl_get_sdl_surface_format(bmp)
white = SDL_MapRGB(myformat, 255, 255, 255)
SDL_SetColorKey(bmp, SDL_True, white)

tex = SDL_CreateTextureFromSurface(ren, bmp)
SDL_FreeSurface(bmp)
rect = sdl_new_sdl_rect()
sdl_set_sdl_rect_x(rect, 0)
sdl_set_sdl_rect_y(rect, 0)
sdl_set_sdl_rect_w(rect, 100)
sdl_set_sdl_rect_h(rect, 100)
SDL_RenderCopy(ren, tex, nullpointer(), rect)

SDL_SetTextureBlendMode(tex, 2)
SDL_SetTextureAlphaMod(tex, 255)
sdl_set_sdl_rect_x(rect, 200)
sdl_set_sdl_rect_y(rect, 200)

```

(continues on next page)

(continued from previous page)

```
sdl_set_sdl_rect_w(rect,100)
sdl_set_sdl_rect_h(rect,100)
SDL_RenderCopy(ren,tex,nullpointer(),rect)

SDL_DestroyTexture(tex)
SDL_Destroy_SDL_Rect(rect)

SDL_RenderPresent(ren)
SDL_Delay(2000)
SDL_DestroyRenderer(ren)
SDL_DestroyWindow(win)
SDL_Quit()
```

76.8 Close Window Event

Example:

```
Load "libsdl.ring"

SDL_Init(SDL_INIT_EVERYTHING)
win = SDL_CreateWindow("Hello World!", 100, 100, 640, 480, SDL_WINDOW_SHOWN)

myevent = sdl_new_sdl_event()
while true
    thevent = sdl_pollEvent(myevent)
    switch sdl_get_sdl_event_type(myevent)
        on sdl_get_sdl_quit()
            exit
        on sdl_get_sdl_keydown()
            Key = SDL_GET_SDL_Event_key_keysym_sym(myevent)
            if key = 27 exit ok
        off
end

SDL_DestroyWindow(win)
SDL_Quit()
```

76.9 Mouse Events

Example:

```
Load "libsdl.ring"

SDL_Init(SDL_INIT_EVERYTHING)

win = SDL_CreateWindow("Mouse Events ", 100, 100, 640, 480, SDL_WINDOW_SHOWN)

TTF_Init()
font = TTF_OpenFont("pirulen.ttf", 16)
color = sdl_new_sdl_color()
```

(continues on next page)

(continued from previous page)

```

sdl_set_sdl_color_r(color,0)
sdl_set_sdl_color_g(color,255)
sdl_set_sdl_color_b(color,0)

surface = SDL_GetWindowSurface(win)

myevent = sdl_new_sdl_event()
while true
    cMsg = ""
    sdl_pollevent(myevent)
    switch sdl_get_sdl_event_type(myevent)
        on SDL_QUIT
            exit
        on SDL_KEYDOWN
            Key = SDL_GET_SDL_Event_key_keysym_sym(myevent)
            if key = 27 exit ok
        on SDL_MOUSEBUTTONDOWN
            if sdl_get_Sdl_Event_button_button(myevent) = SDL_BUTTON_LEFT
                SDL_SETWINDOWTITLE(win, " Button_Left_Down " )
            but sdl_get_Sdl_Event_button_button(myevent) = SDL_BUTTON_
↪MIDDLE
                SDL_SETWINDOWTITLE(win, " Button_Middle_Down " )
            but sdl_get_Sdl_Event_button_button(myevent) = SDL_BUTTON_
↪RIGHT
                SDL_SETWINDOWTITLE(win, " Button_Right_Down " )
            ok
        on SDL_MOUSEMOTION
            sdl_fillrect(surface,nullpointer(),0)
            if sdl_get_sdl_event_motion_xrel(myevent) < 0
                cMsg += " Left "
            else
                cMsg += " Right "
            ok
            if sdl_get_sdl_event_motion_yrel(myevent) < 0
                cMsg += " Up "
            else
                cMsg += " Down "
            ok
            cMsg += " x = " + sdl_get_sdl_event_motion_x(myevent)
            cMsg += " y = " + sdl_get_sdl_event_motion_y(myevent)
            showmsg(cMsg)
        off
end

SDL_Destroy	SDL_Color(Color)
TTF_CloseFont(font)
SDL_DestroyWindow(win)
SDL_Quit()

func showmsg mymsg
    text = TTF_RenderText_Solid(font,mymsg,color)
    SDL_BlitSurface(text, nullpointer(), surface, nullpointer())
    SDL_UpdateWindowSurface(win)
    SDL_FreeSurface(text)

```

76.10 Play Sound

Example:

```
Load "libsdl.ring"

SDL_Init(SDL_INIT_EVERYTHING)
win = SDL_CreateWindow("Hello World!", 100, 100, 640, 480, SDL_WINDOW_SHOWN)
Mix_OpenAudio( 44100, MIX_DEFAULT_FORMAT , 2, 10000)
Mix_AllocateChannels(4)
sound = Mix_LoadWav( "sound.wav" )
Mix_VolumeChunk(sound,1)
Mix_PlayChannel(1,sound,0)

myevent = sdl_new_sdl_event()
while true
    thevent = sdl_pollevent(myevent)
    switch sdl_get_sdl_event_type(myevent)
        on sdl_get_sdl_quit()
            exit
        on sdl_get_sdl_keydown()
            Key = SDL_GET_SDL_Event_key_keysym_sym(myevent)
            if key = 27 exit ok
        off
    end

Mix_FreeChunk( sound )
Mix_CloseAudio()
Mix_Quit()
SDL_DestroyWindow(win)
SDL_Quit()
```

CHAPTER
SEVENTYSEVEN

RINGLIBSDL FUNCTIONS REFERENCE

77.1 Introduction

In this chapter we have a list of the supported functions by this extension

77.2 Reference

- MIX_DEFAULT_FORMAT
- SDL_QUIT
- SDL_BUTTON_LEFT
- SDL_BUTTON_MIDDLE
- SDL_BUTTON_RIGHT
- SDL_PRESSED
- SDL_RELEASED
- SDL_APP_TERMINATING
- SDL_APP_LOWMEMORY
- SDL_APP_WILLENTERBACKGROUND
- SDL_APP_DIDENTERBACKGROUND
- SDL_APP_WILLENTERFOREGROUND
- SDL_APP_DIDENTERFOREGROUND
- SDL_WINDOWEVENT
- SDL_SYSWMEVENT
- SDL_KEYDOWN
- SDL_KEYUP
- SDL_TEXTEDITING
- SDL_TEXTINPUT
- SDL_MOUSEMOTION
- SDL_MOUSEBUTTONDOWN
- SDL_MOUSEBUTTONUP

- `SDL_MOUSEWHEEL`
- `SDL_JOYAXISMOTION`
- `SDL_JOYBALLMOTION`
- `SDL_JOYHATMOTION`
- `SDL_JOYBUTTONDOWN`
- `SDL_JOYBUTTONUP`
- `SDL_JOYDEVICEADDED`
- `SDL_JOYDEVICEREMOVED`
- `SDL_CONTROLLERAXISMOTION`
- `SDL_CONTROLLERBUTTONDOWN`
- `SDL_CONTROLLERBUTTONUP`
- `SDL_CONTROLLERDEVICEADDED`
- `SDL_CONTROLLERDEVICEREMOVED`
- `SDL_CONTROLLERDEVICEREMAPPED`
- `SDL_FINGERDOWN`
- `SDL_FINGERUP`
- `SDL_FINGERMOTION`
- `SDL_DOLLARGESTURE`
- `SDL_DOLLARRECORD`
- `SDL_MULTIGESTURE`
- `SDL_CLIPBOARDUPDATE`
- `SDL_DROPFILE`
- `SDL_RENDER_TARGETS_RESET`
- `SDL_USEREVENT`
- `SDL_LASTEVENT`
- `SDL_NET_MAJOR_VERSION`
- `SDL_NET_MINOR_VERSION`
- `SDL_NET_PATCHLEVEL`
- `INADDR_ANY`
- `INADDR_NONE`
- `INADDR_BROADCAST`
- `SDLNET_MAX_UDPCHANNELS`
- `SDLNET_MAX_UDPADDRESSES`
- `SDLK_0`
- `SDLK_1`
- `SDLK_2`

- SDLK_3
- SDLK_4
- SDLK_5
- SDLK_6
- SDLK_7
- SDLK_8
- SDLK_9
- SDLK_a
- SDLK_AC_BACK
- SDLK_AC_BOOKMARKS
- SDLK_AC_FORWARD
- SDLK_AC_HOME
- SDLK_AC_REFRESH
- SDLK_AC_SEARCH
- SDLK_AC_STOP
- SDLK AGAIN
- SDLK_ALTERASE
- SDLK_QUOTE
- SDLK_APPLICATION
- SDLK_AUDIOMUTE
- SDLK_AUDIONEXT
- SDLK_AUDIOPLAY
- SDLK_AUDIOPREV
- SDLK_BRIGHTNESSDOWN
- SDLK_BRIGHTNESSUP
- SDLK_c
- SDLK_CALCULATOR
- SDLK_CANCEL
- SDLK_CAPSLOCK
- SDLK_CLEAR
- SDLK_CLEARAGAIN
- SDLK_COMMA
- SDLK COMPUTER
- SDLK_COPY
- SDLK_CRSEL
- SDLK_CURRENCYSUBUNIT

- SDLK_CURRENCYUNIT
- SDLK_CUT
- SDLK_d
- SDLK_DECIMALSEPARATOR
- SDLK_DELETE
- SDLK_DISPLAYSWITCH
- SDLK_DOWN
- SDLK_e
- SDLK_EJECT
- SDLK_END
- SDLK_EQUALS
- SDLK_ESCAPE
- SDLK_EXECUTE
- SDLK_EXSEL
- SDLK_f
- SDLK_F1
- SDLK_F10
- SDLK_F11
- SDLK_F12
- SDLK_F13
- SDLK_F14
- SDLK_F15
- SDLK_F16
- SDLK_F17
- SDLK_F18
- SDLK_F19
- SDLK_F2
- SDLK_F20
- SDLK_F21
- SDLK_F22
- SDLK_F23
- SDLK_F24
- SDLK_F3
- SDLK_F4
- SDLK_F5
- SDLK_F6

- SDLK_F7
- SDLK_F8
- SDLK_F9
- SDLK_FIND
- SDLK_g
- SDLK_BACKQUOTE
- SDLK_h
- SDLK_HELP
- SDLK_HOME
- SDLK_i
- SDLK_INSERT
- SDLK_j
- SDLK_k
- SDLK_KBDILLUMDOWN
- SDLK_KBDILLUMTOGGLE
- SDLK_KBDILLUMUP
- SDLK_KP_0
- SDLK_KP_00
- SDLK_KP_000
- SDLK_KP_1
- SDLK_KP_2
- SDLK_KP_3
- SDLK_KP_4
- SDLK_KP_5
- SDLK_KP_6
- SDLK_KP_7
- SDLK_KP_8
- SDLK_KP_9
- SDLK_KP_A
- SDLK_KP_AMPERSAND
- SDLK_KP_AT
- SDLK_KP_B
- SDLK_KP_BACKSPACE
- SDLK_KP_BINARY
- SDLK_KP_C
- SDLK_KP_CLEAR

- SDLK_KP_CLEARENTRY
- SDLK_KP_COLON
- SDLK_KP_COMMA
- SDLK_KP_D
- SDLK_KP_DBLAMPERSAND
- SDLK_KP_DBLVERTICALBAR
- SDLK_KP_DECIMAL
- SDLK_KP_DIVIDE
- SDLK_KP_E
- SDLK_KP_ENTER
- SDLK_KP_EQUALS
- SDLK_KP_EQUALSAS400
- SDLK_KP_EXCLAM
- SDLK_KP_F
- SDLK_KP_GREATER
- SDLK_KP_HASH
- SDLK_KP_HEXADECIMAL
- SDLK_KP_LEFTBRACE
- SDLK_KP_LEFTPAREN
- SDLK_KP_LESS
- SDLK_KP_MEMADD
- SDLK_KP_MEMCLEAR
- SDLK_KP_MEMDIVIDE
- SDLK_KP_MEMMULTIPLY
- SDLK_KP_MEMRECALL
- SDLK_KP_MEMSTORE
- SDLK_KP_MEMSUBTRACT
- SDLK_KP_MINUS
- SDLK_KP_MULTIPLY
- SDLK_KP_OCTAL
- SDLK_KP_PERCENT
- SDLK_KP_PERIOD
- SDLK_KP_PLUS
- SDLK_KP_PLUSMINUS
- SDLK_KP_POWER
- SDLK_KP_RIGHTBRACE

- SDLK_KP_RIGHTPAREN
- SDLK_KP_SPACE
- SDLK_KP_TAB
- SDLK_KP_VERTICALBAR
- SDLK_KP_XOR
- SDLK_l
- SDLK_LALT
- SDLK_LCTRL
- SDLK_LEFT
- SDLK_LEFTBRACKET
- SDLK_LGUI
- SDLK_LSHIFT
- SDLK_m
- SDLK_MAIL
- SDLK_MEDIASELECT
- SDLK_MENU
- SDLK_MINUS
- SDLK_MODE
- SDLK_MUTE
- SDLK_n
- SDLK_NUMLOCKCLEAR
- SDLK_o
- SDLK_OPER
- SDLK_OUT
- SDLK_p
- SDLK_PAGEDOWN
- SDLK_PAGEUP
- SDLK_PASTE
- SDLK_PAUSE
- SDLK_PERIOD
- SDLK_POWER
- SDLK_PRINTSCREEN
- SDLK_PRIOR
- SDLK_q
- SDLK_r
- SDLK_RALT

- SDLK_RCTRL
- SDLK_RETURN
- SDLK_RETURN2
- SDLK_RGUI
- SDLK_RIGHT
- SDLK_RIGHTBRACKET
- SDLK_RSHIFT
- SDLK_s
- SDLK_SCROLLLOCK
- SDLK_SELECT
- SDLK_SEMICOLON
- SDLK_SEPARATOR
- SDLK_SLASH
- SDLK_SLEEP
- SDLK_SPACE
- SDLK_STOP
- SDLK_SYSREQ
- SDLK_t
- SDLK_TAB
- SDLK_THOUSANDSSEPARATOR
- SDLK_u
- SDLK_UNDO
- SDLK_UNKNOWN
- SDLK_UP
- SDLK_v
- SDLK_VOLUMEDOWN
- SDLK_VOLUMEUP
- SDLK_w
- SDLK_WWW
- SDLK_x
- SDLK_y
- SDLK_z
- SDLK_AMPERSAND
- SDLK_ASTERISK
- SDLK_AT
- SDLK_CARET

- SDLK_COLON
- SDLK_DOLLAR
- SDLK_EXCLAIM
- SDLK_GREATER
- SDLK_HASH
- SDLK_LEFTPAREN
- SDLK_LESS
- SDLK_PERCENT
- SDLK_PLUS
- SDLK_QUESTION
- SDLK_QUOTEDBL
- SDLK_RIGHTPAREN
- SDLK_UNDERSCORE
- SDL_THREAD_PRIORITY_LOW
- SDL_THREAD_PRIORITY_NORMAL
- SDL_THREAD_PRIORITY_HIGH
- void SDL_RenderCopy2(SDL_Renderer *,SDL_Texture *)
- void SDL_Delay(int)
- void SDL_Init(int)
- int SDL_InitSubSystem(Uint32 flags)
- void SDL_Quit(void)
- void SDL_QuitSubSystem(Uint32 flags)
- void SDL_SetMainReady(void)
- Uint32 SDL_WasInit(Uint32 flags)
- SDL_bool SDL_SetHint(const char *name,const char *value)
- SDL_bool SDL_SetHintWithPriority(const char *name,const char *value,SDL_HintPriority priority)
- void SDL_ClearError(void)
- const char *SDL_GetError(void)
- SDL_LogPriority SDL_LogGetPriority(int category)
- void SDL_LogResetPriorities(void)
- void SDL_LogSetAllPriority(SDL_LogPriority priority)
- SDL_ASSERTIONHandler SDL_GetDefaultAssertionHandler(void)
- void SDL_ResetAssertionReport(void)
- void SDL_SetAssertionHandler(SDL_ASSERTIONHandler handler,void *userdata)
- void SDL_TriggerBreakpoint(void)
- void SDL_assert(int)

- void SDL_assert_paranoid(int)
- void SDL_assert_release(int)
- const char * SDL_GetRevision(void)
- int SDL_GetRevisionNumber(void)
- void SDL_GetVersion(SDL_version *ver)
- SDL_Window *SDL_CreateWindow(const char * title,int x, int y,int w,int h,Uint32 flags)
- void SDL_DestroyWindow(SDL_Window *window)
- void SDL_DisableScreenSaver(void)
- void SDL_EnableScreenSaver(void)
- SDL_GLContext SDL_GL_CreateContext(SDL_Window *window)
- void SDL_GL_DeleteContext(SDL_GLContext context)
- SDL_bool SDL_GL_ExtensionSupported(const char *extension)
- int SDL_GL_GetAttribute(SDL_GLattr attr,int *value)
- SDL_GLContext SDL_GL_GetCurrentContext(void)
- SDL_Window *SDL_GL_GetCurrentWindow(void)
- void SDL_GL_GetDrawableSize(SDL_Window *window,int *w,int *h)
- void *SDL_GL_GetProcAddress(const char *proc)
- int SDL_GL_GetSwapInterval(void)
- int SDL_GL_LoadLibrary(const char *path)
- int SDL_GL_MakeCurrent(SDL_Window *window,SDL_GLContext context)
- void SDL_GL_ResetAttributes(void)
- int SDL_GL_SetAttribute(SDL_GLattr attr,int value)
- int SDL_GL_SetSwapInterval(int interval)
- void SDL_GL_SwapWindow(SDL_Window *window)
- void SDL_GL_UnloadLibrary(void)
- **SDL_DisplayMode** *SDL_GetClosestDisplayMode(int mode,SDL_DisplayMode *closest) displayIndex,SDL_DisplayMode
- int SDL_GetCurrentDisplayMode(int displayIndex,SDL_DisplayMode *mode)
- const char *SDL_GetCurrentVideoDriver(void)
- int SDL_GetDesktopDisplayMode(int displayIndex,SDL_DisplayMode *mode)
- int SDL_GetDisplayBounds(int displayIndex,SDL_Rect *rect)
- int SDL_GetNumVideoDisplays(void)
- int SDL_GetNumVideoDrivers(void)
- const char * SDL_GetVideoDriver(int index)
- void *SDL_GetWindowData(SDL_Window *window,const char *name)
- int SDL_GetWindowDisplayIndex(SDL_Window *window)

- int `SDL_GetWindowDisplayMode(SDL_Window *window,SDL_DisplayMode *mode)`
- Uint32 `SDL_GetWindowFlags(SDL_Window *window)`
- `SDL_Window *SDL_GetWindowFromID(Uint32 id)`
- int `SDL_SetWindowGammaRamp(SDL_Window *window,Uint16 *red,Uint16 *green,Uint16 *blue)`
- `SDL_bool SDL_SetWindowGrab(SDL_Window *window)`
- Uint32 `SDL_SetWindowID(SDL_Window* window)`
- void `SDL_SetWindowMaximumSize(SDL_Window *window,int *w,int *h)`
- void `SDL_SetWindowMinimumSize(SDL_Window *window,int *w,int *h)`
- void `SDL_SetWindowPosition(SDL_Window *window,int *x,int *y)`
- void `SDL_SetWindowSize(SDL_Window *window,int *w,int *h)`
- `SDL_Surface *SDL_SetWindowSurface(SDL_Window *window)`
- const char `*SDL_SetWindowTitle(SDL_Window *window)`
- `SDL_bool SDL_IsScreenSaverEnabled(void)`
- void `SDL_MaximizeWindow(SDL_Window *window)`
- void `SDL_MinimizeWindow(SDL_Window *window)`
- void `SDL_RaiseWindow(SDL_Window *window)`
- void `SDL_RestoreWindow(SDL_Window *window)`
- void `SDL_SetWindowBordered(SDL_Window *window,SDL_bool bordered)`
- int `SDL_SetWindowBrightness(SDL_Window *window,float brightness)`
- void `*SDL_SetWindowData(SDL_Window *window,const char *name,void *userdata)`
- int `SDL_SetWindowDisplayMode(SDL_Window *window,const SDL_DisplayMode *mode)`
- int `SDL_SetWindowFullscreen(SDL_Window *window,Uint32 flags)`
- int `SDL_SetWindowGammaRamp(SDL_Window window,const Uint16 *red,const Uint16 *green,const Uint16 blue)`
- void `SDL_SetWindowGrab(SDL_Window *window,SDL_bool grabbed)`
- void `SDL_SetWindowMinimumSize(SDL_Window* window,int min_w,int min_h)`
- void `SDL_SetWindowSize(SDL_Window *window,int w,int h)`
- void `SDL_SetWindowTitle(SDL_Window *window,const char *title)`
- int `SDL_ShowMessageBox(const SDL_MessageBoxData *messageboxdata,int *buttonid)`
- int `SDL_ShowSimpleMessageBox(Uint32 flags,const char *title,const char *message,SDL_Window *window)`
- void `SDL_ShowWindow(SDL_Window *window)`
- int `SDL_UpdateWindowSurface(SDL_Window *window)`
- int `SDL_UpdateWindowSurfaceRects(SDL_Window *window,const SDL_Rect *rects,int numrects)`
- int `SDL_VideoInit(const char *driver_name)`
- void `SDL_VideoQuit(void)`
- `SDL_Renderer *SDL_CreateRenderer(SDL_Window *window,int index,Uint32 flags)`

- `SDL_Renderer *SDL_CreateSoftwareRenderer(SDL_Surface *surface)`
- `SDL_Texture *SDL_CreateTexture(SDL_Renderer *renderer,Uint32 format,int access,int w,int h)`
- `SDL_Texture *SDL_CreateTextureFromSurface(SDL_Renderer *renderer,SDL_Surface *surface)`
- `void SDL_DestroyTexture(SDL_Texture *texture)`
- `int SDL_GL_BindTexture(SDL_Texture *texture,float *texw,float *texh)`
- `int SDL_GL_UnbindTexture(SDL_Texture *texture)`
- `int SDL_GetNumRenderDrivers(void)`
- `int SDL_GetRenderDrawBlendMode(SDL_Renderer *renderer,SDL_BlendMode *blendMode)`
- `int SDL_GetRenderDrawColor(SDL_Renderer *renderer,Uint8 *r,Uint8 *g,Uint8 *b,Uint8 *a)`
- `int SDL_GetRenderDriverInfo(int index,SDL_RendererInfo *info)`
- `SDL_Texture *SDL_GetRenderTarget(SDL_Renderer *renderer)`
- `SDL_Renderer *SDL_GetRenderer(SDL_Window *window)`
- `int SDL_GetRendererInfo(SDL_Renderer *renderer,SDL_RendererInfo *info)`
- `int SDL_GetRendererOutputSize(SDL_Renderer *renderer,int *w,int *h)`
- `int SDL_GetTextureAlphaMod(SDL_Texture *texture,Uint8 *alpha)`
- `int SDL_GetTextureBlendMode(SDL_Texture *texture,SDL_BlendMode *blendMode)`
- `int SDL_GetTextureColorMod(SDL_Texture *texture,Uint8 *r,Uint8 *g,Uint8 *b)`
- `int SDL_LockTexture(SDL_Texture *texture,const SDL_Rect *rect,void **pixels,int *pitch)`
- `int SDL_QueryTexture(SDL_Texture *texture,int *format,int *access,int *w,int *h)`
- `int SDL_RenderClear(SDL_Renderer *renderer)`
- `int SDL_RenderCopy(SDL_Renderer *renderer,SDL_Texture *texture,const SDL_Rect *srcrect,const SDL_Rect *dstrect)`
- `int SDL_RenderCopyEx(SDL_Renderer *renderer,SDL_Texture *texture,const SDL_Rect *srcrect,const SDL_Rect *dstrect,const double angle,const SDL_Point *center,const SDL_RendererFlip flip)`
- `int SDL_RenderDrawLine(SDL_Renderer *renderer,int x1,int y1,int x2,int y2)`
- `int SDL_RenderDrawLines(SDL_Renderer *renderer,const SDL_Point *points,int count)`
- `int SDL_RenderDrawPoint(SDL_Renderer *renderer,int x, int y)`
- `int SDL_RenderDrawPoints(SDL_Renderer *renderer,const SDL_Point *points,int count)`
- `int SDL_RenderDrawRect(SDL_Renderer *renderer,const SDL_Rect *rect)`
- `int SDL_RenderDrawRects(SDL_Renderer *renderer,const SDL_Rect *rects,int count)`
- `int SDL_RenderFillRect(SDL_Renderer *renderer,const SDL_Rect *rect)`
- `int SDL_RenderFillRects(SDL_Renderer renderer,const SDL_Rect rects,int count)`
- `void SDL_RenderGetClipRect(SDL_Renderer *renderer,SDL_Rect *rect)`
- `void SDL_RenderGetScale(SDL_Renderer *renderer,float *scaleX,float *scaleY)`
- `void SDL_RenderGetViewport(SDL_Renderer *renderer,SDL_Rect *rect)`
- `int SDL_RenderReadPixels(SDL_Renderer *renderer,const SDL_Rect *rect,Uint32 format,void *pixels,int pitch)`

- int `SDL_RenderSetClipRect(SDL_Renderer *renderer,const SDL_Rect *rect)`
- int `SDL_RenderSetScale(SDL_Renderer *renderer,float scaleX,float scaleY)`
- int `SDL_RenderSetViewport(SDL_Renderer *renderer,const SDL_Rect *rect)`
- `SDL_bool SDL_RenderTargetSupported(SDL_Renderer *renderer)`
- int `SDL_SetRenderDrawBlendMode(SDL_Renderer *renderer,SDL_BlendMode blendMode)`
- int `SDL_SetRenderDrawColor(SDL_Renderer *renderer,Uint8 r,Uint8 g,Uint8 b,Uint8 a)`
- int `SDL_SetRenderTarget(SDL_Renderer *renderer,SDL_Texture *texture)`
- int `SDL_SetTextureAlphaMod(SDL_Texture *texture,Uint8 alpha)`
- int `SDL_SetTextureBlendMode(SDL_Texture *texture,SDL_BlendMode blendMode)`
- int `SDL_SetTextureColorMod(SDL_Texture *texture,Uint8 r,Uint8 g,Uint8 b)`
- void `SDL_UnlockTexture(SDL_Texture *texture)`
- int `SDL_UpdateTexture(SDL_Texture *texture,const SDL_Rect *rect,const void*pixels,int pitch)`
- int `SDL_UpdateYUVTexture(SDL_Texture *texture,const SDL_Rect *rect,const Uint8 *Yplane,int Ypitch,const Uint8 *Uplane,int Upitch,const Uint8 *Vplane,int Vpitch)`
- `SDL_PixelFormat *SDL_AllocFormat(Uint32 pixel_format)`
- `SDL_Palette *SDL_AllocPalette(int ncolors)`
- void `SDL_CalculateGammaRamp(float gamma,Uint16 *ramp)`
- void `SDL_FreeFormat(SDL_PixelFormat *format)`
- void `SDL_FreePalette(SDL_Palette *palette)`
- const char `*SDL_GetPixelFormatName(Uint32 format)`
- void `SDL_GetRGB(Uint32 pixel,const SDL_PixelFormat* format,Uint8 *r,Uint8 *g,Uint8 *b)`
- void `SDL_GetRGBA(Uint32 pixel,const SDL_PixelFormat* format,Uint8 *r,Uint8 *g,Uint8 *b,Uint8 *a)`
- `Uint32 SDL_MapRGB(const SDL_PixelFormat* format,Uint8 r,Uint8 g, Uint8 b)`
- `Uint32 SDL_MapRGBA(const SDL_PixelFormat* format,Uint8 r,Uint8 g, Uint8 b, Uint8 a)`
- `Uint32 SDL_MasksToPixelFormatEnum(int bpp,Uint32 Rmask,Uint32 Gmask,Uint32 Bmask,Uint32 Amask)`
- `SDL_bool SDL_PixelFormatEnumToMasks(Uint32 format,int *bpp,Uint32 *Rmask,Uint32 *Gmask,Uint32 *Bmask,Uint32 *Amask)`
- int `SDL_SetPaletteColors(SDL_Palette *palette,const SDL_Color *colors,int firstcolor,int ncolors)`
- int `SDL_SetPixelFormatPalette(SDL_PixelFormat *format,SDL_Palette *palette)`
- `SDL_bool SDL_EnclosePoints(const SDL_Point* points,int count,const SDL_Rect *clip,SDL_Rect *result)`
- `SDL_bool SDL_HasIntersection(const SDL_Rect *A,const SDL_Rect *B)`
- `SDL_bool SDL_IntersectRect(const SDL_Rect *A,const SDL_Rect *B,SDL_Rect *result)`
- `SDL_bool SDL_IntersectRectAndLine(const SDL_Rect *rect,int *X1,int *Y1,int *X2,int *Y2)`
- `SDL_bool SDL_RectEquals(const SDL_Rect *a,const SDL_Rect *b)`
- void `SDL_UnionRect(const SDL_Rect *A,const SDL_Rect *B,SDL_Rect *result)`
- int `SDL_BlitScaled(SDL_Surface *src,const SDL_Rect *srcrect,SDL_Surface *dst,SDL_Rect *dstrect)`
- int `SDL_BlitSurface(SDL_Surface src,const SDL_Rect srcrect,SDL_Surface *dst,SDL_Rect *dstrect)`

- int `SDL_ConvertPixels(int width,int height,Uint32 src_format,const void *src,int src_pitch,Uint32 dst_format,void *dst,int dst_pitch)`
- `SDL_Surface *SDL_ConvertSurface(SDL_Surface *src,const SDL_PixelFormat *fmt,Uint32 flags)`
- `SDL_Surface *SDL_ConvertSurfaceFormat(SDL_Surface *src,Uint32 pixel_format,Uint32 flags)`
- `SDL_Surface *SDL_CreateRGBSurface(Uint32 flags,int width,int height,int depth,Uint32 Rmask,Uint32 Gmask,Uint32 Bmask,Uint32 Amask)`
- `SDL_Surface* SDL_CreateRGBSurfaceFrom(void *pixels,int width,int height,int depth,int pitch,Uint32 Rmask,Uint32 Gmask,Uint32 Bmask,Uint32 Amask)`
- int `SDL_FillRect(SDL_Surface *dst,const SDL_Rect *rect,Uint32 color)`
- int `SDL_FillRects(SDL_Surface *dst,const SDL_Rect *rects,int count,Uint32 color)`
- void `SDL_FreeSurface(SDL_Surface *surface)`
- void `SDL_GetClipRect(SDL_Surface *surface,SDL_Rect *rect)`
- int `SDL_GetColorKey(SDL_Surface *surface,Uint32 *key)`
- int `SDL_GetSurfaceAlphaMod(SDL_Surface *surface,Uint8 *alpha)`
- int `SDL_GetSurfaceBlendMode(SDL_Surface *surface,SDL_BlendMode *blendMode)`
- int `SDL_GetSurfaceColorMod(SDL_Surface *surface,Uint8 *r,Uint8 *g,Uint8 *b)`
- `SDL_Surface *SDL_LoadBMP(const char *file)`
- `SDL_Surface *SDL_LoadBMP_RW(SDL_RWops *src,int freesrc)`
- int `SDL_LockSurface(SDL_Surface *surface)`
- int `SDL_LowerBlit(SDL_Surface *src,SDL_Rect *srcrect,SDL_Surface *dst,SDL_Rect *dstrect)`
- int `SDL_LowerBlitScaled(SDL_Surface *src,SDL_Rect *srcrect,SDL_Surface *dst,SDL_Rect *dstrect)`
- `SDL_bool SDL_MUSTLOCK(SDL_Surface *surface)`
- int `SDL_SaveBMP(SDL_Surface *surface,const char *file)`
- int `SDL_SaveBMP_RW(SDL_Surface *surface,SDL_RWops *dst,int freedst)`
- `SDL_bool SDL_SetClipRect(SDL_Surface *surface,const SDL_Rect *rect)`
- int `SDL_SetColorKey(SDL_Surface *surface,int flag,Uint32 key)`
- int `SDL_SetSurfaceAlphaMod(SDL_Surface *surface,Uint8 alpha)`
- int `SDL_SetSurfaceBlendMode(SDL_Surface *surface,SDL_BlendMode blendMode)`
- int `SDL_SetSurfaceColorMod(SDL_Surface *surface,Uint8 r,Uint8 g,Uint8 b)`
- int `SDL_SetSurfacePalette(SDL_Surface *surface,SDL_Palette *palette)`
- int `SDL_SetSurfaceRLE(SDL_Surface *surface,int flag)`
- void `SDL_UnlockSurface(SDL_Surface* surface)`
- `SDL_bool SDL_GetWindowWMInfo(SDL_Window *window,SDL_SysWMinfo *info)`
- `char *SDL_GetClipboardText(void)`
- `SDL_bool SDL_HasClipboardText(void)`
- int `SDL_SetClipboardText(const char *text)`
- void `SDL_AddEventWatch(SDL_EventFilter filter,void *userdata)`

- void SDL_DelEventWatch(SDL_EventFilter filter,void *userdata)
- Uint8 SDL_EventState(Uint32 type,int state)
- void SDL_FilterEvents(SDL_EventFilter filter,void *userdata)
- void SDL_FlushEvent(Uint32 type)
- void SDL_FlushEvents(Uint32 minType,Uint32 maxType)
- SDL_bool SDL_GetEventFilter(SDL_EventFilter *filter,void **userdata)
- Uint8 SDL_GetEventState(Uint32 type)
- int SDL_GetNumTouchDevices(void)
- int SDL_GetNumTouchFingers(SDL_TouchID touchID)
- SDL_TouchID SDL_GetTouchDevice(int index)
- SDL_Finger* SDL_GetTouchFinger(SDL_TouchID touchID,int index)
- SDL_bool SDL_HasEvent(Uint32 type)
- SDL_bool SDL_HasEvents(Uint32 minType,Uint32 maxType)
- int SDL_LoadDollarTemplates(SDL_TouchID touchId,SDL_RWops *src)
- int SDL_PeepEvents(SDL_Event *events,int numevents,SDL_eventaction action,Uint32 minType,Uint32 maxType)
- int SDL_PollEvent(SDL_Event *event)
- void SDL_PumpEvents(void)
- int SDL_PushEvent(SDL_Event *event)
- SDL_bool SDL_QuitRequested(void)
- int SDL_RecordGesture(SDL_TouchID touchId)
- Uint32 SDL_RegisterEvents(int numevents)
- int SDL_SaveAllDollarTemplates(SDL_RWops *dst)
- int SDL_SaveDollarTemplate(SDL_GestureID gestureId,SDL_RWops *dst)
- void SDL_SetEventFilter(SDL_EventFilter filter,void *userdata)
- int SDL_WaitEvent(SDL_Event *event)
- int SDL_WaitEventTimeout(SDL_Event *event,int timeout)
- SDL_Keycode SDL_GetKeyFromName(const char * name)
- SDL_Keycode SDL_GetKeyFromScancode(SDL_Scancode scancode)
- const char * SDL_GetKeyName(SDL_Keycode key)
- SDL_Window* SDL_GetKeyboardFocus(void)
- const Uint8* SDL_GetKeyboardState(int* numkeys)
- SDL_Keymod SDL_GetModState(void)
- SDL_Scancode SDL_GetScancodeFromKey(SDL_Keycode key)
- SDL_Scancode SDL_GetScancodeFromName(const char * name)
- const char * SDL_GetScancodeName(SDL_Scancode scancode)

- `SDL_bool SDL_HasScreenKeyboardSupport(void)`
- `SDL_bool SDL_IsScreenKeyboardShown(SDL_Window* window)`
- `SDL_bool SDL_IsTextInputActive(void)`
- `void SDL_SetModState(SDL_Keymod modstate)`
- `void SDL_SetTextInputRect(SDL_Rect* rect)`
- `void SDL_StartTextInput(void)`
- `void SDL_StopTextInput(void)`
- `SDL_Cursor *SDL_CreateCursor(const Uint8 *data,const Uint8 *mask,int w,int h,int hot_x,int hot_y)`
- `void SDL_FreeCursor(SDL_Cursor *cursor)`
- `SDL_Cursor *SDL_GetCursor(void)`
- `SDL_Cursor *SDL_GetDefaultCursor(void)`
- `Uint32 SDL_GetMouseState(int *x,int *y)`
- `SDL_bool SDL_GetRelativeMouseMode(void)`
- `Uint32 SDL_GetRelativeMouseState(int *x,int *y)`
- `void SDL_SetCursor(SDL_Cursor *cursor)`
- `int SDL_SetRelativeMouseMode(SDL_bool enabled)`
- `int SDL_ShowCursor(int toggle)`
- `void SDL_JoystickClose(SDL_Joystick *joystick)`
- `SDL_bool SDL_JoystickGetAttached(SDL_Joystick *joystick)`
- `Sint16 SDL_JoystickGetAxis(SDL_Joystick *joystick,int axis)`
- `int SDL_JoystickGetBall(SDL_Joystick *joystick,int ball,int *dx,int *dy)`
- `Uint8 SDL_JoystickGetButton(SDL_Joystick *joystick,int button)`
- `SDL_JoystickGUID SDL_JoystickGetDeviceGUID(int device_index)`
- `SDL_JoystickGUID SDL_JoystickGetGUID(SDL_Joystick *joystick)`
- `SDL_JoystickGUID SDL_JoystickGetGUIDFromString(const char *pchGUID)`
- `void SDL_JoystickGetGUIDString(SDL_JoystickGUID guid,char *pszGUID,int cbGUID)`
- `Uint8 SDL_JoystickGetHat(SDL_Joystick *joystick,int hat)`
- `SDL_JoystickID SDL_JoystickInstanceID(SDL_Joystick *joystick)`
- `const char *SDL_JoystickName(SDL_Joystick *joystick)`
- `const char *SDL_JoystickNameForIndex(int device_index)`
- `int SDL_JoystickNumAxes(SDL_Joystick *joystick)`
- `int SDL_JoystickNumBalls(SDL_Joystick *joystick)`
- `int SDL_JoystickNumButtons(SDL_Joystick *joystick)`
- `int SDL_JoystickNumHats(SDL_Joystick *joystick)`
- `SDL_Joystick *SDL_JoystickOpen(int device_index)`
- `void SDL_JoystickUpdate(void)`

- int SDL_NumJoysticks(void)
- int SDL_GameControllerAddMapping(const char *mappingString)
- int SDL_GameControllerAddMappingsFromFile(const char *filename)
- int SDL_GameControllerAddMappingsFromRW(SDL_RWops *rw,int freerw)
- void SDL_GameControllerClose(SDL_GameController *gamecontroller)
- int SDL_GameControllerEventState(int state)
- Sint16 SDL_GameControllerGetAxis(SDL_GameController *gamecontroller,SDL_GameControllerAxis axis)
- SDL_GameControllerAxis SDL_GameControllerGetAxisFromString(const char *pchString)
- SDL_GameControllerButtonBind SDL_GameControllerGetBindForAxis(SDL_GameController *gamecontroller,SDL_GameControllerAxis axis)
- SDL_GameControllerButtonBind SDL_GameControllerGetBindForButton(SDL_GameController *gamecontroller,SDL_GameControllerButton button)
- Uint8 SDL_GameControllerGetButton(SDL_GameController *gamecontroller,SDL_GameControllerButton button)
- SDL_GameControllerButton SDL_GameControllerGetButtonFromString(const char *pchString)
- SDL_Joystick *SDL_GameControllerGetJoystick(SDL_GameController *gamecontroller)
- const char *SDL_GameControllerGetStringForAxis(SDL_GameControllerAxis axis)
- const char *SDL_GameControllerGetStringForButton(SDL_GameControllerButton button)
- char *SDL_GameControllerMapping(SDL_GameController *gamecontroller)
- char *SDL_GameControllerMappingForGUID(SDL_JoystickGUID guid)
- const char *SDL_GameControllerName(SDL_GameController *gamecontroller)
- const char *SDL_GameControllerNameForIndex(int joystick_index)
- SDL_GameController* SDL_GameControllerOpen(int joystick_index)
- void SDL_GameControllerUpdate(void)
- SDL_bool SDL_IsGameController(int joystick_index)
- void SDL_HapticClose(SDL_Haptic* haptic)
- void SDL_HapticDestroyEffect(SDL_Haptic *haptic,int effect)
- int SDL_HapticEffectSupported(SDL_Haptic *haptic,SDL_HapticEffect *effect)
- int SDL_HapticGetEffectStatus(SDL_Haptic *haptic,int effect)
- int SDL_HapticIndex(SDL_Haptic *haptic)
- const char *SDL_HapticName(int device_index)
- int SDL_HapticNewEffect(SDL_Haptic *haptic,SDL_HapticEffect *effect)
- int SDL_HapticNumAxes(SDL_Haptic *haptic)
- int SDL_HapticNumEffects(SDL_Haptic *haptic)
- int SDL_HapticNumEffectsPlaying(SDL_Haptic *haptic)
- SDL_Haptic *SDL_HapticOpen(int device_index)
- SDL_Haptic *SDL_HapticOpenFromJoystick(SDL_Joystick *joystick)

- `SDL_Haptic *SDL_HapticOpenFromMouse(void)`
- `int SDL_HapticOpened(int device_index)`
- `int SDL_HapticPause(SDL_Haptic *haptic)`
- `unsigned int SDL_HapticQuery(SDL_Haptic *haptic)`
- `int SDL_HapticRumbleInit(SDL_Haptic *haptic)`
- `int SDL_HapticRumblePlay(SDL_Haptic *haptic, float strength, Uint32 length)`
- `int SDL_HapticRumbleStop(SDL_Haptic *haptic)`
- `int SDL_HapticRumbleSupported(SDL_Haptic *haptic)`
- `int SDL_HapticRunEffect(SDL_Haptic *haptic, int effect, Uint32 iterations)`
- `int SDL_HapticSetAutocenter(SDL_Haptic *haptic, int autocenter)`
- `int SDL_HapticSetGain(SDL_Haptic *haptic, int gain)`
- `int SDL_HapticStopAll(SDL_Haptic *haptic)`
- `int SDL_HapticStopEffect(SDL_Haptic *haptic, int effect)`
- `int SDL_HapticUnpause(SDL_Haptic *haptic)`
- `int SDL_HapticUpdateEffect(SDL_Haptic *haptic, int effect, SDL_HapticEffect *data)`
- `int SDL_JoystickIsHaptic(SDL_Joystick *joystick)`
- `int SDL_MouseIsHaptic(void)`
- `int SDL_NumHaptics(void)`
- `int SDL_AudioInit(const char * driver_name)`
- `void SDL_AudioQuit(void)`
- `int SDL_BuildAudioCVT(SDL_AudioCVT *cvt, SDL_AudioFormat src_format, Uint8 src_channels, int src_rate, SDL_AudioFormat dst_format, Uint8 dst_channels, int dst_rate)`
- `void SDL_CloseAudioDevice(SDL_AudioDeviceID dev)`
- `int SDL_ConvertAudio(SDL_AudioCVT *cvt)`
- `void SDL_FreeWAV(Uint8 *audio_buf)`
- `const char * SDL_GetAudioDeviceName(int index, int iscapture)`
- `SDL_AudioStatus SDL_GetAudioDeviceStatus(SDL_AudioDeviceID dev)`
- `const char * SDL_GetAudioDriver(int index)`
- `SDL_AudioStatus SDL_GetAudioStatus(void)`
- `const char * SDL_GetCurrentAudioDriver(void)`
- `int SDL_GetNumAudioDevices(int iscapture)`
- `int SDL_GetNumAudioDrivers(void)`
- `SDL_AudioSpec *SDL_LoadWAV_RW(SDL_RWops *src, int freesrc, SDL_AudioSpec *spec, Uint8 **audio_buf, Uint32 *audio_len)`
- `void SDL_LockAudio(void)`
- `void SDL_LockAudioDevice(SDL_AudioDeviceID dev)`
- `void SDL_MixAudio(Uint8 dst, const Uint8 src, Uint32 len, int volume)`

- void SDL_MixAudioFormat(Uint8 *dst,const Uint8 *src,SDL_AudioFormat format,Uint32 len,int volume)
- int SDL_OpenAudio(SDL_AudioSpec *desired,SDL_AudioSpec *obtained)
- SDL_AudioDeviceID SDL_OpenAudioDevice(const char *device,int iscapture,const SDL_AudioSpec *desired,SDL_AudioSpec *obtained,int allowed_changes)
- void SDL_PauseAudio(int pause_on)
- void SDL_PauseAudioDevice(SDL_AudioDeviceID dev,int pause_on)
- void SDL_UnlockAudio(void)
- void SDL_UnlockAudioDevice(SDL_AudioDeviceID dev)
- char *SDL_GetBasePath(void)
- char *SDL_GetPrefPath(const char *org,const char *app)
- SDL_RWops *SDL_AllocRW(void)
- void SDL_FreeRW(SDL_RWops *area)
- *SDL_RWops* *SDL_RWFromConstMem(const void mem,int size)*
- *SDL_RWops* *SDL_RWFromFP(void *fp,SDL_bool autoclose)
- *SDL_RWops* *SDL_RWFromFile(const char *file,const char *mode)
- *SDL_RWops* *SDL_RWFromMem(void *mem,int size)
- int SDL_RWclose(struct SDL_RWops *context)
- size_t *SDL_RWread(struct SDL_RWops *context,void *ptr,size_t size,size_t maxnum)*
- Sint64 *SDL_RWseek(SDL_RWops *context,Sint64 offset,int whence)*
- Sint64 *SDL_RWsize(SDL_RWops *context)*
- Sint64 *SDL_RWtell(struct SDL_RWops *context)*
- size_t *SDL_RWwrite(struct SDL_RWops *context,const void *ptr,size_t size,size_t num)*
- Uint16 *SDL_ReadBE16(SDL_RWops *src)*
- Uint32 *SDL_ReadBE32(SDL_RWops *src)*
- Uint64 *SDL_ReadBE64(SDL_RWops *src)*
- Uint16 *SDL_ReadLE16(SDL_RWops *src)*
- Uint32 *SDL_ReadLE32(SDL_RWops *src)*
- Uint64 *SDL_ReadLE64(SDL_RWops *src)*
- Uint8 *SDL_ReadU8(SDL_RWops *src)*
- size_t *SDL_WriteBE16(SDL_RWops *dst,Uint16 value)*
- size_t *SDL_WriteBE32(SDL_RWops *dst,Uint32 value)*
- size_t *SDL_WriteBE64(SDL_RWops *dst,Uint64 value)*
- size_t *SDL_WriteLE16(SDL_RWops *dst,Uint16 value)*
- size_t *SDL_WriteLE32(SDL_RWops *dst,Uint32 value)*
- size_t *SDL_WriteLE64(SDL_RWops *dst,Uint64 value)*
- size_t *SDL_WriteU8(SDL_RWops *dst,Uint8 value)*

- void *SDL_LoadFunction(void *handle,const char *name)
- void *SDL_LoadObject(const char *sofile)
- void SDL_UnloadObject(void *handle)
- const char *SDL_GetPlatform(void)
- int SDL_GetCPUCacheLineSize(void)
- int SDL_GetCPUCount(void)
- int SDL_GetSystemRAM(void)
- SDL_bool SDL_Has3DNow(void)
- SDL_bool SDL_HasAVX(void)
- SDL_bool SDL_HasMMX(void)
- SDL_bool SDL_HasRDTSC(void)
- SDL_bool SDL_HasSSE(void)
- SDL_bool SDL_HasSSE2(void)
- SDL_bool SDL_HasSSE3(void)
- SDL_bool SDL_HasSSE41(void)
- SDL_bool SDL_HasSSE42(void)
- SDL_PowerState SDL_GetPowerInfo(int *secs,int *pct)
- double SDL_acos(double x)
- int IMG_Init(int flags)
- void IMG_Quit(void)
- SDL_Surface *IMG_Load(const char *file)
- SDL_Surface *IMG_Load_RW(SDL_RWops *src, int freesrc)
- SDL_Surface *IMG_LoadTyped_RW(SDL_RWops *src, int freesrc, char *type)
- SDL_Surface *IMG_LoadCUR_RW(SDL_RWops *src)
- SDL_Surface *IMG_LoadBMP_RW(SDL_RWops *src)
- SDL_Surface *IMG_LoadPNM_RW(SDL_RWops *src)
- SDL_Surface *IMG_LoadXPM_RW(SDL_RWops *src)
- SDL_Surface *IMG_LoadXCF_RW(SDL_RWops *src)
- SDL_Surface *IMG_LoadPCX_RW(SDL_RWops *src)
- SDL_Surface *IMG_LoadGIF_RW(SDL_RWops *src)
- SDL_Surface *IMG_LoadJPEG_RW(SDL_RWops *src)
- SDL_Surface *IMG_LoadTIF_RW(SDL_RWops *src)
- SDL_Surface *IMG_LoadPNG_RW(SDL_RWops *src)
- SDL_Surface *IMG_LoadTGA_RW(SDL_RWops *src)
- SDL_Surface *IMG_LoadLBM_RW(SDL_RWops *src)
- SDL_Surface *IMG_LoadXV_RW(SDL_RWops *src)

- `SDL_Surface *IMG_ReadXPMFromArray(char **xpm)`
- `int IMG_isCUR(SDL_RWops *src)`
- `int IMG_isICO(SDL_RWops *src)`
- `int IMG_isBMP(SDL_RWops *src)`
- `int IMG_isPNM(SDL_RWops *src)`
- `int IMG_isXPM(SDL_RWops *src)`
- `int IMG_isXCF(SDL_RWops *src)`
- `int IMG_isPCX(SDL_RWops *src)`
- `int IMG_isGIF(SDL_RWops *src)`
- `int IMG_isJPG(SDL_RWops *src)`
- `int IMG_isTIF(SDL_RWops *src)`
- `int IMG_isPNG(SDL_RWops *src)`
- `int IMG_isLBM(SDL_RWops *src)`
- `int IMG_isXV(SDL_RWops *src)`
- `int TTF_Init(void)`
- `int TTF_WasInit(void)`
- `void TTF_Quit(void)`
- `TTF_Font *TTF_OpenFont(const char *file, int ptsize)`
- `TTF_Font *TTF_OpenFontRW(SDL_RWops *src, int freesrc, int ptsize)`
- `TTF_Font *TTF_OpenFontIndex(const char *file, int ptsize, long index)`
- `TTF_Font *TTF_OpenFontIndexRW(SDL_RWops *src, int freesrc, int ptsize, long index)`
- `void TTF_CloseFont(TTF_Font *font)`
- `void TTF_ByteSwappedUNICODE(int swapped)`
- `int TTF_GetFontStyle(TTF_Font *font)`
- `void TTF_SetFontStyle(TTF_Font *font, int style)`
- `int TTF_GetFontOutline(TTF_Font *font)`
- `void TTF_SetFontOutline(TTF_Font *font, int outline)`
- `int TTF_GetFontHinting(TTF_Font *font)`
- `void TTF_SetFontHinting(TTF_Font *font, int hinting)`
- `int TTF_GetFontKerning(TTF_Font *font)`
- `void TTF_SetFontKerning(TTF_Font *font, int allowed)`
- `int TTF_FontHeight(const TTF_Font *font)`
- `int TTF_FontAscent(const TTF_Font *font)`
- `int TTF_FontDescent(const TTF_Font *font)`
- `int TTF_FontLineSkip(const TTF_Font *font)`
- `long TTF_FontFaces(const TTF_Font *font)`

- int TTF_FontFaceIsFixedWidth(const TTF_Font *font)
- char *TTF_FontFaceFamilyName(const TTF_Font *font)
- char *TTF_FontFaceStyleName(const TTF_Font *font)
- int TTF_GlyphIsProvided(const TTF_Font *font, Uint16 ch)
- int TTF_GlyphMetrics(TTF_Font *font, Uint16 ch, int *minx, int *maxx, int *miny, int *maxy, int *advance)
- int TTF_SizeText(TTF_Font *font, const char *text, int *w, int *h)
- int TTF_SizeUTF8(TTF_Font *font, const char *text, int *w, int *h)
- int TTF_SizeUNICODE(TTF_Font *font, const Uint16 *text, int *w, int *h)
- SDL_Surface *TTF_RenderText_Solid(TTF_Font *font, const char *text, SDL_Color fg)
- SDL_Surface *TTF_RenderUTF8_Solid(TTF_Font *font, const char *text,SDL_Color fg)
- SDL_Surface *TTF_RenderUNICODE_Solid(TTF_Font *font, const Uint16 *text,SDL_Color fg)
- SDL_Surface *TTF_RenderGlyph_Solid(TTF_Font *font, Uint16 ch, SDL_Color fg)
- SDL_Surface *TTF_RenderText_Shaded(TTF_Font *font, const char *text,SDL_Color fg, SDL_Color bg)
- SDL_Surface *TTF_RenderUTF8_Shaded(TTF_Font *font, const char *text,SDL_Color fg, SDL_Color bg)
- SDL_Surface *TTF_RenderUNICODE_Shaded(TTF_Font *font, const Uint16 *text,SDL_Color fg,SDL_Color bg)
- SDL_Surface *TTF_RenderGlyph_Shaded(TTF_Font *font, Uint16 ch, SDL_Color fg,SDL_Color bg)
- SDL_Surface *TTF_RenderText_Blended(TTF_Font *font, const char *text,SDL_Color fg)
- SDL_Surface *TTF_RenderUTF8_Blended(TTF_Font *font, const char *text,SDL_Color fg)
- SDL_Surface *TTF_RenderUNICODE_Blended(TTF_Font *font, const Uint16 *text,SDL_Color fg)
- SDL_Surface *TTF_RenderGlyph_Blended(TTF_Font *font, Uint16 ch, SDL_Color fg)
- int Mix_Init(int flags)
- void Mix_Quit(void)
- int Mix_OpenAudio(int frequency, Uint16 format, int channels, int chunksize)
- void Mix_CloseAudio(void)
- int Mix_QuerySpec(int *frequency, Uint16 *format, int *channels)
- int Mix_GetNumChunkDecoders(void)
- const char *Mix_GetChunkDecoder(int index)
- Mix_Chunk *Mix_LoadWAV(char *file)
- Mix_Chunk *Mix_LoadWAV_RW(SDL_RWops *src, int freesrc)
- Mix_Chunk *Mix_QuickLoad_WAV(Uint8 *mem)
- void Mix_FreeChunk(Mix_Chunk *chunk)
- int Mix_AllocateChannels(int numchans)
- int Mix_Volume(int channel, int volume)
- int Mix_PlayChannel(int channel, Mix_Chunk *chunk, int loops)
- int Mix_PlayChannelTimed(int channel, Mix_Chunk *chunk, int loops, int ticks)

- int Mix_FadeInChannel(int channel, Mix_Chunk *chunk, int loops, int ms)
- int Mix_FadeInChannelTimed(int channel, Mix_Chunk *chunk, int loops, int ms, int ticks)
- void Mix_Pause(int channel)
- void Mix_Resume(int channel)
- int Mix_HaltChannel(int channel)
- int Mix_ExpireChannel(int channel, int ticks)
- int Mix_FadeOutChannel(int channel, int ms)
- int Mix_Paused(int channel)
- Mix_Fading Mix_FadingChannel(int which)
- Mix_Chunk *Mix_GetChunk(int channel)
- int Mix_ReserveChannels(int num)
- int Mix_GroupChannel(int which, int tag)
- int Mix_GroupChannels(int from, int to, int tag)
- int Mix_GroupCount(int tag)
- int Mix_GroupAvailable(int tag)
- int Mix_GroupOldest(int tag)
- int Mix_GroupNewer(int tag)
- int Mix_FadeOutGroup(int tag, int ms)
- int Mix_HaltGroup(int tag)
- int Mix_GetNumMusicDecoders(void)
- const char *Mix_GetMusicDecoder(int index)
- Mix_Music *Mix_LoadMUS(const char *file)
- void Mix_FreeMusic(Mix_Music *music)
- int Mix_PlayMusic(Mix_Music *music, int loops)
- int Mix_FadeInMusic(Mix_Music *music, int loops, int ms)
- int Mix_FadeInMusicPos(Mix_Music *music, int loops, int ms, double position)
- int Mix_PlayingMusic(void)
- int Mix_PausedMusic(void)
- Mix_Fading Mix_FadingMusic(void)
- void *Mix_GetMusicHookData(void)
- int Mix_RegisterEffect(int chan, Mix_EffectFunc_t f, Mix_EffectDone_t d, void *arg)
- int Mix_UnregisterEffect(int channel, Mix_EffectFunc_t f)
- int Mix_UnregisterAllEffects(int channel)
- int Mix_SetDistance(int channel, Uint8 distance)
- int Mix_SetPosition(int channel, Sint16 angle, Uint8 distance)
- int Mix_SetReverseStereo(int channel, int flip)

- int SDLNet_Init(void)
- void SDLNet_Quit(void)
- char *SDLNet_GetError(void)
- void SDLNet_Write16(Uint16 value, void *area)
- void SDLNet_Write32(Uint32 value, void *area)
- Uint16 SDLNet_Read16(void *area)
- Uint32 SDLNet_Read32(void *area)
- int SDLNet_ResolveHost(IPAddress *address, const char *host, Uint16 port)
- const char *SDLNet_ResolveIP(IPAddress *address)
- TCPsocket SDLNet_TCP_Open(IPAddress *ip)
- void SDLNet_TCP_Close(TCPsocket sock)
- TCPsocket SDLNet_TCP_Accept(TCPsocket server)
- int SDLNet_TCP_Send(TCPsocket sock, const void *data, int len)
- int SDLNet_TCP_Recv(TCPsocket sock, void *data, int maxlen)
- UDPsocket SDLNet_UDP_Open(Uint16 port)
- void SDLNet_UDP_Close(UDPsocket sock)
- int SDLNet_UDP_Bind(UDPsocket sock, int channel, IPAddress *address)
- void SDLNet_UDP_Unbind(UDPsocket sock, int channel)
- IPAddress *SDLNet_UDP_GetPeerAddress(UDPsocket sock, int channel)
- int SDLNet_UDP_Send(UDPsocket sock, int channel, UDPpacket *packet)
- int SDLNet_UDP_Recv(UDPsocket sock, UDPpacket *packet)
- int SDLNet_UDP_SendV(UDPsocket sock, UDPpacket **packetV, int npackets)
- int SDLNet_UDP_RecvV(UDPsocket sock, UDPpacket **packetV)
- UDPpacket *SDLNet_AllocPacket(int size)
- int SDLNet_ResizePacket(UDPpacket *packet, int size)
- void SDLNet_FreePacket(UDPpacket *packet)
- UDPpacket **SDLNet_AllocPacketV(int howmany, int size)
- void SDLNet_FreePacketV(UDPpacket **packetV)
- SDLNet_SocketSet SDLNet_AllocSocketSet(int maxsockets)
- void SDLNet_FreeSocketSet(SDLNet_SocketSet set)
- int SDLNet_AddSocket(SDLNet_SocketSet set, SDLNet_GenericSocket sock)
- int SDLNet_TCP_AddSocket(SDLNet_SocketSet set, TCPsocket sock)
- int SDLNet_UDP_AddSocket(SDLNet_SocketSet set, UDPsocket sock)
- int SDLNet_DelSocket(SDLNet_SocketSet set, SDLNet_GenericSocket sock)
- int SDLNet_TCP_DelSocket(SDLNet_SocketSet set, TCPsocket sock)
- int SDLNet_UDP_DelSocket(SDLNet_SocketSet set, UDPsocket sock)

- int SDLNet_CheckSockets(SDLNet_SocketSet set, Uint32 timeout)
- int SDLNet_SocketReady(TCPsocket sock)
- int circleRGBA(SDL_Renderer * renderer, Sint16 x, Sint16 y, Sint16 rad, Uint8 r, Uint8 g, Uint8 b, Uint8 a)
- SDL_Thread *SDL_CreateThread(SDL_ThreadFunction fn,const char *name,void *data)
- void SDL_DetachThread(SDL_Thread *thread)
- SDL_threadID SDL_GetThreadID(SDL_Thread *thread)
- const char *SDL_GetThreadName*(*SDL_Thread* thread)
- int SDL_SetThreadPriority(SDL_ThreadPriority priority)
- SDL_TLSID SDL_TLSCreate(void)
- void *SDL_TLSGet(SDL_TLSID id)
- int SDL_TLSSet(SDL_TLSID id,const void *value,void *)
- SDL_threadID SDL_ThreadID(void)
- void SDL_WaitThread(SDL_Thread *thread,int *status)
- int SDL_CondBroadcast(SDL_cond *cond)
- int SDL_CondSignal(SDL_cond *cond)
- int SDL_CondWait(SDL_cond *cond,SDL_mutex *mutex)
- int SDL_CondWaitTimeout(SDL_cond *cond,SDL_mutex *mutex,Uint32 ms)
- SDL_cond *SDL_CreateCond(void)
- SDL_mutex *SDL_CreateMutex(void)
- SDL_sem *SDL_CreateSemaphore(Uint32 initial_value)
- void SDL_DestroyCond(SDL_cond *cond)
- void SDL_DestroyMutex(SDL_mutex *mutex)
- void SDL_DestroySemaphore(SDL_sem *sem)
- int SDL_LockMutex(SDL_mutex *mutex)
- int SDL_SemPost(SDL_sem *sem)
- int SDL_SemTryWait(SDL_sem *sem)
- Uint32 SDL_SemValue(SDL_sem *sem)
- int SDL_SemWait(SDL_sem *sem)
- int SDL_SemWaitTimeout(SDL_sem *sem,Uint32 ms)
- int SDL_TryLockMutex(SDL_mutex *mutex)
- int SDL_UnlockMutex(SDL_mutex *mutex)

CHAPTER
SEVENTYEIGHT

USING RINGLIBUV

In this chapter we will learn about using RingLibuv

Note: To use RingLibuv, Check ring/extensions/ringlibuv folder.

Information from the library website: <http://libuv.org/>

Libuv is a multi-platform support library with a focus on asynchronous I/O.

Feature highlights

- Full-featured event loop backed by epoll, kqueue, IOCP, event ports.
- Asynchronous TCP and UDP sockets
- Asynchronous DNS resolution
- Asynchronous file and file system operations
- File system events
- ANSI escape code controlled TTY
- IPC with socket sharing, using Unix domain sockets or named pipes (Windows)
- Child processes
- Thread pool
- Signal handling
- High resolution clock
- Threading and synchronization primitives

78.1 First Application using RingLibuv

Example:

```
load "libuv.ring"

func main

    myloop = new_uv_loop_t()
    uv_loop_init(myloop)
    ? "Now quitting"
```

(continues on next page)

(continued from previous page)

```
uv_run(myloop, UV_RUN_DEFAULT)
uv_loop_close(myloop)
destroy_uv_loop_t(myloop)
```

Output:

```
Now quitting
```

78.2 The Events Loop

Example:

```
load "libuv.ring"

counter = 0
idler = NULL

func main
    idler = new_uv_idle_t()
    uv_idle_init(uv_default_loop(), idler)
    uv_idle_start(idler, "wait()")
    ? "Idling..."
    uv_run(uv_default_loop(), UV_RUN_DEFAULT);
    uv_loop_close(uv_default_loop());
    destroy_uv_idle_t(idler)

func wait
    counter++
    if counter >= 100000
        uv_idle_stop(idler)
    ok
```

Output:

```
Idling...
```

78.3 Server Example

Example:

```
load "libuv.ring"

? "Testing RingLibuv - Server Side"

DEFAULT_PORT      = 13370
DEFAULT_BACKLOG  = 1024

addr      = new_sockaddr_in()
server   = NULL
client   = NULL
myloop   = NULL
```

(continues on next page)

(continued from previous page)

```

func main
    myloop = uv_default_loop()
    server = new_uv_tcp_t()
    uv_tcp_init(myloop, server)
    uv_ip4_addr("127.0.0.1", DEFAULT_PORT, addr)
    uv_tcp_bind(server, addr, 0)
    r = uv_listen(server, DEFAULT_BACKLOG, "newconnection()")
    if r
        ? "Listen error " + uv_strerror(r)
        return 1
    ok
    uv_run(myloop, UV_RUN_DEFAULT)
    destroy_uv_tcp_t(server)
    destroy_uv_sockaddr_in(addr)

func newconnection
    ? "New Connection"
    aPara = uv_Eventpara(server,:connect)
    nStatus = aPara[2]
    if nStatus < 0
        ? "New connection error : " + nStatus
        return
    ok
    client = new_uv_tcp_t()
    uv_tcp_init(myloop, client)
    if uv_accept(server, client) = 0
        uv_read_start(client, uv_myalloccallback(), "echo_read()")
    ok

func echo_read
    aPara = uv_Eventpara(client,:read)
    nRead = aPara[2]
    buf = aPara[3]
    if nRead > 0
        req = new_uv_write_t()
        wrbuf = uv_buf_init(get_uv_buf_t_base(buf), nread)
        uv_write(req, client, wrbuf, 1, "echo_write()")
        ? uv_buf2str(wrbuf)
        message = "message from the server to the client"
        buf = new_uv_buf_t()
        set_uv_buf_t_len(buf, len(message))
        set_uv_buf_t_base(buf, varptr("message",:char))
        uv_write(req, client, buf, 1, "echo_write()")
    ok

func echo_write
    aPara = uv_Eventpara(client,:read)
    req = aPara[1]

```

Output:

When we run the client, We will see the message “New Connection”

Then the message “hello from the client”

Testing RingLibuv - Server Side

(continues on next page)

(continued from previous page)

```
New Connection
hello from the client
```

78.4 Client Example

Example:

```
load "libuv.ring"

? "Testing RingLibuv - Client Side"

DEFAULT_PORT      = 13370
DEFAULT_BACKLOG  = 1024

addr   = new_sockaddr_in()
connect = NULL
buffer = null
socket = null

func main
    myloop  = uv_default_loop()
    Socket  = new_uv_tcp_t()
    connect = new_uv_connect_t()
    uv_tcp_init(myloop, Socket)
    uv_ip4_addr("127.0.0.1", DEFAULT_PORT, addr)
    uv_tcp_connect(connect, Socket, addr, "connect()")
    uv_run(myloop, UV_RUN_DEFAULT)
    destroy_uv_tcp_t(socket)
    destroy_uv_connect_t(connect)

func connect
    ? "Client: Start Connection"
    aPara  = uv_Eventpara(connect,:connect)
    req    = aPara[1]
    nStatus = aPara[2]
    if nStatus = -1
        ? "Error : on_write_end"
        return
    ok
    buf = new_uv_buf_t()
    message = "hello from the client"
    set_uv_buf_t_len(buf, len(message))
    set_uv_buf_t_base(buf, varptr("message",:char))
    tcp     = get_uv_connect_t_handle(req)
    write_req = new_uv_write_t()
    buf_count = 1
    uv_write(write_req, tcp, buf, buf_count, "on_write_end()")

func on_write_end
    uv_read_start(socket, uv_myalloccallback(), "echo_read()")

func echo_read
    aPara = uv_Eventpara(socket,:read)
    nRead = aPara[2]
```

(continues on next page)

(continued from previous page)

```

buf   = aPara[3]
if nRead > 0
    wrbuf = uv_buf_init(get_uv_buf_t_base(buf), nread);
    ? uv_buf2str(wrbuf)
ok

```

Output:

We will run the client after the server

```

Testing RingLibuv - Client Side
Client: Start Connection
hello from the client
message from the server to the client

```

78.5 Server Example Using Classes

Example:

```

load "libuv.ring"
load "objectslib.ring"

? "Testing RingLibuv - Server Side - Using Classes"

open_object(:MyServer)

class MyServer from ObjectControllerParent

    DEFAULT_PORT      = 13370
    DEFAULT_BACKLOG = 1024

    addr      = new_sockaddr_in()
    server   = NULL
    client   = NULL
    myloop   = NULL

    func start
        myloop = uv_default_loop()
        server = new_uv_tcp_t()
        uv_tcp_init(myloop, server)
        uv_ip4_addr("127.0.0.1", DEFAULT_PORT, addr)
        uv_tcp_bind(server, addr, 0)
        r = uv_listen(server, DEFAULT_BACKLOG, Method(:newconnection) )
        if r
            ? "Listen error " + uv_strerror(r)
            return 1
        ok
        uv_run(myloop, UV_RUN_DEFAULT)
        destroy_uv_tcp_t(server)
        destroy_uv_sockaddr_in(addr)

    func newconnection
        ? "New Connection"
        aPara   = uv_Eventpara(server,:connect)

```

(continues on next page)

(continued from previous page)

```

nStatus = aPara[2]
if nStatus < 0
    ? "New connection error : " + nStatus
    return

ok
client = new_uv_tcp_t()
uv_tcp_init(myloop, client)
if uv_accept(server, client) = 0
    uv_read_start(client, uv_myalloccallback(),
                  Method(:echo_read))

ok

func echo_read
    aPara = uv_Eventpara(client,:read)
    nRead = aPara[2]
    buf   = aPara[3]
    if nRead > 0
        req = new_uv_write_t()
        wrbuf = uv_buf_init(get_uv_buf_t_base(buf), nread)
        uv_write(req, client, wrbuf, 1, Method(:echo_write))
        ? uv_buf2str(wrbuf)
        message = "message from the server to the client"
        buf = new_uv_buf_t()
        set_uv_buf_t_len(buf, len(message))
        set_uv_buf_t_base(buf, varptr("message",:char))
        uv_write(req, client, buf, 1, Method(:echo_write))
    ok

func echo_write
    aPara = uv_Eventpara(client,:read)
    req   = aPara[1]

```

Output:

When we run the client, We will see the message “New Connection”

Then the message “hello from the client”

```

Testing RingLibuv - Server Side - Using Classes
New Connection
hello from the client

```

78.6 Client Example Using Classes

Example:

```

load "libuv.ring"
load "objectslib.ring"

? "Testing RingLibuv - Client Side - Using Classes"

open_object(:MyClient)

Class MyClient from ObjectControllerParent

```

(continues on next page)

(continued from previous page)

```

DEFAULT_PORT      = 13370
DEFAULT_BACKLOG  = 1024

addr      = new_sockaddr_in()
connect   = NULL
buffer    = null
socket    = null

func start
    myloop  = uv_default_loop()
    Socket   = new_uv_tcp_t()
    connect  = new_uv_connect_t()
    uv_tcp_init(myloop, Socket)
    uv_ip4_addr("127.0.0.1", DEFAULT_PORT, addr)
    uv_tcp_connect(connect, Socket, addr, Method(:connect))
    uv_run(myloop, UV_RUN_DEFAULT)
    destroy_uv_tcp_t(socket)
    destroy_uv_connect_t(connect)

func connect
    ? "Client: Start Connection"
    aPara   = uv_Eventpara(connect,:connect)
    req     = aPara[1]
    nStatus = aPara[2]
    if nStatus == -1
        ? "Error : on_write_end"
        return
    ok
    buf = new_uv_buf_t()
    message = "hello from the client"
    set_uv_buf_t_len(buf, len(message))
    set_uv_buf_t_base(buf, varptr("message",:char))
    tcp      = get_uv_connect_t_handle(req)
    write_req = new_uv_write_t()
    buf_count = 1
    uv_write(write_req, tcp, buf, buf_count, Method(:on_write_end))

func on_write_end
    uv_read_start(socket, uv_myalloccallback(), Method(:echo_
→read))

func echo_read
    aPara = uv_Eventpara(socket,:read)
    nRead = aPara[2]
    buf   = aPara[3]
    if nRead > 0
        wrbuf = uv_buf_init(get_uv_buf_t_base(buf), nread);
        ? uv_buf2str(wrbuf)
    ok

```

Output:

We will run the client after the server

```

Testing RingLibuv - Client Side - Using Classes
Client: Start Connection
hello from the client

```

(continues on next page)

(continued from previous page)

message from the server to the client

78.7 Threads Example

Example:

```
load "libuv.ring"

? "Testing RingLibuv - Threads"

func main
    one_id = new_uv_thread_t()
    two_id = new_uv_thread_t()
    uv_thread_create(one_id, "one()")
    uv_thread_create(two_id, "two()")
    uv_thread_join(one_id)
    uv_thread_join(two_id)
    destroy_uv_thread_t(one_id)
    destroy_uv_thread_t(two_id)

func one
    ? "Message from the First Thread!"

func two
    ? "Message from the Second Thread!"
```

Output:

```
Testing RingLibuv - Threads
Message from the First Thread!
Message from the Second Thread!
```

78.8 Threads Example - Using Classes

Example:

```
load "libuv.ring"
load "objectslib.ring"

? "Testing RingLibuv - Threads - Using Classes"

open_object (:MyThreads)

class MyThreads from ObjectControllerParent

    func Start
        one_id = new_uv_thread_t()
        two_id = new_uv_thread_t()
        uv_thread_create(one_id, Method(:One))
        uv_thread_create(two_id, Method(:Two))
        uv_thread_join(one_id)
```

(continues on next page)

(continued from previous page)

```
uv_thread_join(two_id)
destroy_uv_thread_t(one_id)
destroy_uv_thread_t(two_id)

func one
    ? "Message from the First Thread!"

func Two
    ? "Message from the Second Thread!"
```

Output:

```
Testing RingLibuv - Threads - Using Classes
Message from the First Thread!
Message from the Second Thread!
```

RINGLIBUV FUNCTIONS REFERENCE

79.1 Introduction

In this chapter we have a list of the supported functions by this extension

79.2 Reference

- int uv_loop_init(uv_loop_t* loop)
- int uv_loop_configure(uv_loop_t* loop, uv_loop_option option, int)
- int uv_loop_close(uv_loop_t* loop)
- uv_loop_t* uv_default_loop(void)
- int uv_run(uv_loop_t* loop, uv_run_mode mode)
- int uv_loop_alive(const uv_loop_t* loop)
- void uv_stop(uv_loop_t* loop)
- size_t uv_loop_size(void)
- int uv_backend_fd(const uv_loop_t* loop)
- int uv_backend_timeout(const uv_loop_t* loop)
- uint64_t uv_now(const uv_loop_t* loop)
- void uv_update_time(uv_loop_t* loop)
- void uv_walk(uv_loop_t* loop, uv_walk_cb walk_cb, void* arg)
- void uv_walk_2(uv_loop_t* loop, uv_walk_cb walk_cb, void* arg)
- int uv_loop_fork(uv_loop_t* loop)
- int uv_is_active(const uv_handle_t* handle)
- int uv_is_closing(const uv_handle_t* handle)
- void uv_close(uv_handle_t* handle, uv_close_cb close_cb)
- void uv_close_2(uv_handle_t* handle, uv_close_cb close_cb)
- void uv_ref(uv_handle_t* handle)
- void uv_unref(uv_handle_t* handle)
- int uv_has_ref(const uv_handle_t* handle)

- `size_t uv_handle_size(uv_handle_type type)`
- `int uv_send_buffer_size(uv_handle_t* handle, int* value)`
- `int uv_recv_buffer_size(uv_handle_t* handle, int* value)`
- `int uv_fileno(const uv_handle_t* handle, uv_os_fd_t* fd)`
- `int uv_cancel(uv_req_t* req)`
- `size_t uv_req_size(uv_req_type type)`
- `int uv_timer_init(uv_loop_t* loop, uv_timer_t* handle)`
- `int uv_timer_start(uv_timer_t* handle, uv_timer_cb cb, uint64_t timeout, uint64_t repeat)`
- `int uv_timer_start_2(uv_timer_t* handle, uv_timer_cb cb, uint64_t timeout, uint64_t repeat)`
- `int uv_timer_stop(uv_timer_t* handle)`
- `int uv_timer_again(uv_timer_t* handle)`
- `void uv_timer_set_repeat(uv_timer_t* handle, uint64_t repeat)`
- `uint64_t uv_timer_get_repeat(const uv_timer_t* handle)`
- `int uv_prepare_init(uv_loop_t* loop, uv_prepare_t* prepare)`
- `int uv_prepare_start(uv_prepare_t* prepare, uv_prepare_cb cb)`
- `int uv_prepare_start_2(uv_prepare_t* prepare, uv_prepare_cb cb)`
- `int uv_prepare_stop(uv_prepare_t* prepare)`
- `int uv_check_init(uv_loop_t* loop, uv_check_t* check)`
- `int uv_check_start(uv_check_t* check, uv_check_cb cb)`
- `int uv_check_start_2(uv_check_t* check, uv_check_cb cb)`
- `int uv_check_stop(uv_check_t* check)`
- `int uv_idle_init(uv_loop_t* loop, uv_idle_t* idle)`
- `int uv_idle_start(uv_idle_t* idle, uv_idle_cb cb)`
- `int uv_idle_start_2(uv_idle_t* idle, uv_idle_cb cb)`
- `int uv_idle_stop(uv_idle_t* idle)`
- `int uv_async_init(uv_loop_t* loop, uv_async_t* async, uv_async_cb async_cb)`
- `int uv_async_init_2(uv_loop_t* loop, uv_async_t* async, uv_async_cb async_cb)`
- `int uv_async_send(uv_async_t* async)`
- `int uv_poll_init(uv_loop_t* loop, uv_poll_t* handle, int fd)`
- `int uv_poll_init_socket(uv_loop_t* loop, uv_poll_t* handle, uv_os_sock_t socket)`
- `int uv_poll_start(uv_poll_t* handle, int events, uv_poll_cb cb)`
- `int uv_poll_start_2(uv_poll_t* handle, int events, uv_poll_cb cb)`
- `int uv_poll_stop(uv_poll_t* poll)`
- `int uv_signal_init(uv_loop_t* loop, uv_signal_t* signal)`
- `int uv_signal_start(uv_signal_t* signal, uv_signal_cb cb, int signum)`
- `int uv_signal_start_2(uv_signal_t* signal, uv_signal_cb cb, int signum)`

- int uv_signal_start_oneshot(uv_signal_t* signal, uv_signal_cb cb, int signum)
- int uv_signal_start_oneshot_2(uv_signal_t* signal, uv_signal_cb cb, int signum)
- int uv_signal_stop(uv_signal_t* signal)
- void uv_disable_stdio_inheritance(void)
- int uv_spawn(uv_loop_t* loop, uv_process_t* handle, const uv_process_options_t* options)
- int uv_process_kill(uv_process_t* handle, int signum)
- int uv_kill(int pid, int signum)
- int uv_shutdown(uv_shutdown_t* req, uv_stream_t* handle, uv_shutdown_cb cb)
- int uv_shutdown_2(uv_shutdown_t* req, uv_stream_t* handle, uv_shutdown_cb cb)
- int uv_listen(uv_stream_t* stream, int backlog, uv_connection_cb cb)
- int uv_listen_2(uv_stream_t* stream, int backlog, uv_connection_cb cb)
- int uv_accept(uv_stream_t* server, uv_stream_t* client)
- int uv_read_start(uv_stream_t* stream, uv_alloc_cb alloc_cb, uv_read_cb read_cb)
- int uv_read_start_2(uv_stream_t* stream, uv_alloc_cb alloc_cb, uv_read_cb read_cb)
- int uv_read_stop(uv_stream_t*)
- int uv_write(uv_write_t* req, uv_stream_t* handle, uv_buf_t *bufs, unsigned int nbufs, uv_write_cb cb)
- int uv_write_2(uv_write_t* req, uv_stream_t* handle, uv_buf_t *bufs, unsigned int nbufs, uv_write_cb cb)
- int uv_write2(uv_write_t* req, uv_stream_t* handle, uv_buf_t bufs, *unsigned int nbufs*, uv_stream_t send_handle, uv_write_cb cb)
- int uv_write2_2(uv_write_t* req, uv_stream_t* handle, uv_buf_t bufs, *unsigned int nbufs*, uv_stream_t send_handle, uv_write_cb cb)
- int uv_try_write(uv_stream_t* handle, uv_buf_t *bufs, unsigned int nbufs)
- int uv_is_readable(const uv_stream_t* handle)
- int uv_is_writable(const uv_stream_t* handle)
- int uv_stream_set_blocking(uv_stream_t* handle, int blocking)
- int uv_tcp_init(uv_loop_t* loop, uv_tcp_t* handle)
- int uv_tcp_init_ex(uv_loop_t* loop, uv_tcp_t* handle, unsigned int flags)
- int uv_tcp_open(uv_tcp_t* handle, uv_os_sock_t sock)
- int uv_tcp_nodelay(uv_tcp_t* handle, int enable)
- int uv_tcp_keepalive(uv_tcp_t* handle, int enable, unsigned int delay)
- int uv_tcp_simultaneous_accepts(uv_tcp_t* handle, int enable)
- int uv_tcp_bind(uv_tcp_t *handle,sockaddr *addr,unsigned int flags)
- int uv_tcp_getsockname(const uv_tcp_t* handle, struct sockaddr* name, int* namelen)
- int uv_tcp_getpeername(const uv_tcp_t* handle, struct sockaddr* name, int* namelen)
- int uv_tcp_connect(uv_connect_t* req, uv_tcp_t* handle, sockaddr * addr, uv_connect_cb cb)
- int uv_tcp_connect_2(uv_connect_t* req, uv_tcp_t* handle, sockaddr * addr, uv_connect_cb cb)
- int uv_pipe_init(uv_loop_t* loop, uv_pipe_t* handle, int ipc)

- int uv_pipe_open(uv_pipe_t* handle, uv_file file)
- int uv_pipe_bind(uv_pipe_t* handle, const char * name)
- void uv_pipe_connect(uv_connect_t* req, uv_pipe_t* handle, const char * name, uv_connect_cb cb)
- void uv_pipe_connect_2(uv_connect_t* req, uv_pipe_t* handle, const char * name, uv_connect_cb cb)
- int uv_pipe_getsockname(const uv_pipe_t* handle, char* buffer, size_t* size)
- int uv_pipe_getpeername(const uv_pipe_t* handle, char* buffer, size_t* size)
- void uv_pipe_pending_instances(uv_pipe_t* handle, int count)
- int uv_pipe_pending_count(uv_pipe_t* handle)
- uv_handle_type uv_pipe_pending_type(uv_pipe_t* handle)
- int uv_pipe_chmod(uv_pipe_t* handle, int flags)
- int uv_tty_init(uv_loop_t* loop, uv_tty_t* handle, uv_file fd, int readable)
- int uv_tty_set_mode(uv_tty_t* handle, uv_tty_mode_t mode)
- int uv_tty_reset_mode(void)
- int uv_tty_get_winsize(uv_tty_t* handle, int* width, int* height)
- int uv_udp_init(uv_loop_t* loop, uv_udp_t* handle)
- int uv_udp_init_ex(uv_loop_t* loop, uv_udp_t* handle, unsigned int flags)
- int uv_udp_open(uv_udp_t* handle, uv_os_sock_t sock)
- int uv_udp_bind(uv_udp_t* handle, sockaddr * addr, unsigned int flags)
- int uv_udp_getsockname(const uv_udp_t* handle, struct sockaddr* name, int* namelen)
- int uv_udp_set_membership(uv_udp_t* handle, const char * multicast_addr, const char * interface_addr, uv_membership membership)
- int uv_udp_set_multicast_loop(uv_udp_t* handle, int on)
- int uv_udp_set_multicast_ttl(uv_udp_t* handle, int ttl)
- int uv_udp_set_multicast_interface(uv_udp_t* handle, const char * interface_addr)
- int uv_udp_set_broadcast(uv_udp_t* handle, int on)
- int uv_udp_set_ttl(uv_udp_t* handle, int ttl)
- int uv_udp_send(uv_udp_send_t* req, uv_udp_t* handle, uv_buf_t *bufs, unsigned int nbufs, sockaddr * addr, uv_udp_send_cb send_cb)
- int uv_udp_send_2(uv_udp_send_t* req, uv_udp_t* handle, uv_buf_t *bufs, unsigned int nbufs, sockaddr * addr, uv_udp_send_cb send_cb)
- int uv_udp_try_send(uv_udp_t* handle, uv_buf_t *bufs, unsigned int nbufs, sockaddr * addr)
- int uv_udp_recv_start(uv_udp_t* handle, uv_alloc_cb alloc_cb, uv_udp_recv_cb recv_cb)
- int uv_udp_recv_start_2(uv_udp_t* handle, uv_alloc_cb alloc_cb, uv_udp_recv_cb recv_cb)
- int uv_udp_recv_stop(uv_udp_t* handle)
- int uv_fs_event_init(uv_loop_t* loop, uv_fs_event_t* handle)
- int uv_fs_event_start(uv_fs_event_t* handle, uv_fs_event_cb cb, const char * path, unsigned int flags)
- int uv_fs_event_start_2(uv_fs_event_t* handle, uv_fs_event_cb cb, const char * path, unsigned int flags)

- int uv_fs_event_stop(uv_fs_event_t* handle)
- int uv_fs_event_getpath(uv_fs_event_t* handle, char* buffer, size_t* size)
- int uv_fs_poll_init(uv_loop_t* loop, uv_fs_poll_t* handle)
- int uv_fs_poll_start(uv_fs_poll_t* handle, uv_fs_poll_cb poll_cb, const char * path, unsigned int interval)
- int uv_fs_poll_start_2(uv_fs_poll_t* handle, uv_fs_poll_cb poll_cb, const char * path, unsigned int interval)
- int uv_fs_poll_stop(uv_fs_poll_t* handle)
- int uv_fs_poll_getpath(uv_fs_poll_t* handle, char* buffer, size_t* size)
- void uv_fs_req_cleanup(uv_fs_t* req)
- int uv_fs_close(uv_loop_t* loop, uv_fs_t* req, uv_file file, uv_fs_cb cb)
- int uv_fs_open(uv_loop_t* loop, uv_fs_t* req, const char * path, int flags, int mode, uv_fs_cb cb)
- int uv_fs_read(uv_loop_t* loop, uv_fs_t* req, uv_file file, uv_buf_t *bufs, unsigned int nbufs, int64_t offset, uv_fs_cb cb)
- int uv_fs_unlink(uv_loop_t* loop, uv_fs_t* req, const char * path, uv_fs_cb cb)
- int uv_fs_write(uv_loop_t* loop, uv_fs_t* req, uv_file file, uv_buf_t *bufs, unsigned int nbufs, int64_t offset, uv_fs_cb cb)
- int uv_fs_mkdir(uv_loop_t* loop, uv_fs_t* req, const char * path, int mode, uv_fs_cb cb)
- int uv_fs_mkdtemp(uv_loop_t* loop, uv_fs_t* req, const char * tpl, uv_fs_cb cb)
- int uv_fs_rmdir(uv_loop_t* loop, uv_fs_t* req, const char * path, uv_fs_cb cb)
- int uv_fs_scandir(uv_loop_t* loop, uv_fs_t* req, const char * path, int flags, uv_fs_cb cb)
- int uv_fs_scandir_next(uv_fs_t* req, uv_dirent_t* ent)
- int uv_fs_stat(uv_loop_t* loop, uv_fs_t* req, const char * path, uv_fs_cb cb)
- int uv_fs_fstat(uv_loop_t* loop, uv_fs_t* req, uv_file file, uv_fs_cb cb)
- int uv_fs_lstat(uv_loop_t* loop, uv_fs_t* req, const char * path, uv_fs_cb cb)
- int uv_fs_rename(uv_loop_t* loop, uv_fs_t* req, const char * path, const char * new_path, uv_fs_cb cb)
- int uv_fs_fsync(uv_loop_t* loop, uv_fs_t* req, uv_file file, uv_fs_cb cb)
- int uv_fs_fdatasync(uv_loop_t* loop, uv_fs_t* req, uv_file file, uv_fs_cb cb)
- int uv_fs_ftruncate(uv_loop_t* loop, uv_fs_t* req, uv_file file, int64_t offset, uv_fs_cb cb)
- int uv_fs_copyfile(uv_loop_t* loop, uv_fs_t* req, const char * path, const char * new_path, int flags, uv_fs_cb cb)
- int uv_fs_sendfile(uv_loop_t* loop, uv_fs_t* req, uv_file out_fd, uv_file in_fd, int64_t in_offset, size_t length, uv_fs_cb cb)
- int uv_fs_access(uv_loop_t* loop, uv_fs_t* req, const char * path, int mode, uv_fs_cb cb)
- int uv_fs_chmod(uv_loop_t* loop, uv_fs_t* req, const char * path, int mode, uv_fs_cb cb)
- int uv_fs_fchmod(uv_loop_t* loop, uv_fs_t* req, uv_file file, int mode, uv_fs_cb cb)
- int uv_fs_utime(uv_loop_t* loop, uv_fs_t* req, const char * path, double atime, double mtime, uv_fs_cb cb)
- int uv_fs_futime(uv_loop_t* loop, uv_fs_t* req, uv_file file, double atime, double mtime, uv_fs_cb cb)
- int uv_fs_link(uv_loop_t* loop, uv_fs_t* req, const char * path, const char * new_path, uv_fs_cb cb)

- int uv_fs_symlink(uv_loop_t* loop, uv_fs_t* req, const char * path, const char * new_path, int flags, uv_fs_cb cb)
- int uv_fs_readlink(uv_loop_t* loop, uv_fs_t* req, const char * path, uv_fs_cb cb)
- int uv_fs_realpath(uv_loop_t* loop, uv_fs_t* req, const char * path, uv_fs_cb cb)
- int uv_fs_chown(uv_loop_t* loop, uv_fs_t* req, const char * path, uv_uid_t uid, uv_gid_t gid, uv_fs_cb cb)
- int uv_fs_fchown(uv_loop_t* loop, uv_fs_t* req, uv_file file, uv_uid_t uid, uv_gid_t gid, uv_fs_cb cb)
- int uv_fs_close_2(uv_loop_t* loop, uv_fs_t* req, uv_file file, uv_fs_cb cb)
- int uv_fs_open_2(uv_loop_t* loop, uv_fs_t* req, const char * path, int flags, int mode, uv_fs_cb cb)
- int uv_fs_read_2(uv_loop_t* loop, uv_fs_t* req, uv_file file, uv_buf_t *bufs, unsigned int nbufs, int64_t offset, uv_fs_cb cb)
- int uv_fs_unlink_2(uv_loop_t* loop, uv_fs_t* req, const char * path, uv_fs_cb cb)
- int uv_fs_write_2(uv_loop_t* loop, uv_fs_t* req, uv_file file, uv_buf_t *bufs, unsigned int nbufs, int64_t offset, uv_fs_cb cb)
- int uv_fs_mkdir_2(uv_loop_t* loop, uv_fs_t* req, const char * path, int mode, uv_fs_cb cb)
- int uv_fs_mkdtemp_2(uv_loop_t* loop, uv_fs_t* req, const char * tpl, uv_fs_cb cb)
- int uv_fs_rmdir_2(uv_loop_t* loop, uv_fs_t* req, const char * path, uv_fs_cb cb)
- int uv_fs_scandir_2(uv_loop_t* loop, uv_fs_t* req, const char * path, int flags, uv_fs_cb cb)
- int uv_fs_stat_2(uv_loop_t* loop, uv_fs_t* req, const char * path, uv_fs_cb cb)
- int uv_fs_fstat_2(uv_loop_t* loop, uv_fs_t* req, uv_file file, uv_fs_cb cb)
- int uv_fs_lstat_2(uv_loop_t* loop, uv_fs_t* req, const char * path, uv_fs_cb cb)
- int uv_fs_rename_2(uv_loop_t* loop, uv_fs_t* req, const char * path, const char * new_path, uv_fs_cb cb)
- int uv_fs_fsync_2(uv_loop_t* loop, uv_fs_t* req, uv_file file, uv_fs_cb cb)
- int uv_fs_fdatasync_2(uv_loop_t* loop, uv_fs_t* req, uv_file file, uv_fs_cb cb)
- int uv_fs_ftruncate_2(uv_loop_t* loop, uv_fs_t* req, uv_file file, int64_t offset, uv_fs_cb cb)
- int uv_fs_copyfile_2(uv_loop_t* loop, uv_fs_t* req, const char * path, const char * new_path, int flags, uv_fs_cb cb)
- int uv_fs_sendfile_2(uv_loop_t* loop, uv_fs_t* req, uv_file out_fd, uv_file in_fd, int64_t in_offset, size_t length, uv_fs_cb cb)
- int uv_fs_access_2(uv_loop_t* loop, uv_fs_t* req, const char * path, int mode, uv_fs_cb cb)
- int uv_fs_chmod_2(uv_loop_t* loop, uv_fs_t* req, const char * path, int mode, uv_fs_cb cb)
- int uv_fs_fchmod_2(uv_loop_t* loop, uv_fs_t* req, uv_file file, int mode, uv_fs_cb cb)
- int uv_fs_utime_2(uv_loop_t* loop, uv_fs_t* req, const char * path, double atime, double mtime, uv_fs_cb cb)
- int uv_fs_futime_2(uv_loop_t* loop, uv_fs_t* req, uv_file file, double atime, double mtime, uv_fs_cb cb)
- int uv_fs_link_2(uv_loop_t* loop, uv_fs_t* req, const char * path, const char * new_path, uv_fs_cb cb)
- int uv_fs_symlink_2(uv_loop_t* loop, uv_fs_t* req, const char * path, const char * new_path, int flags, uv_fs_cb cb)
- int uv_fs_readlink_2(uv_loop_t* loop, uv_fs_t* req, const char * path, uv_fs_cb cb)
- int uv_fs_realpath_2(uv_loop_t* loop, uv_fs_t* req, const char * path, uv_fs_cb cb)

- int uv_fs_chown_2(`uv_loop_t*` loop, `uv_fs_t*` req, const char * path, `uv_uid_t` uid, `uv_gid_t` gid, `uv_fs_cb` cb)
- int uv_fs_fchown_2(`uv_loop_t*` loop, `uv_fs_t*` req, `uv_file` file, `uv_uid_t` uid, `uv_gid_t` gid, `uv_fs_cb` cb)
- int `uv_queue_work`(`uv_loop_t*` loop, `uv_work_t*` req, `uv_work_cb` work_cb, `uv_after_work_cb` after_work_cb)
- int `uv_queue_work_2`(`uv_loop_t*` loop, `uv_work_t*` req, `uv_work_cb` work_cb, `uv_after_work_cb` after_work_cb)
- int `uv_getaddrinfo`(`uv_loop_t*` loop, `uv_getaddrinfo_t*` req, `uv_getaddrinfo_cb` getaddrinfo_cb, const char * node, const char * service, const struct `addrinfo`* hints)
- int `uv_getaddrinfo_2`(`uv_loop_t*` loop, `uv_getaddrinfo_t*` req, `uv_getaddrinfo_cb` getaddrinfo_cb, const char * node, const char * service, const struct `addrinfo`* hints)
- void `uv_freeaddrinfo`(struct `addrinfo`* ai)
- int `uv_getnameinfo`(`uv_loop_t*` loop, `uv_getnameinfo_t*` req, `uv_getnameinfo_cb` getnameinfo_cb, `sockaddr` * addr, int flags)
- int `uv_getnameinfo_2`(`uv_loop_t*` loop, `uv_getnameinfo_t*` req, `uv_getnameinfo_cb` getnameinfo_cb, `sockaddr` * addr, int flags)
- int `uv_dlopen`(const char * filename, `uv_lib_t*` lib)
- void `uv_dlclose`(`uv_lib_t*` lib)
- int `uv_dlsym`(`uv_lib_t*` lib, const char * name, void** ptr)
- const char * `uv_dlerror`(const `uv_lib_t*` lib)
- int `uv_thread_create`(`uv_thread_t*` tid, `uv_thread_cb` entry, void* arg)
- int `uv_thread_create_2`(`uv_thread_t*` tid, `uv_thread_cb` entry, void* arg)
- `uv_thread_t` `uv_thread_self`(void)
- int `uv_thread_join`(`uv_thread_t`* tid)
- int `uv_thread_equal`(const `uv_thread_t*` t1, const `uv_thread_t*` t2)
- int `uv_key_create`(`uv_key_t*` key)
- void `uv_key_delete`(`uv_key_t*` key)
- void* `uv_key_get`(`uv_key_t*` key)
- void `uv_key_set`(`uv_key_t*` key, void* value)
- int `uv_mutex_init`(`uv_mutex_t*` handle)
- int `uv_mutex_init_recursive`(`uv_mutex_t*` handle)
- void `uv_mutex_destroy`(`uv_mutex_t*` handle)
- void `uv_mutex_lock`(`uv_mutex_t*` handle)
- int `uv_mutex_trylock`(`uv_mutex_t*` handle)
- void `uv_mutex_unlock`(`uv_mutex_t*` handle)
- int `uv_rwlock_init`(`uv_rwlock_t*` rwlock)
- void `uv_rwlock_destroy`(`uv_rwlock_t*` rwlock)
- void `uv_rwlock_rdlock`(`uv_rwlock_t*` rwlock)
- int `uv_rwlock_tryrdlock`(`uv_rwlock_t*` rwlock)

- void uv_rwlock_rdunlock(uv_rwlock_t* rwlock)
- void uv_rwlock_wrlock(uv_rwlock_t* rwlock)
- int uv_rwlock_trywrlock(uv_rwlock_t* rwlock)
- void uv_rwlock_wrunlock(uv_rwlock_t* rwlock)
- int uv_sem_init(uv_sem_t* sem, unsigned int value)
- void uv_sem_destroy(uv_sem_t* sem)
- void uv_sem_post(uv_sem_t* sem)
- void uv_sem_wait(uv_sem_t* sem)
- int uv_sem_trywait(uv_sem_t* sem)
- int uv_cond_init(uv_cond_t* cond)
- void uv_cond_destroy(uv_cond_t* cond)
- void uv_cond_signal(uv_cond_t* cond)
- void uv_cond_broadcast(uv_cond_t* cond)
- void uv_cond_wait(uv_cond_t* cond, uv_mutex_t* mutex)
- int uv_cond_timedwait(uv_cond_t* cond, uv_mutex_t* mutex, uint64_t timeout)
- int uv_barrier_init(uv_barrier_t* barrier, unsigned int count)
- void uv_barrier_destroy(uv_barrier_t* barrier)
- int uv_barrier_wait(uv_barrier_t* barrier)
- uv_handle_type uv_guess_handle(uv_file file)
- int uv_replace_allocator(uv_malloc_func malloc_func, uv_realloc_func realloc_func, uv_calloc_func calloc_func, uv_free_func free_func)
- uv_buf_t uv_buf_init(char* base, unsigned int len)
- char** uv_setup_args(int argc, char** argv)
- int uv_get_process_title(char* buffer, size_t size)
- int uv_set_process_title(const char * title)
- int uv_resident_set_memory(size_t* rss)
- int uv_uptime(double* uptime)
- int uv_getrusage(uv_rusage_t* rusage)
- uv_pid_t uv_os_getpid(void)
- uv_pid_t uv_os_getppid(void)
- int uv_cpu_info(uv_cpu_info_t** cpu_infos, int* count)
- void uv_free_cpu_info(uv_cpu_info_t* cpu_infos, int count)
- int uv_interface_addresses(uv_interface_address_t** addresses, int* count)
- void uv_free_interface_addresses(uv_interface_address_t* addresses, int count)
- int uv_ip6_addr(const char * ip, int port, sockaddr_in6* addr)
- int uv_ip4_name(sockaddr_in* src, char* dst, size_t size)

- int uv_ip6_name(sockaddr_in6* src, char* dst, size_t size)
- int uv_inet_ntop(int af, const void* src, char* dst, size_t size)
- int uv_inet_pton(int af, const char * src, void* dst)
- int uv_if_indextoname(unsigned int ifindex, char* buffer, size_t* size)
- int uv_if_indextoiid(unsigned int ifindex, char* buffer, size_t* size)
- int uv_exepath(char* buffer, size_t* size)
- int uv_cwd(char* buffer, size_t* size)
- int uv_chdir(const char * dir)
- int uv_os_homedir(char* buffer, size_t* size)
- int uv_os_tmpdir(char* buffer, size_t* size)
- int uv_os_get_passwd(uv_passwd_t* pwd)
- void uv_os_free_passwd(uv_passwd_t* pwd)
- uint64_t uv_get_total_memory(void)
- uint64_t uv_hrtime(void)
- void uv_print_all_handles(uv_loop_t* loop, FILE* stream)
- void uv_print_active_handles(uv_loop_t* loop, FILE* stream)
- int uv_os_getenv(const char * name, char* buffer, size_t* size)
- int uv_os_setenv(const char * name, const char * value)
- int uv_os_unsetenv(const char * name)
- int uv_os_gethostname(char* buffer, size_t* size)

RINGFREEGLUT FUNCTIONS REFERENCE

80.1 Introduction

In this chapter we have a list of the supported functions by this extension

80.2 Reference

- GLUT_RGB
- GLUT_RGBA
- GLUT_INDEX
- GLUT_SINGLE
- GLUT_DOUBLE
- GLUT_ACCUM
- GLUT_ALPHA
- GLUT_DEPTH
- GLUT_STENCIL
- GLUT_MULTISAMPLE
- GLUT_STEREO
- GLUT_LUMINANCE
- GLUT_KEY_F1
- GLUT_KEY_F2
- GLUT_KEY_F3
- GLUT_KEY_F4
- GLUT_KEY_F5
- GLUT_KEY_F6
- GLUT_KEY_F7
- GLUT_KEY_F8
- GLUT_KEY_F9
- GLUT_KEY_F10

- GLUT_KEY_F11
- GLUT_KEY_F12
- GLUT_KEY_LEFT
- GLUT_KEY_UP
- GLUT_KEY_RIGHT
- GLUT_KEY_DOWN
- GLUT_KEY_PAGE_UP
- GLUT_KEY_PAGE_DOWN
- GLUT_KEY_HOME
- GLUT_KEY_END
- GLUT_KEY_INSERT
- GLUT_LEFT_BUTTON
- GLUT_MIDDLE_BUTTON
- GLUT_RIGHT_BUTTON
- GLUT_DOWN
- GLUT_UP
- GLUT_LEFT
- GLUT_ENTERED
- GLUT_MENU_NOT_IN_USE
- GLUT_MENU_IN_USE
- GLUT_NOT_VISIBLE
- GLUT_VISIBLE
- GLUT_HIDDEN
- GLUT_FULLY_RETAINED
- GLUT_PARTIALLY_RETAINED
- GLUT_FULLY_COVERED
- GLUT_WINDOW_X
- GLUT_WINDOW_Y
- GLUT_WINDOW_WIDTH
- GLUT_WINDOW_HEIGHT
- GLUT_WINDOW_BUFFER_SIZE
- GLUT_WINDOW_STENCIL_SIZE
- GLUT_WINDOW_DEPTH_SIZE
- GLUT_WINDOW_RED_SIZE
- GLUT_WINDOW_GREEN_SIZE
- GLUT_WINDOW_BLUE_SIZE

- GLUT_WINDOW_ALPHA_SIZE
- GLUT_WINDOW_ACCUM_RED_SIZE
- GLUT_WINDOW_ACCUM_GREEN_SIZE
- GLUT_WINDOW_ACCUM_BLUE_SIZE
- GLUT_WINDOW_ACCUM_ALPHA_SIZE
- GLUT_WINDOW_DOUBLEBUFFER
- GLUT_WINDOW_RGBA
- GLUT_WINDOW_PARENT
- GLUT_WINDOW_NUM_CHILDREN
- GLUT_WINDOW_COLORMAP_SIZE
- GLUT_WINDOW_NUM_SAMPLES
- GLUT_WINDOW_STEREO
- GLUT_WINDOW_CURSOR
- GLUT_SCREEN_WIDTH
- GLUT_SCREEN_HEIGHT
- GLUT_SCREEN_WIDTH_MM
- GLUT_SCREEN_HEIGHT_MM
- GLUT_MENU_NUM_ITEMS
- GLUT_DISPLAY_MODE_POSSIBLE
- GLUT_INIT_WINDOW_X
- GLUT_INIT_WINDOW_Y
- GLUT_INIT_WINDOW_WIDTH
- GLUT_INIT_WINDOW_HEIGHT
- GLUT_INIT_DISPLAY_MODE
- GLUT_ELAPSED_TIME
- GLUT_WINDOW_FORMAT_ID
- GLUT_HAS_KEYBOARD
- GLUT_HAS_MOUSE
- GLUT_HAS_SPACEBALL
- GLUT_HAS_DIAL_AND_BUTTON_BOX
- GLUT_HAS_TABLET
- GLUT_NUM_MOUSE_BUTTONS
- GLUT_NUM_SPACEBALL_BUTTONS
- GLUT_NUM_BUTTON_BOX_BUTTONS
- GLUT_NUM_DIALS
- GLUT_NUM_TABLET_BUTTONS

- GLUT_DEVICE_IGNORE_KEY_REPEAT
- GLUT_DEVICE_KEY_REPEAT
- GLUT_HAS_JOYSTICK
- GLUT_OWNS_JOYSTICK
- GLUT_JOYSTICK_BUTTONS
- GLUT_JOYSTICK_AXES
- GLUT_JOYSTICK_POLL_RATE
- GLUT_OVERLAY_POSSIBLE
- GLUT_LAYER_IN_USE
- GLUT_HAS_OVERLAY
- GLUT_TRANSPARENT_INDEX
- GLUT_NORMAL_DAMAGED
- GLUT_OVERLAY_DAMAGED
- GLUT_VIDEO_RESIZE_POSSIBLE
- GLUT_VIDEO_RESIZE_IN_USE
- GLUT_VIDEO_RESIZE_X_DELTA
- GLUT_VIDEO_RESIZE_Y_DELTA
- GLUT_VIDEO_RESIZE_WIDTH_DELTA
- GLUT_VIDEO_RESIZE_HEIGHT_DELTA
- GLUT_VIDEO_RESIZE_X
- GLUT_VIDEO_RESIZE_Y
- GLUT_VIDEO_RESIZE_WIDTH
- GLUT_VIDEO_RESIZE_HEIGHT
- GLUT_NORMAL
- GLUT_OVERLAY
- GLUT_ACTIVE_SHIFT
- GLUT_ACTIVE_CTRL
- GLUT_ACTIVE_ALT
- GLUT_CURSOR_RIGHT_ARROW
- GLUT_CURSOR_LEFT_ARROW
- GLUT_CURSOR_INFO
- GLUT_CURSOR_DESTROY
- GLUT_CURSOR_HELP
- GLUT_CURSOR_CYCLE
- GLUT_CURSOR_SPRAY
- GLUT_CURSOR_WAIT

- GLUT_CURSOR_TEXT
- GLUT_CURSOR_CROSSHAIR
- GLUT_CURSOR_UP_DOWN
- GLUT_CURSOR_LEFT_RIGHT
- GLUT_CURSOR_TOP_SIDE
- GLUT_CURSOR_BOTTOM_SIDE
- GLUT_CURSOR_LEFT_SIDE
- GLUT_CURSOR_RIGHT_SIDE
- GLUT_CURSOR_TOP_LEFT_CORNER
- GLUT_CURSOR_TOP_RIGHT_CORNER
- GLUT_CURSOR_BOTTOM_RIGHT_CORNER
- GLUT_CURSOR_BOTTOM_LEFT_CORNER
- GLUT_CURSOR_INHERIT
- GLUT_CURSOR_NONE
- GLUT_CURSOR_FULL_CROSSHAIR
- GLUT_RED
- GLUT_GREEN
- GLUT_BLUE
- GLUT_KEY_REPEAT_OFF
- GLUT_KEY_REPEAT_ON
- GLUT_KEY_REPEAT_DEFAULT
- GLUT_JOYSTICK_BUTTON_A
- GLUT_JOYSTICK_BUTTON_B
- GLUT_JOYSTICK_BUTTON_C
- GLUT_JOYSTICK_BUTTON_D
- GLUT_GAME_MODE_ACTIVE
- GLUT_GAME_MODE_POSSIBLE
- GLUT_GAME_MODE_WIDTH
- GLUT_GAME_MODE_HEIGHT
- GLUT_GAME_MODE_PIXEL_DEPTH
- GLUT_GAME_MODE_REFRESH_RATE
- GLUT_GAME_MODE_DISPLAY_CHANGED
- GLUT_STROKE_ROMAN
- GLUT_STROKE_MONO_ROMAN
- GLUT_BITMAP_9_BY_15
- GLUT_BITMAP_8_BY_13

- GLUT_BITMAP_TIMES_ROMAN_10
- GLUT_BITMAP_TIMES_ROMAN_24
- GLUT_BITMAP_HELVETICA_10
- GLUT_BITMAP_HELVETICA_12
- GLUT_BITMAP_HELVETICA_18
- void glutInit(void)
- void glutDisplayFunc(const char *)
- void glutReshapeFunc(const char *)
- int glutEventWidth(void)
- int glutEventHeight(void)
- void glutIdleFunc(const char *)
- void glutKeyboardFunc(const char *)
- void glutSpecialFunc(const char *)
- void glutSpecialUpFunc(const char *)
- void glutMouseFunc(const char *)
- void glutMotionFunc(const char *)
- int glutCreateMenu(const char *)
- void glutMenuStatusFunc(const char *)
- int glutEventKey(void)
- int glutEventX(void)
- int glutEventY(void)
- int glutEventButton(void)
- int glutEventState(void)
- int glutEventValue(void)
- int glutEventStatus(void)
- void test_draw(void)
- void glutInitWindowPosition(int x, int y)
- void glutInitWindowSize(int width, int height)
- void glutInitDisplayMode(unsigned displayMode)
- void glutInitDisplayString(const char * displayMode)
- int glutCreateWindow(const char * title)
- int glutCreateSubWindow(int window, int x, int y, int width, int height)
- void glutDestroyWindow(int window)
- void glutSetWindow(int window)
- int glutGetWindow(void)
- void glutSetWindowTitle(const char * title)

- void glutSetIconTitle(const char * title)
- void glutReshapeWindow(int width, int height)
- void glutPositionWindow(int x, int y)
- void glutShowWindow(void)
- void glutHideWindow(void)
- void glutIconifyWindow(void)
- void glutPushWindow(void)
- void glutPopWindow(void)
- void glutFullScreen(void)
- void glutPostWindowRedisplay(int window)
- void glutPostRedisplay(void)
- void glutSwapBuffers(void)
- void glutWarpPointer(int x, int y)
- void glutSetCursor(int cursor)
- void glutEstablishOverlay(void)
- void glutRemoveOverlay(void)
- void glutUseLayer(GLenum layer)
- void glutPostOverlayRedisplay(void)
- void glutPostWindowOverlayRedisplay(int window)
- void glutShowOverlay(void)
- void glutHideOverlay(void)
- void glutDestroyMenu(int menu)
- int glutGetMenu(void)
- void glutSetMenu(int menu)
- void glutAddMenuEntry(const char * label, int value)
- void glutAddSubMenu(const char * label, int subMenu)
- void glutChangeToMenuEntry(int item, const char * label, int value)
- void glutChangeToSubMenu(int item, const char * label, int value)
- void glutRemoveMenuItem(int item)
- void glutAttachMenu(int button)
- void glutDetachMenu(int button)
- int glutGet(GLenum query)
- int glutDeviceGet(GLenum query)
- int glutGetModifiers(void)
- int glutLayerGet(GLenum query)
- void glutBitmapCharacter(void *font, int character)

- int glutBitmapWidth(void *font, int character)
- void glutStrokeCharacter(void *font, int character)
- int glutStrokeWidth(void *font, int character)
- int glutStrokeLength(void *font, char * string)
- GLfloat glutStrokeWidthf(void *font, int character)
- GLfloat glutStrokeLengthf(void *font, char *string)
- int glutBitmapLength(void *font, char * string)
- void glutWireCube(double size)
- void glutSolidCube(double size)
- void glutWireSphere(double radius, GLint slices, GLint stacks)
- void glutSolidSphere(double radius, GLint slices, GLint stacks)
- void glutWireCone(double base, double height, GLint slices, GLint stacks)
- void glutSolidCone(double base, double height, GLint slices, GLint stacks)
- void glutWireTorus(double innerRadius, double outerRadius, GLint sides, GLint rings)
- void glutSolidTorus(double innerRadius, double outerRadius, GLint sides, GLint rings)
- void glutWireDodecahedron(void)
- void glutSolidDodecahedron(void)
- void glutWireOctahedron(void)
- void glutSolidOctahedron(void)
- void glutWireTetrahedron(void)
- void glutSolidTetrahedron(void)
- void glutWireIcosahedron(void)
- void glutSolidIcosahedron(void)
- void glutWireTeapot(double size)
- void glutSolidTeapot(double size)
- void glutGameModeString(const char * string)
- int glutEnterGameMode(void)
- void glutLeaveGameMode(void)
- int glutGameModeGet(GLenum query)
- int glutVideoResizeGet(GLenum query)
- void glutSetupVideoResizing(void)
- void glutStopVideoResizing(void)
- void glutVideoResize(int x, int y, int width, int height)
- void glutVideoPan(int x, int y, int width, int height)
- void glutSetColor(int color, GLfloat red, GLfloat green, GLfloat blue)
- GLfloat glutGetColor(int color, int component)

- void glutCopyColormap(int window)
- void glutIgnoreKeyRepeat(int ignore)
- void glutSetKeyRepeat(int repeatMode)
- void glutForceJoystickFunc(void)
- int glutExtensionSupported(const char * extension)
- void glutReportErrors(void)
- void glutMainLoop(void)
- void glutCloseFunc(const char *)
- GLUT_KEY_NUM_LOCK
- GLUT_KEY_BEGIN
- GLUT_KEY_DELETE
- GLUT_KEY_SHIFT_L
- GLUT_KEY_SHIFT_R
- GLUT_KEY_CTRL_L
- GLUT_KEY_CTRL_R
- GLUT_KEY_ALT_L
- GLUT_KEY_ALT_R
- GLUT_ACTION_EXIT
- GLUT_ACTION_GLUTMAINLOOP_RETURNS
- GLUT_ACTION_CONTINUE_EXECUTION
- GLUT_CREATE_NEW_CONTEXT
- GLUT_USE_CURRENT_CONTEXT
- GLUT_FORCE INDIRECT_CONTEXT
- GLUT_ALLOW_DIRECT_CONTEXT
- GLUT_TRY_DIRECT_CONTEXT
- GLUT_FORCE_DIRECT_CONTEXT
- GLUT_INIT_STATE
- GLUT_ACTION_ON_WINDOW_CLOSE
- GLUT_WINDOW_BORDER_WIDTH
- GLUT_WINDOW_BORDER_HEIGHT
- GLUT_WINDOW_HEADER_HEIGHT
- GLUT_VERSION
- GLUT_RENDERING_CONTEXT
- GLUT_DIRECT_RENDERING
- GLUT_FULL_SCREEN
- GLUT_SKIP_STALE_MOTION_EVENTS

- GLUT_AUX
- GLUT_AUX1
- GLUT_AUX2
- GLUT_AUX3
- GLUT_AUX4
- GLUT_INIT_MAJOR_VERSION
- GLUT_INIT_MINOR_VERSION
- GLUT_INIT_FLAGS
- GLUT_INIT_PROFILE
- GLUT_DEBUG
- GLUT_FORWARD_COMPATIBLE
- GLUT_CORE_PROFILE
- GLUT_COMPATIBILITY_PROFILE
- GLUT_CAPTIONLESS
- GLUT_BORDERLESS
- GLUT_SRGB
- GLUT_HAS_MULTI
- void glutMainLoopEvent(void)
- void glutLeaveMainLoop(void)
- void glutExit(void)
- void glutFullScreenToggle(void)
- void glutLeaveFullScreen(void)
- void glutSetMenuFont(int menuID, void *font)
- void glutSetOption(GLenum option_flag, int value)
- int *glutGetModeValues(GLenum mode, int * size)
- void *glutGetWindowData(void)
- void glutSetWindowData(void *data)
- void *glutGetMenuData(void)
- void glutSetMenuData(void *data)
- int glutBitmapHeight(void* font)
- GLfloat glutStrokeHeight(void* font)
- void glutBitmapString(void* font, char *string)
- void glutStrokeString(void* font, char *string)
- void glutWireRhombicDodecahedron(void)
- void glutSolidRhombicDodecahedron(void)
- void glutWireSierpinskiSponge(int num_levels, double *offset, double scale)

- void glutSolidSierpinskiSponge(int num_levels, double *offset, double scale)
- void glutWireCylinder(double radius, double height, GLint slices, GLint stacks)
- void glutSolidCylinder(double radius, double height, GLint slices, GLint stacks)
- void glutWireTeacup(double size)
- void glutSolidTeacup(double size)
- void glutWireTeaspoon(double size)
- void glutSolidTeaspoon(double size)
- void glutInitContextVersion(int majorVersion, int minorVersion)
- void glutInitContextFlags(int flags)
- void glutInitContextProfile(int profile)
- void glutSetVertexAttribCoord3(GLint attrib)
- void glutSetVertexAttribNormal(GLint attrib)
- void glutSetVertexAttribTexCoord2(GLint attrib)

RINGSTBIMAGE FUNCTIONS REFERENCE

81.1 Introduction

In this chapter we have a list of the supported functions by this extension

Example:

```
# Load the library
load "stbimage.ring"
# Image Information
    width=0 height=0 channels=0
# Ring will Free cData automatically in the end of the program
    cData = stbi_load("ring.jpg",:width,:height,:channels,STBI_rgb)
# Display the output
    ? "Size (bytes): " + len(cData)
    ? "Width : " + width
    ? "Height: " + height
    ? "Channels: " + channels
```

Output:

```
Size (bytes): 557371
Width : 563
Height: 330
Channels: 3
```

81.2 Constants

- STBI_default
- STBI_grey
- STBI_grey_alpha
- STBI_rgb
- STBI_rgb_alpha

81.3 Functions

- `stbi_uc *stbi_load_from_memory(stbi_uc const *buffer, int len,int *x, int *y, int *channels_in_file, int desired_channels)`
- `stbi_uc *stbi_load(char const *filename, int *x, int *y, int *channels_in_file, int desired_channels)`
- `stbi_uc *stbi_load_from_file(FILE *f, int *x, int *y, int *channels_in_file, int desired_channels)`
- `stbi_us *stbi_load_16_from_memory(stbi_uc const *buffer, int len, int *x, int *y, int *channels_in_file, int desired_channels)`
- `stbi_us *stbi_load_16(char const *filename, int *x, int *y, int *channels_in_file, int desired_channels)`
- `stbi_us *stbi_load_from_file_16(FILE *f, int *x, int *y, int *channels_in_file, int desired_channels)`
- `float *stbi_loadf_from_memory(stbi_uc const *buffer, int len, int *x, int *y, int *channels_in_file, int desired_channels)`
- `float *stbi_loadf(char const *filename, int *x, int *y, int *channels_in_file, int desired_channels)`
- `float *stbi_loadf_from_file(FILE *f, int *x, int *y, int *channels_in_file, int desired_channels)`
- `void stbi_hdr_to_ldr_gamma(float gamma)`
- `void stbi_hdr_to_ldr_scale(float scale)`
- `void stbi_ldr_to_hdr_gamma(float gamma)`
- `void stbi_ldr_to_hdr_scale(float scale)`
- `int stbi_is_hdr_from_memory(stbi_uc const *buffer, int len)`
- `int stbi_is_hdr(char const *filename)`
- `int stbi_is_hdr_from_file(FILE *f)`
- `const char *stbi_failure_reason(void)`
- `int stbi_info_from_memory(stbi_uc const *buffer, int len, int *x, int *y, int *comp)`
- `int stbi_is_16_bit_from_memory(stbi_uc const *buffer, int len)`
- `int stbi_info(char const *filename,int *x,int *y,int *comp)`
- `int stbi_info_from_file(FILE *f,int *x,int *y,int *comp)`
- `int stbi_is_16_bit(char const *filename)`
- `int stbi_is_16_bit_from_file(FILE *f)`
- `void stbi_set_unpremultiply_on_load(int flag_true_if_should_unpremultiply)`
- `void stbi_convert_iphone_png_to_rgb(int flag_true_if_should_convert)`
- `void stbi_set_flip_vertically_on_load(int flag_true_if_should_flip)`
- `void stbi_set_flip_vertically_on_load_thread(int flag_true_if_should_flip)`
- `char *stbi_zlib_decode_malloc_guesssize(const char *buffer, int len, int initial_size, int *outlen)`
- `char *stbi_zlib_decode_malloc_guesssize_headerflag(const char *buffer, int len, int initial_size, int *outlen, int parse_header)`
- `char *stbi_zlib_decode_malloc(const char *buffer, int len, int *outlen)`
- `int stbi_zlib_decode_buffer(char *obuffer,int olen, const char *ibuffer, int ilen)`
- `char *stbi_zlib_decode_noheader_malloc(const char *buffer, int len, int *outlen)`

- int stbi_zlib_decode_noheader_buffer(char *obuffer, int olen, const char *ibuffer, int ilen)

RINGOPENGL (OPENGL 3.2) FUNCTIONS REFERENCE

82.1 Introduction

In this chapter we have a list of the supported functions by this extension

82.2 Reference

- GL_ZERO
- GL_FALSE
- GL_LOGIC_OP
- GL_NONE
- GL_TEXTURE_COMPONENTS
- GL_NO_ERROR
- GL_POINTS
- GL_CURRENT_BIT
- GL_TRUE
- GL_ONE
- GL_CLIENT_PIXEL_STORE_BIT
- GL_LINES
- GL_LINE_LOOP
- GL_POINT_BIT
- GL_CLIENT_VERTEX_ARRAY_BIT
- GL_LINE_STRIP
- GL_LINE_BIT
- GL_TRIANGLES
- GL_TRIANGLE_STRIP
- GL_TRIANGLE_FAN
- GL_QUADS
- GL_QUAD_STRIP

- GL_POLYGON_BIT
- GL_POLYGON
- GL_POLYGON_STIPPLE_BIT
- GL_PIXEL_MODE_BIT
- GL_LIGHTING_BIT
- GL_FOG_BIT
- GL_DEPTH_BUFFER_BIT
- GL_ACCUM
- GL_LOAD
- GL_RETURN
- GL_MULT
- GL_ADD
- GL_NEVER
- GL_ACCUM_BUFFER_BIT
- GL_LESS
- GL_EQUAL
- GL_NOTEQUAL
- GL_GREATER
- GL_GEQUAL
- GL_ALWAYS
- GL_SRC_COLOR
- GL_ONE_MINUS_SRC_COLOR
- GL_SRC_ALPHA
- GL_ONE_MINUS_SRC_ALPHA
- GL_DST_ALPHA
- GL_ONE_MINUS_DST_ALPHA
- GL_DST_COLOR
- GL_ONE_MINUS_DST_COLOR
- GL_SRC_ALPHA_SATURATE
- GL_STENCIL_BUFFER_BIT
- GL_FRONT_LEFT
- GL_FRONT_RIGHT
- GL_BACK_LEFT
- GL_BACK_RIGHT
- GL_FRONT

- GL_BACK
- GL_LEFT
- GL_RIGHT
- GL_FRONT_AND_BACK
- GL_AUX0
- GL_AUX1
- GL_AUX2
- GL_AUX3
- GL_INVALID_ENUM
- GL_INVALID_VALUE
- GL_INVALID_OPERATION
- GL_STACK_OVERFLOW
- GL_STACK_UNDERFLOW
- GL_OUT_OF_MEMORY
- GL_2D
- GL_3D
- GL_3D_COLOR
- GL_3D_COLOR_TEXTURE
- GL_4D_COLOR_TEXTURE
- GL_PASS_THROUGH_TOKEN
- GL_POINT_TOKEN
- GL_LINE_TOKEN
- GL_POLYGON_TOKEN
- GL_BITMAP_TOKEN
- GL_DRAW_PIXEL_TOKEN
- GL_COPY_PIXEL_TOKEN
- GL_LINE_RESET_TOKEN
- GL_EXP
- GL_VIEWPORT_BIT
- GL_EXP2
- GL_CW
- GL_CCW
- GL_COEFF
- GL_ORDER
- GL_DOMAIN
- GL_CURRENT_COLOR

- GL_CURRENT_INDEX
- GL_CURRENT_NORMAL
- GL_CURRENT_TEXTURE_COORDS
- GL_CURRENT_RASTER_COLOR
- GL_CURRENT_RASTER_INDEX
- GL_CURRENT_RASTER_TEXTURE_COORDS
- GL_CURRENT_RASTER_POSITION
- GL_CURRENT_RASTER_POSITION_VALID
- GL_CURRENT_RASTER_DISTANCE
- GL_POINT_SMOOTH
- GL_POINT_SIZE
- GL_POINT_SIZE_RANGE
- GL_POINT_SIZE_GRANULARITY
- GL_LINE_SMOOTH
- GL_LINE_WIDTH
- GL_LINE_WIDTH_RANGE
- GL_LINE_WIDTH_GRANULARITY
- GL_LINE_STIPPLE
- GL_LINE_STIPPLE_PATTERN
- GL_LINE_STIPPLE_REPEAT
- GL_LIST_MODE
- GL_MAX_LIST_NESTING
- GL_LIST_BASE
- GL_LIST_INDEX
- GL_POLYGON_MODE
- GL_POLYGON_SMOOTH
- GL_POLYGON_STIPPLE
- GL_EDGE_FLAG
- GL_CULL_FACE
- GL_CULL_FACE_MODE
- GL_FRONT_FACE
- GL_LIGHTING
- GL_LIGHT_MODEL_LOCAL_VIEWER
- GL_LIGHT_MODEL_TWO_SIDE
- GL_LIGHT_MODEL_AMBIENT
- GL_SHADE_MODEL

- GL_COLOR_MATERIAL_FACE
- GL_COLOR_MATERIAL_PARAMETER
- GL_COLOR_MATERIAL
- GL_FOG
- GL_FOG_INDEX
- GL_FOG_DENSITY
- GL_FOG_START
- GL_FOG_END
- GL_FOG_MODE
- GL_FOG_COLOR
- GL_DEPTH_RANGE
- GL_DEPTH_TEST
- GL_DEPTH_WRITEMASK
- GL_DEPTH_CLEAR_VALUE
- GL_DEPTH_FUNC
- GL_ACCUM_CLEAR_VALUE
- GL_STENCIL_TEST
- GL_STENCIL_CLEAR_VALUE
- GL_STENCIL_FUNC
- GL_STENCIL_VALUE_MASK
- GL_STENCIL_FAIL
- GL_STENCIL_PASS_DEPTH_FAIL
- GL_STENCIL_PASS_DEPTH_PASS
- GL_STENCIL_REF
- GL_STENCIL_WRITEMASK
- GL_MATRIX_MODE
- GL_NORMALIZE
- GL_VIEWPORT
- GL_MODELVIEW_STACK_DEPTH
- GL_PROJECTION_STACK_DEPTH
- GL_TEXTURE_STACK_DEPTH
- GL_MODELVIEW_MATRIX
- GL_PROJECTION_MATRIX
- GL_TEXTURE_MATRIX
- GL_ATTRIB_STACK_DEPTH
- GL_CLIENT_ATTRIB_STACK_DEPTH

- GL_ALPHA_TEST
- GL_ALPHA_TEST_FUNC
- GL_ALPHA_TEST_REF
- GL_DITHER
- GL_BLEND_DST
- GL_BLEND_SRC
- GL_BLEND
- GL_LOGIC_OP_MODE
- GL_INDEX_LOGIC_OP
- GL_COLOR_LOGIC_OP
- GL_AUX_BUFFERS
- GL_DRAW_BUFFER
- GL_READ_BUFFER
- GL_SCISSOR_BOX
- GL_SCISSOR_TEST
- GL_INDEX_CLEAR_VALUE
- GL_INDEX_WRITEMASK
- GL_COLOR_CLEAR_VALUE
- GL_COLOR_WRITEMASK
- GL_INDEX_MODE
- GL_RGBA_MODE
- GL_DOUBLEBUFFER
- GL_STEREO
- GL_RENDER_MODE
- GL_PERSPECTIVE_CORRECTION_HINT
- GL_POINT_SMOOTH_HINT
- GL_LINE_SMOOTH_HINT
- GL_POLYGON_SMOOTH_HINT
- GL_FOG_HINT
- GL_TEXTURE_GEN_S
- GL_TEXTURE_GEN_T
- GL_TEXTURE_GEN_R
- GL_TEXTURE_GEN_Q
- GL_PIXEL_MAP_I_TO_I
- GL_PIXEL_MAP_S_TO_S
- GL_PIXEL_MAP_I_TO_R

- GL_PIXEL_MAP_I_TO_G
- GL_PIXEL_MAP_I_TO_B
- GL_PIXEL_MAP_I_TO_A
- GL_PIXEL_MAP_R_TO_R
- GL_PIXEL_MAP_G_TO_G
- GL_PIXEL_MAP_B_TO_B
- GL_PIXEL_MAP_A_TO_A
- GL_PIXEL_MAP_I_TO_I_SIZE
- GL_PIXEL_MAP_S_TO_S_SIZE
- GL_PIXEL_MAP_I_TO_R_SIZE
- GL_PIXEL_MAP_I_TO_G_SIZE
- GL_PIXEL_MAP_I_TO_B_SIZE
- GL_PIXEL_MAP_I_TO_A_SIZE
- GL_PIXEL_MAP_R_TO_R_SIZE
- GL_PIXEL_MAP_G_TO_G_SIZE
- GL_PIXEL_MAP_B_TO_B_SIZE
- GL_PIXEL_MAP_A_TO_A_SIZE
- GL_UNPACK_SWAP_BYTES
- GL_UNPACK_LSB_FIRST
- GL_UNPACK_ROW_LENGTH
- GL_UNPACK_SKIP_ROWS
- GL_UNPACK_SKIP_PIXELS
- GL_UNPACK_ALIGNMENT
- GL_PACK_SWAP_BYTES
- GL_PACK_LSB_FIRST
- GL_PACK_ROW_LENGTH
- GL_PACK_SKIP_ROWS
- GL_PACK_SKIP_PIXELS
- GL_PACK_ALIGNMENT
- GL_MAP_COLOR
- GL_MAP_STENCIL
- GL_INDEX_SHIFT
- GL_INDEX_OFFSET
- GL_RED_SCALE
- GL_RED_BIAS
- GL_ZOOM_X

- GL_ZOOM_Y
- GL_GREEN_SCALE
- GL_GREEN_BIAS
- GL_BLUE_SCALE
- GL_BLUE_BIAS
- GL_ALPHA_SCALE
- GL_ALPHA_BIAS
- GL_DEPTH_SCALE
- GL_DEPTH_BIAS
- GL_MAX_EVAL_ORDER
- GL_MAX_LIGHTS
- GL_MAX_CLIP_PLANES
- GL_MAX_TEXTURE_SIZE
- GL_MAX_PIXEL_MAP_TABLE
- GL_MAX_ATTRIB_STACK_DEPTH
- GL_MAX_MODELVIEW_STACK_DEPTH
- GL_MAX_NAME_STACK_DEPTH
- GL_MAX_PROJECTION_STACK_DEPTH
- GL_MAX_TEXTURE_STACK_DEPTH
- GL_MAX_VIEWPORT_DIMS
- GL_MAX_CLIENT_ATTRIB_STACK_DEPTH
- GL_SUBPIXEL_BITS
- GL_INDEX_BITS
- GL_RED_BITS
- GL_GREEN_BITS
- GL_BLUE_BITS
- GL_ALPHA_BITS
- GL_DEPTH_BITS
- GL_STENCIL_BITS
- GL_ACCUM_RED_BITS
- GL_ACCUM_GREEN_BITS
- GL_ACCUM_BLUE_BITS
- GL_ACCUM_ALPHA_BITS
- GL_NAME_STACK_DEPTH
- GL_AUTO_NORMAL
- GL_MAP1_COLOR_4

- GL_MAP1_INDEX
- GL_MAP1_NORMAL
- GL_MAP1_TEXTURE_COORD_1
- GL_MAP1_TEXTURE_COORD_2
- GL_MAP1_TEXTURE_COORD_3
- GL_MAP1_TEXTURE_COORD_4
- GL_MAP1_VERTEX_3
- GL_MAP1_VERTEX_4
- GL_MAP2_COLOR_4
- GL_MAP2_INDEX
- GL_MAP2_NORMAL
- GL_MAP2_TEXTURE_COORD_1
- GL_MAP2_TEXTURE_COORD_2
- GL_MAP2_TEXTURE_COORD_3
- GL_MAP2_TEXTURE_COORD_4
- GL_MAP2_VERTEX_3
- GL_MAP2_VERTEX_4
- GL_MAP1_GRID_DOMAIN
- GL_MAP1_GRID_SEGMENTS
- GL_MAP2_GRID_DOMAIN
- GL_MAP2_GRID_SEGMENTS
- GL_TEXTURE_1D
- GL_TEXTURE_2D
- GL_FEEDBACK_BUFFER_POINTER
- GL_FEEDBACK_BUFFER_SIZE
- GL_FEEDBACK_BUFFER_TYPE
- GL_SELECTION_BUFFER_POINTER
- GL_SELECTION_BUFFER_SIZE
- GL_TEXTURE_WIDTH
- GL_TRANSFORM_BIT
- GL_TEXTURE_HEIGHT
- GL_TEXTURE_INTERNAL_FORMAT
- GL_TEXTURE_BORDER_COLOR
- GL_TEXTURE_BORDER
- GL_DONT_CARE
- GL_FASTEST

- GL_NICEST
- GL_AMBIENT
- GL_DIFFUSE
- GL_SPECULAR
- GL_POSITION
- GL_SPOT_DIRECTION
- GL_SPOT_EXPONENT
- GL_SPOT_CUTOFF
- GL_CONSTANT_ATTENUATION
- GL_LINEAR_ATTENUATION
- GL_QUADRATIC_ATTENUATION
- GL_COMPILE
- GL_COMPILE_AND_EXECUTE
- GL_BYTE
- GL_UNSIGNED_BYTE
- GL_SHORT
- GL_UNSIGNED_SHORT
- GL_INT
- GL_UNSIGNED_INT
- GL_FLOAT
- GL_2_BYTES
- GL_3_BYTES
- GL_4_BYTES
- GL_DOUBLE
- GL_CLEAR
- GL_AND
- GL_AND_REVERSE
- GL_COPY
- GL_AND_INVERTED
- GL_NOOP
- GL_XOR
- GL_OR
- GL_NOR
- GL_EQUIV
- GL_INVERT
- GL_OR_REVERSE

- GL_COPY_INVERTED
- GL_OR_INVERTED
- GL_NAND
- GL_SET
- GL_EMISSION
- GL_SHININESS
- GL_AMBIENT_AND_DIFFUSE
- GL_COLOR_INDEXES
- GL_MODELVIEW
- GL_PROJECTION
- GL_TEXTURE
- GL_COLOR
- GL_DEPTH
- GL_STENCIL
- GL_COLOR_INDEX
- GL_STENCIL_INDEX
- GL_DEPTH_COMPONENT
- GL_RED
- GL_GREEN
- GL_BLUE
- GL_ALPHA
- GL_RGB
- GL_RGBA
- GL_LUMINANCE
- GL_LUMINANCE_ALPHA
- GL_BITMAP
- GL_POINT
- GL_LINE
- GL_FILL
- GL_RENDER
- GL_FEEDBACK
- GL_SELECT
- GL_FLAT
- GL_SMOOTH
- GL_KEEP
- GL_REPLACE

- GL_INCR
- GL_DECR
- GL_VENDOR
- GL_RENDERER
- GL_VERSION
- GL_EXTENSIONS
- GL_S
- GL_ENABLE_BIT
- GL_T
- GL_R
- GL_Q
- GL_MODULATE
- GL_DECAL
- GL_TEXTURE_ENV_MODE
- GL_TEXTURE_ENV_COLOR
- GL_TEXTURE_ENV
- GL_EYE_LINEAR
- GL_OBJECT_LINEAR
- GL_SPHERE_MAP
- GL_TEXTURE_GEN_MODE
- GL_OBJECT_PLANE
- GL_EYE_PLANE
- GL_NEAREST
- GL_LINEAR
- GL_NEAREST_MIPMAP_NEAREST
- GL_LINEAR_MIPMAP_NEAREST
- GL_NEAREST_MIPMAP_LINEAR
- GL_LINEAR_MIPMAP_LINEAR
- GL_TEXTURE_MAG_FILTER
- GL_TEXTURE_MIN_FILTER
- GL_TEXTURE_WRAP_S
- GL_TEXTURE_WRAP_T
- GL_CLAMP
- GL_REPEAT
- GL_POLYGON_OFFSET_UNITS
- GL_POLYGON_OFFSET_POINT

- GL_POLYGON_OFFSET_LINE
- GL_R3_G3_B2
- GL_V2F
- GL_V3F
- GL_C4UB_V2F
- GL_C4UB_V3F
- GL_C3F_V3F
- GL_N3F_V3F
- GL_C4F_N3F_V3F
- GL_T2F_V3F
- GL_T4F_V4F
- GL_T2F_C4UB_V3F
- GL_T2F_C3F_V3F
- GL_T2F_N3F_V3F
- GL_T2F_C4F_N3F_V3F
- GL_T4F_C4F_N3F_V4F
- GL_CLIP_PLANE0
- GL_CLIP_PLANE1
- GL_CLIP_PLANE2
- GL_CLIP_PLANE3
- GL_CLIP_PLANE4
- GL_CLIP_PLANES5
- GL_LIGHT0
- GL_COLOR_BUFFER_BIT
- GL_LIGHT1
- GL_LIGHT2
- GL_LIGHT3
- GL_LIGHT4
- GL_LIGHT5
- GL_LIGHT6
- GL_LIGHT7
- GL_HINT_BIT
- GL_POLYGON_OFFSET_FILL
- GL_POLYGON_OFFSET_FACTOR
- GL_ALPHA4
- GL_ALPHA8

- GL_ALPHA12
- GL_ALPHA16
- GL_LUMINANCE4
- GL_LUMINANCE8
- GL_LUMINANCE12
- GL_LUMINANCE16
- GL_LUMINANCE4_ALPHA4
- GL_LUMINANCE6_ALPHA2
- GL_LUMINANCE8_ALPHA8
- GL_LUMINANCE12_ALPHA4
- GL_LUMINANCE12_ALPHA12
- GL_LUMINANCE16_ALPHA16
- GL_INTENSITY
- GL_INTENSITY4
- GL_INTENSITY8
- GL_INTENSITY12
- GL_INTENSITY16
- GL_RGB4
- GL_RGB5
- GL_RGB8
- GL_RGB10
- GL_RGB12
- GL_RGB16
- GL_RGBA2
- GL_RGBA4
- GL_RGB5_A1
- GL_RGBA8
- GL_RGB10_A2
- GL_RGBA12
- GL_RGBA16
- GL_TEXTURE_RED_SIZE
- GL_TEXTURE_GREEN_SIZE
- GL_TEXTURE_BLUE_SIZE
- GL_TEXTURE_ALPHA_SIZE
- GL_TEXTURE_LUMINANCE_SIZE
- GL_TEXTURE_INTENSITY_SIZE

- GL_PROXY_TEXTURE_1D
- GL_PROXY_TEXTURE_2D
- GL_TEXTURE_PRIORITY
- GL_TEXTURE_RESIDENT
- GL_TEXTURE_BINDING_1D
- GL_TEXTURE_BINDING_2D
- GL_VERTEX_ARRAY
- GL_NORMAL_ARRAY
- GL_COLOR_ARRAY
- GL_INDEX_ARRAY
- GL_TEXTURE_COORD_ARRAY
- GL_EDGE_FLAG_ARRAY
- GL_VERTEX_ARRAY_SIZE
- GL_VERTEX_ARRAY_TYPE
- GL_VERTEX_ARRAY_STRIDE
- GL_NORMAL_ARRAY_TYPE
- GL_NORMAL_ARRAY_STRIDE
- GL_COLOR_ARRAY_SIZE
- GL_COLOR_ARRAY_TYPE
- GL_COLOR_ARRAY_STRIDE
- GL_INDEX_ARRAY_TYPE
- GL_INDEX_ARRAY_STRIDE
- GL_TEXTURE_COORD_ARRAY_SIZE
- GL_TEXTURE_COORD_ARRAY_TYPE
- GL_TEXTURE_COORD_ARRAY_STRIDE
- GL_EDGE_FLAG_ARRAY_STRIDE
- GL_VERTEX_ARRAY_POINTER
- GL_NORMAL_ARRAY_POINTER
- GL_COLOR_ARRAY_POINTER
- GL_INDEX_ARRAY_POINTER
- GL_TEXTURE_COORD_ARRAY_POINTER
- GL_EDGE_FLAG_ARRAY_POINTER
- GL_COLOR_INDEX1_EXT
- GL_COLOR_INDEX2_EXT
- GL_COLOR_INDEX4_EXT
- GL_COLOR_INDEX8_EXT

- GL_COLOR_INDEX12_EXT
- GL_COLOR_INDEX16_EXT
- GL_EVAL_BIT
- GL_LIST_BIT
- GL_TEXTURE_BIT
- GL_SCISSOR_BIT
- GL_ALL_ATTRIB_BITS
- GL_CLIENT_ALL_ATTRIB_BITS
- GL_SMOOTH_POINT_SIZE_RANGE
- GL_SMOOTH_POINT_SIZE_GRANULARITY
- GL_SMOOTH_LINE_WIDTH_RANGE
- GL_SMOOTH_LINE_WIDTH_GRANULARITY
- GL_UNSIGNED_BYTE_3_3_2
- GL_UNSIGNED_SHORT_4_4_4_4
- GL_UNSIGNED_SHORT_5_5_5_1
- GL_UNSIGNED_INT_8_8_8_8
- GL_UNSIGNED_INT_10_10_10_2
- GL_RESCALE_NORMAL
- GL_TEXTURE_BINDING_3D
- GL_PACK_SKIP_IMAGES
- GL_PACK_IMAGE_HEIGHT
- GL_UNPACK_SKIP_IMAGES
- GL_UNPACK_IMAGE_HEIGHT
- GL_TEXTURE_3D
- GL_PROXY_TEXTURE_3D
- GL_TEXTURE_DEPTH
- GL_TEXTURE_WRAP_R
- GL_MAX_3D_TEXTURE_SIZE
- GL_BGR
- GL_BGRA
- GL_MAX_ELEMENTS_VERTICES
- GL_MAX_ELEMENTS_INDICES
- GL_CLAMP_TO_EDGE
- GL_TEXTURE_MIN_LOD
- GL_TEXTURE_MAX_LOD
- GL_TEXTURE_BASE_LEVEL

- GL_TEXTURE_MAX_LEVEL
- GL_LIGHT_MODEL_COLOR_CONTROL
- GL_SINGLE_COLOR
- GL_SEPARATE_SPECULAR_COLOR
- GL_UNSIGNED_BYTE_2_3_3_REV
- GL_UNSIGNED_SHORT_5_6_5
- GL_UNSIGNED_SHORT_5_6_5_REV
- GL_UNSIGNED_SHORT_4_4_4_4_REV
- GL_UNSIGNED_SHORT_1_5_5_5_REV
- GL_UNSIGNED_INT_8_8_8_8_REV
- GL_ALIASED_POINT_SIZE_RANGE
- GL_ALIASED_LINE_WIDTH_RANGE
- GL_MULTISAMPLE
- GL_SAMPLE_ALPHA_TO_COVERAGE
- GL_SAMPLE_ALPHA_TO_ONE
- GL_SAMPLE_COVERAGE
- GL_SAMPLE_BUFFERS
- GL_SAMPLES
- GL_SAMPLE_COVERAGE_VALUE
- GL_SAMPLE_COVERAGE_INVERT
- GL_CLAMP_TO_BORDER
- GL_TEXTURE0
- GL_TEXTURE1
- GL_TEXTURE2
- GL_TEXTURE3
- GL_TEXTURE4
- GL_TEXTURE5
- GL_TEXTURE6
- GL_TEXTURE7
- GL_TEXTURE8
- GL_TEXTURE9
- GL_TEXTURE10
- GL_TEXTURE11
- GL_TEXTURE12
- GL_TEXTURE13
- GL_TEXTURE14

- GL_TEXTURE15
- GL_TEXTURE16
- GL_TEXTURE17
- GL_TEXTURE18
- GL_TEXTURE19
- GL_TEXTURE20
- GL_TEXTURE21
- GL_TEXTURE22
- GL_TEXTURE23
- GL_TEXTURE24
- GL_TEXTURE25
- GL_TEXTURE26
- GL_TEXTURE27
- GL_TEXTURE28
- GL_TEXTURE29
- GL_TEXTURE30
- GL_TEXTURE31
- GL_ACTIVE_TEXTURE
- GL_CLIENT_ACTIVE_TEXTURE
- GL_MAX_TEXTURE_UNITS
- GL_TRANSPOSE_MODELVIEW_MATRIX
- GL_TRANSPOSE_PROJECTION_MATRIX
- GL_TRANSPOSE_TEXTURE_MATRIX
- GL_TRANSPOSE_COLOR_MATRIX
- GL_SUBTRACT
- GL_COMPRESSED_ALPHA
- GL_COMPRESSED_LUMINANCE
- GL_COMPRESSED_LUMINANCE_ALPHA
- GL_COMPRESSED_INTENSITY
- GL_COMPRESSED_RGB
- GL_COMPRESSED_RGBA
- GL_TEXTURE_COMPRESSION_HINT
- GL_NORMAL_MAP
- GL_REFLECTION_MAP
- GL_TEXTURE_CUBE_MAP
- GL_TEXTURE_BINDING_CUBE_MAP

- GL_TEXTURE_CUBE_MAP_POSITIVE_X
- GL_TEXTURE_CUBE_MAP_NEGATIVE_X
- GL_TEXTURE_CUBE_MAP_POSITIVE_Y
- GL_TEXTURE_CUBE_MAP_NEGATIVE_Y
- GL_TEXTURE_CUBE_MAP_POSITIVE_Z
- GL_TEXTURE_CUBE_MAP_NEGATIVE_Z
- GL_PROXY_TEXTURE_CUBE_MAP
- GL_MAX_CUBE_MAP_TEXTURE_SIZE
- GL_COMBINE
- GL_COMBINE_RGB
- GL_COMBINE_ALPHA
- GL_RGB_SCALE
- GL_ADD_SIGNED
- GL_INTERPOLATE
- GL_CONSTANT
- GL_PRIMARY_COLOR
- GL_PREVIOUS
- GL_SOURCE0_RGB
- GL_SOURCE1_RGB
- GL_SOURCE2_RGB
- GL_SOURCE0_ALPHA
- GL_SOURCE1_ALPHA
- GL_SOURCE2_ALPHA
- GL_OPERAND0_RGB
- GL_OPERAND1_RGB
- GL_OPERAND2_RGB
- GL_OPERAND0_ALPHA
- GL_OPERAND1_ALPHA
- GL_OPERAND2_ALPHA
- GL_TEXTURE_COMPRESSED_IMAGE_SIZE
- GL_TEXTURE_COMPRESSED
- GL_NUM_COMPRESSED_TEXTURE_FORMATS
- GL_COMPRESSED_TEXTURE_FORMATS
- GL_DOT3_RGB
- GL_DOT3_RGBA
- GL_MULTISAMPLE_BIT

- GL_BLEND_DST_RGB
- GL_BLEND_SRC_RGB
- GL_BLEND_DST_ALPHA
- GL_BLEND_SRC_ALPHA
- GL_POINT_SIZE_MIN
- GL_POINT_SIZE_MAX
- GL_POINT_FADE_THRESHOLD_SIZE
- GL_POINT_DISTANCE_ATTENUATION
- GL_GENERATE_MIPMAP
- GL_GENERATE_MIPMAP_HINT
- GL_DEPTH_COMPONENT16
- GL_DEPTH_COMPONENT24
- GL_DEPTH_COMPONENT32
- GL_MIRRORED_REPEAT
- GL_FOG_COORDINATE_SOURCE
- GL_FOG_COORDINATE
- GL_FRAGMENT_DEPTH
- GL_CURRENT_FOG_COORDINATE
- GL_FOG_COORDINATE_ARRAY_TYPE
- GL_FOG_COORDINATE_ARRAY_STRIDE
- GL_FOG_COORDINATE_ARRAY_POINTER
- GL_FOG_COORDINATE_ARRAY
- GL_COLOR_SUM
- GL_CURRENT_SECONDARY_COLOR
- GL_SECONDARY_COLOR_ARRAY_SIZE
- GL_SECONDARY_COLOR_ARRAY_TYPE
- GL_SECONDARY_COLOR_ARRAY_STRIDE
- GL_SECONDARY_COLOR_ARRAY_POINTER
- GL_SECONDARY_COLOR_ARRAY
- GL_MAX_TEXTURE_LOD_BIAS
- GL_TEXTURE_FILTER_CONTROL
- GL_TEXTURE_LOD_BIAS
- GL_INCR_WRAP
- GL_DECR_WRAP
- GL_TEXTURE_DEPTH_SIZE
- GL_DEPTH_TEXTURE_MODE

- GL_TEXTURE_COMPARE_MODE
- GL_TEXTURE_COMPARE_FUNC
- GL_COMPARE_R_TO_TEXTURE
- GL_CURRENT_FOG_COORD
- GL_FOG_COORD
- GL_FOG_COORD_ARRAY
- GL_FOG_COORD_ARRAY_BUFFER_BINDING
- GL_FOG_COORD_ARRAY_POINTER
- GL_FOG_COORD_ARRAY_STRIDE
- GL_FOG_COORD_ARRAY_TYPE
- GL_FOG_COORD_SRC
- GL_SRC0_ALPHA
- GL_SRC0_RGB
- GL_SRC1_ALPHA
- GL_SRC1_RGB
- GL_SRC2_ALPHA
- GL_SRC2_RGB
- GL_BUFFER_SIZE
- GL_BUFFER_USAGE
- GL_QUERY_COUNTER_BITS
- GL_CURRENT_QUERY
- GL_QUERY_RESULT
- GL_QUERY_RESULT_AVAILABLE
- GL_ARRAY_BUFFER
- GL_ELEMENT_ARRAY_BUFFER
- GL_ARRAY_BUFFER_BINDING
- GL_ELEMENT_ARRAY_BUFFER_BINDING
- GL_VERTEX_ARRAY_BUFFER_BINDING
- GL_NORMAL_ARRAY_BUFFER_BINDING
- GL_COLOR_ARRAY_BUFFER_BINDING
- GL_INDEX_ARRAY_BUFFER_BINDING
- GL_TEXTURE_COORD_ARRAY_BUFFER_BINDING
- GL_EDGE_FLAG_ARRAY_BUFFER_BINDING
- GL_SECONDARY_COLOR_ARRAY_BUFFER_BINDING
- GL_FOG_COORDINATE_ARRAY_BUFFER_BINDING
- GL_WEIGHT_ARRAY_BUFFER_BINDING

- GL_VERTEX_ATTRIB_ARRAY_BUFFER_BINDING
- GL_READ_ONLY
- GL_WRITE_ONLY
- GL_READ_WRITE
- GL_BUFFER_ACCESS
- GL_BUFFER_MAPPED
- GL_BUFFER_MAP_POINTER
- GL_STREAM_DRAW
- GL_STREAM_READ
- GL_STREAM_COPY
- GL_STATIC_DRAW
- GL_STATIC_READ
- GL_STATIC_COPY
- GL_DYNAMIC_DRAW
- GL_DYNAMIC_READ
- GL_DYNAMIC_COPY
- GL_SAMPLES_PASSED
- GL_BLEND_EQUATION_RGB
- GL_VERTEX_ATTRIB_ARRAY_ENABLED
- GL_VERTEX_ATTRIB_ARRAY_SIZE
- GL_VERTEX_ATTRIB_ARRAY_STRIDE
- GL_VERTEX_ATTRIB_ARRAY_TYPE
- GL_CURRENT_VERTEX_ATTRIB
- GL_VERTEX_PROGRAM_POINT_SIZE
- GL_VERTEX_PROGRAM_TWO_SIDE
- GL_VERTEX_ATTRIB_ARRAY_POINTER
- GL_STENCIL_BACK_FUNC
- GL_STENCIL_BACK_FAIL
- GL_STENCIL_BACK_PASS_DEPTH_FAIL
- GL_STENCIL_BACK_PASS_DEPTH_PASS
- GL_MAX_DRAW_BUFFERS
- GL_DRAW_BUFFER0
- GL_DRAW_BUFFER1
- GL_DRAW_BUFFER2
- GL_DRAW_BUFFER3
- GL_DRAW_BUFFER4

- GL_DRAW_BUFFER5
- GL_DRAW_BUFFER6
- GL_DRAW_BUFFER7
- GL_DRAW_BUFFER8
- GL_DRAW_BUFFER9
- GL_DRAW_BUFFER10
- GL_DRAW_BUFFER11
- GL_DRAW_BUFFER12
- GL_DRAW_BUFFER13
- GL_DRAW_BUFFER14
- GL_DRAW_BUFFER15
- GL_BLEND_EQUATION_ALPHA
- GL_POINT_SPRITE
- GL_COORD_REPLACE
- GL_MAX_VERTEX_ATTRIBS
- GL_VERTEX_ATTRIB_ARRAY_NORMALIZED
- GL_MAX_TEXTURE_COORDS
- GL_MAX_TEXTURE_IMAGE_UNITS
- GL_FRAGMENT_SHADER
- GL_VERTEX_SHADER
- GL_MAX_FRAGMENT_UNIFORM_COMPONENTS
- GL_MAX_VERTEX_UNIFORM_COMPONENTS
- GL_MAX_VARYING_FLOATS
- GL_MAX_VERTEX_TEXTURE_IMAGE_UNITS
- GL_MAX_COMBINED_TEXTURE_IMAGE_UNITS
- GL_SHADER_TYPE
- GL_FLOAT_VEC2
- GL_FLOAT_VEC3
- GL_FLOAT_VEC4
- GL_INT_VEC2
- GL_INT_VEC3
- GL_INT_VEC4
- GL_BOOL
- GL_BOOL_VEC2
- GL_BOOL_VEC3
- GL_BOOL_VEC4

- GL_FLOAT_MAT2
- GL_FLOAT_MAT3
- GL_FLOAT_MAT4
- GL_SAMPLER_1D
- GL_SAMPLER_2D
- GL_SAMPLER_3D
- GL_SAMPLER_CUBE
- GL_SAMPLER_1D_SHADOW
- GL_SAMPLER_2D_SHADOW
- GL_DELETE_STATUS
- GL_COMPILE_STATUS
- GL_LINK_STATUS
- GL_VALIDATE_STATUS
- GL_INFO_LOG_LENGTH
- GL_ATTACHED_SHADERS
- GL_ACTIVE_UNIFORMS
- GL_ACTIVE_UNIFORM_MAX_LENGTH
- GL_SHADER_SOURCE_LENGTH
- GL_ACTIVE_ATTRIBUTES
- GL_ACTIVE_ATTRIBUTE_MAX_LENGTH
- GL_FRAGMENT_SHADER_DERIVATIVE_HINT
- GL_SHADING_LANGUAGE_VERSION
- GL_CURRENT_PROGRAM
- GL_POINT_SPRITE_COORD_ORIGIN
- GL_LOWER_LEFT
- GL_UPPER_LEFT
- GL_STENCIL_BACK_REF
- GL_STENCIL_BACK_VALUE_MASK
- GL_STENCIL_BACK_WRITEMASK
- GL_CURRENT_RASTER_SECONDARY_COLOR
- GL_PIXEL_PACK_BUFFER
- GL_PIXEL_UNPACK_BUFFER
- GL_PIXEL_PACK_BUFFER_BINDING
- GL_PIXEL_UNPACK_BUFFER_BINDING
- GL_FLOAT_MAT2x3
- GL_FLOAT_MAT2x4

- GL_FLOAT_MAT3x2
- GL_FLOAT_MAT3x4
- GL_FLOAT_MAT4x2
- GL_FLOAT_MAT4x3
- GL_SRGB
- GL_SRGB8
- GL_SRGB_ALPHA
- GL_SRGB8_ALPHA8
- GL_SLUMINANCE_ALPHA
- GL_SLUMINANCE8_ALPHA8
- GL_SLUMINANCE
- GL_SLUMINANCE8
- GL_COMPRESSED_SRGB
- GL_COMPRESSED_SRGB_ALPHA
- GL_COMPRESSED_SLUMINANCE
- GL_COMPRESSED_SLUMINANCE_ALPHA
- GL_CLIP_DISTANCE0
- GL_CLIP_DISTANCE1
- GL_CLIP_DISTANCE2
- GL_CLIP_DISTANCE3
- GL_CLIP_DISTANCE4
- GL_CLIP_DISTANCE5
- GL_COMPARE_REF_TO_TEXTURE
- GL_MAX_CLIP_DISTANCES
- GL_MAX_VARYING_COMPONENTS
- GL_CONTEXT_FLAG_FORWARD_COMPATIBLE_BIT
- GL_MAJOR_VERSION
- GL_MINOR_VERSION
- GL_NUM_EXTENSIONS
- GL_CONTEXT_FLAGS
- GL_DEPTH_BUFFER
- GL_STENCIL_BUFFER
- GL_RGBA32F
- GL_RGB32F
- GL_RGBA16F
- GL_RGB16F

- GL_VERTEX_ATTRIB_ARRAY_INTEGER
- GL_MAX_ARRAY_TEXTURE_LAYERS
- GL_MIN_PROGRAM_TEXEL_OFFSET
- GL_MAX_PROGRAM_TEXEL_OFFSET
- GL_CLAMP_VERTEX_COLOR
- GL_CLAMP_FRAGMENT_COLOR
- GL_CLAMP_READ_COLOR
- GL_FIXED_ONLY
- GL_TEXTURE_RED_TYPE
- GL_TEXTURE_GREEN_TYPE
- GL_TEXTURE_BLUE_TYPE
- GL_TEXTURE_ALPHA_TYPE
- GL_TEXTURE_LUMINANCE_TYPE
- GL_TEXTURE_INTENSITY_TYPE
- GL_TEXTURE_DEPTH_TYPE
- GL_TEXTURE_1D_ARRAY
- GL_PROXY_TEXTURE_1D_ARRAY
- GL_TEXTURE_2D_ARRAY
- GL_PROXY_TEXTURE_2D_ARRAY
- GL_TEXTURE_BINDING_1D_ARRAY
- GL_TEXTURE_BINDING_2D_ARRAY
- GL_R11F_G11F_B10F
- GL_UNSIGNED_INT_10F_11F_11F_REV
- GL_RGB9_E5
- GL_UNSIGNED_INT_5_9_9_9_REV
- GL_TEXTURE_SHARED_SIZE
- GL_TRANSFORM_FEEDBACK_VARYING_MAX_LENGTH
- GL_TRANSFORM_FEEDBACK_BUFFER_MODE
- GL_MAX_TRANSFORM_FEEDBACK_SEPARATE_COMPONENTS
- GL_TRANSFORM_FEEDBACK_VARYINGS
- GL_TRANSFORM_FEEDBACK_BUFFER_START
- GL_TRANSFORM_FEEDBACK_BUFFER_SIZE
- GL_PRIMITIVES_GENERATED
- GL_TRANSFORM_FEEDBACK_PRIMITIVES_WRITTEN
- GL_RASTERIZER_DISCARD
- GL_MAX_TRANSFORM_FEEDBACK_INTERLEAVED_COMPONENTS

- GL_MAX_TRANSFORM_FEEDBACK_SEPARATE_ATTRIBS
- GL_INTERLEAVED_ATTRIBS
- GL_SEPARATE_ATTRIBS
- GL_TRANSFORM_FEEDBACK_BUFFER
- GL_TRANSFORM_FEEDBACK_BUFFER_BINDING
- GL_RGBA32UI
- GL_RGB32UI
- GL_RGBA16UI
- GL_RGB16UI
- GL_RGBA8UI
- GL_RGB8UI
- GL_RGBA32I
- GL_RGB32I
- GL_RGBA16I
- GL_RGB16I
- GL_RGBA8I
- GL_RGB8I
- GL_RED_INTEGER
- GL_GREEN_INTEGER
- GL_BLUE_INTEGER
- GL_ALPHA_INTEGER
- GL_RGB_INTEGER
- GL_RGBA_INTEGER
- GL_BGR_INTEGER
- GL_BGRA_INTEGER
- GL_SAMPLER_1D_ARRAY
- GL_SAMPLER_2D_ARRAY
- GL_SAMPLER_1D_ARRAY_SHADOW
- GL_SAMPLER_2D_ARRAY_SHADOW
- GL_SAMPLER_CUBE_SHADOW
- GL_UNSIGNED_INT_VEC2
- GL_UNSIGNED_INT_VEC3
- GL_UNSIGNED_INT_VEC4
- GL_INT_SAMPLER_1D
- GL_INT_SAMPLER_2D
- GL_INT_SAMPLER_3D

- GL_INT_SAMPLER_CUBE
- GL_INT_SAMPLER_1D_ARRAY
- GL_INT_SAMPLER_2D_ARRAY
- GL_UNSIGNED_INT_SAMPLER_1D
- GL_UNSIGNED_INT_SAMPLER_2D
- GL_UNSIGNED_INT_SAMPLER_3D
- GL_UNSIGNED_INT_SAMPLER_CUBE
- GL_UNSIGNED_INT_SAMPLER_1D_ARRAY
- GL_UNSIGNED_INT_SAMPLER_2D_ARRAY
- GL_QUERY_WAIT
- GL_QUERY_NO_WAIT
- GL_QUERY_BY_REGION_WAIT
- GL_QUERY_BY_REGION_NO_WAIT
- GL_TEXTURE_RECTANGLE
- GL_TEXTURE_BINDING_RECTANGLE
- GL_PROXY_TEXTURE_RECTANGLE
- GL_MAX_RECTANGLE_TEXTURE_SIZE
- GL_SAMPLER_2D_RECT
- GL_SAMPLER_2D_RECT_SHADOW
- GL_TEXTURE_BUFFER
- GL_MAX_TEXTURE_BUFFER_SIZE
- GL_TEXTURE_BINDING_BUFFER
- GL_TEXTURE_BUFFER_DATA_STORE_BINDING
- GL_TEXTURE_BUFFER_FORMAT
- GL_SAMPLER_BUFFER
- GL_INT_SAMPLER_2D_RECT
- GL_INT_SAMPLER_BUFFER
- GL_UNSIGNED_INT_SAMPLER_2D_RECT
- GL_UNSIGNED_INT_SAMPLER_BUFFER
- GL_RED_SNORM
- GL_RG_SNORM
- GL_RGB_SNORM
- GL_RGBA_SNORM
- GL_R8_SNORM
- GL_RG8_SNORM
- GL_RGB8_SNORM

- GL_RGBA8_SNORM
- GL_R16_SNORM
- GL_RG16_SNORM
- GL_RGB16_SNORM
- GL_RGBA16_SNORM
- GL_SIGNED_NORMALIZED
- GL_PRIMITIVE_RESTART
- GL_PRIMITIVE_RESTART_INDEX
- GL_BUFFER_ACCESS_FLAGS
- GL_BUFFER_MAP_LENGTH
- GL_BUFFER_MAP_OFFSET
- GL_CONTEXT_CORE_PROFILE_BIT
- GL_CONTEXT_COMPATIBILITY_PROFILE_BIT
- GL_LINES_ADJACENCY
- GL_LINE_STRIP_ADJACENCY
- GL_TRIANGLES_ADJACENCY
- GL_TRIANGLE_STRIP_ADJACENCY
- GL_PROGRAM_POINT_SIZE
- GL_GEOMETRY_VERTICES_OUT
- GL_GEOMETRY_INPUT_TYPE
- GL_GEOMETRY_OUTPUT_TYPE
- GL_MAX_GEOMETRY_TEXTURE_IMAGE_UNITS
- GL_FRAMEBUFFER_ATTACHMENT_LAYERED
- GL_FRAMEBUFFER_INCOMPLETE_LAYER_TARGETS
- GL_GEOMETRY_SHADER
- GL_MAX_GEOMETRY_UNIFORM_COMPONENTS
- GL_MAX_GEOMETRY_OUTPUT_VERTICES
- GL_MAX_GEOMETRY_TOTAL_OUTPUT_COMPONENTS
- GL_MAX_VERTEX_OUTPUT_COMPONENTS
- GL_MAX_GEOMETRY_INPUT_COMPONENTS
- GL_MAX_GEOMETRY_OUTPUT_COMPONENTS
- GL_MAX_FRAGMENT_INPUT_COMPONENTS
- GL_CONTEXT_PROFILE_MASK
- void glAccum(GLenum op,GLfloat value)
- void glActiveTexture(GLenum texture)
- void glAlphaFunc(GLenum func,GLclampf ref)

- `GLboolean glAreTexturesResident(GLsizei n,const GLuint * textures,GLboolean * residences)`
- `void glArrayElement(GLint i)`
- `void glAttachShader(GLuint program,GLuint shader)`
- `void glBegin(GLenum mode)`
- `void glBeginQuery(GLenum target,GLuint id)`
- `void glBindAttribLocation(GLuint program,GLuint index,const GLchar *name)`
- `void glBindBuffer(GLenum target,GLuint buffer)`
- `void glBindTexture(GLenum target,GLuint texture)`
- `void glBitmap(GLsizei width,GLsizei height,GLfloat xorig,GLfloat yorig,GLfloat xmove,GLfloat ymove,const GLubyte * bitmap)`
- `void glBlendColor(GLclampf red,GLclampf green,GLclampf blue,GLclampf alpha)`
- `void glBlendEquation(GLenum mode)`
- `void glBlendEquationSeparate(GLenum modeRGB,GLenum modeAlpha)`
- `void glBlendFunc(GLenum sfactor,GLenum dfactor)`
- `void glBlendFuncSeparate(GLenum srcRGB,GLenum dstRGB,GLenum srcAlpha,GLenum dstAlpha)`
- `void glBufferData(GLenum target,GLsizeiptr size,const GLvoid * data,GLenum usage)`
- `void glBufferSubData(GLenum target,GLintptr offset,GLsizeiptr size,const GLvoid * data)`
- `void glCallList(GLuint list)`
- `void glCallLists(GLsizei n,GLenum type,const GLvoid * lists)`
- `void glClear(GLbitfield mask)`
- `void glClearAccum(GLfloat red,GLfloat green,GLfloat blue,GLfloat alpha)`
- `void glClearColor(GLclampf red,GLclampf green,GLclampf blue,GLclampf alpha)`
- `void glClearDepth(GLclampd depth)`
- `void glClearIndex(GLfloat c)`
- `void glClearStencil(GLint s)`
- `void glClientActiveTexture(GLenum texture)`
- `void glClipPlane(GLenum plane,const GLdouble * equation)`
- `void glColor3b(GLbyte red,GLbyte green,GLbyte blue)`
- `void glColor3s(GLshort red,GLshort green,GLshort blue)`
- `void glColor3i(GLint red,GLint green,GLint blue)`
- `void glColor3f(GLfloat red,GLfloat green,GLfloat blue)`
- `void glColor3d(GLdouble red,GLdouble green,GLdouble blue)`
- `void glColor3ub(GLubyte red,GLubyte green,GLubyte blue)`
- `void glColor3us(GLushort red,GLushort green,GLushort blue)`
- `void glColor3ui(GLuint red,GLuint green,GLuint blue)`
- `void glColor4b(GLbyte red,GLbyte green,GLbyte blue,GLbyte alpha)`

- void glColor4s(GLshort red,GLshort green,GLshort blue,GLshort alpha)
- void glColor4i(GLint red,GLint green,GLint blue,GLint alpha)
- void glColor4f(GLfloat red,GLfloat green,GLfloat blue,GLfloat alpha)
- void glColor4d(GLdouble red,GLdouble green,GLdouble blue,GLdouble alpha)
- void glColor4ub(GLubyte red,GLubyte green,GLubyte blue,GLubyte alpha)
- void glColor4us(GLushort red,GLushort green,GLushort blue,GLushort alpha)
- void glColor4ui(GLuint red,GLuint green,GLuint blue,GLuint alpha)
- void glColor3bv(const GLbyte * v)
- void glColor3sv(const GLshort * v)
- void glColor3iv(const GLint * v)
- void glColor3fv(const GLfloat * v)
- void glColor3dv(const GLdouble * v)
- void glColor3ubv(const GLubyte * v)
- void glColor3usv(const GLushort * v)
- void glColor3uiv(const GLuint * v)
- void glColor4bv(const GLbyte * v)
- void glColor4sv(const GLshort * v)
- void glColor4iv(const GLint * v)
- void glColor4fv(const GLfloat * v)
- void glColor4dv(const GLdouble * v)
- void glColor4ubv(const GLubyte * v)
- void glColor4usv(const GLushort * v)
- void glColor4uiv(const GLuint * v)
- void glColorMask(GLboolean red,GLboolean green,GLboolean blue,GLboolean alpha)
- void glColorMaterial(GLenum face,GLenum mode)
- void glColorPointer(GLint size,GLenum type,GLsizei stride,const GLvoid * pointer)
- void glColorSubTable(GLenum target,GLsizei start,GLsizei count,GLenum format,GLenum type,const GLvoid * data)
- void glColorTable(GLenum target,GLenum internalformat,GLsizei width,GLenum format,GLenum type,const GLvoid * data)
- void glColorTableParameterfv(GLenum target,GLenum pname,const GLfloat * params)
- void glColorTableParameteriv(GLenum target,GLenum pname,const GLint * params)
- void glCompileShader(GLuint shader)
- void glCompressedTexImage1D(GLenum target,GLint level,GLenum internalformat,GLsizei width,GLint border,GLsizei imageSize,const GLvoid * data)
- void glCompressedTexImage2D(GLenum target,GLint level,GLenum internalformat,GLsizei width,GLsizei height,GLint border,GLsizei imageSize,const GLvoid * data)

- void glCompressedTexImage3D(GLenum target,GLint level,GLenum internalformat,GLsizei width,GLsizei height,GLsizei depth,GLint border,GLsizei imageSize,const GLvoid * data)
- void glCompressedTexSubImage1D(GLenum target,GLint level,GLint xoffset,GLsizei width,GLenum format,GLsizei imageSize,const GLvoid * data)
- void glCompressedTexSubImage2D(GLenum target,GLint level,GLint xoffset,GLint yoffset,GLsizei width,GLsizei height,GLenum format,GLsizei imageSize,const GLvoid * data)
- void glCompressedTexSubImage3D(GLenum target,GLint level,GLint xoffset,GLint yoffset,GLint zoffset,GLsizei width,GLsizei height,GLsizei depth,GLenum format,GLsizei imageSize,const GLvoid * data)
- void glConvolutionFilter1D(GLenum target,GLenum internalformat,GLsizei width,GLenum format,GLenum type,const GLvoid * data)
- void glConvolutionFilter2D(GLenum target,GLenum internalformat,GLsizei width,GLsizei height,GLenum format,GLenum type,const GLvoid * data)
- void glConvolutionParameterf(GLenum target,GLenum pname,GLfloat params)
- void glConvolutionParameteri(GLenum target,GLenum pname,GLint params)
- void glConvolutionParameterfv(GLenum target,GLenum pname,const GLfloat * params)
- void glConvolutionParameteriv(GLenum target,GLenum pname,const GLint * params)
- void glCopyColorSubTable(GLenum target,GLsizei start,GLint x,GLint y,GLsizei width)
- void glCopyColorTable(GLenum target,GLenum internalformat,GLint x,GLint y,GLsizei width)
- void glCopyConvolutionFilter1D(GLenum target,GLenum internalformat,GLint x,GLint y,GLsizei width)
- void glCopyConvolutionFilter2D(GLenum target,GLenum internalformat,GLint x,GLint y,GLsizei width,GLsizei height)
- void glCopyPixels(GLint x,GLint y,GLsizei width,GLsizei height,GLenum type)
- void glCopyTexImage1D(GLenum target,GLint level,GLenum internalformat,GLint x,GLint y,GLsizei width,GLint border)
- void glCopyTexImage2D(GLenum target,GLint level,GLenum internalformat,GLint x,GLint y,GLsizei width,GLsizei height,GLint border)
- void glCopyTexSubImage1D(GLenum target,GLint level,GLint xoffset,GLint x,GLint y,GLsizei width)
- void glCopyTexSubImage2D(GLenum target,GLint level,GLint xoffset,GLint yoffset,GLint x,GLint y,GLsizei width,GLsizei height)
- void glCopyTexSubImage3D(GLenum target,GLint level,GLint xoffset,GLint yoffset,GLint zoffset,GLint x,GLint y,GLsizei width,GLsizei height)
- GLuint glCreateProgram(void)
- GLuint glCreateShader(GLenum shaderType)
- void glCullFace(GLenum mode)
- void glDeleteBuffers(GLsizei n,const GLuint * buffers)
- void glDeleteLists(GLuint list,GLsizei range)
- void glDeleteProgram(GLuint program)
- void glDeleteQueries(GLsizei n,const GLuint * ids)
- void glDeleteShader(GLuint shader)
- void glDeleteTextures(GLsizei n,const GLuint * textures)

- void glDepthFunc(GLenum func)
- void glDepthMask(GLboolean flag)
- void glDepthRange(GLclampd nearVal,GLclampd farVal)
- void glDetachShader(GLuint program,GLuint shader)
- void glEnable(GLenum cap)
- void glEnableClientState(GLenum cap)
- void glEnableVertexAttribArray(GLuint index)
- void glDisableVertexAttribArray(GLuint index)
- void glDrawArrays(GLenum mode,GLint first,GLsizei count)
- void glDrawBuffer(GLenum mode)
- void glDrawBuffers(GLsizei n,const GLenum *bufs)
- void glDrawElements(GLenum mode,GLsizei count,GLenum type,const GLvoid * indices)
- void glDrawPixels(GLsizei width,GLsizei height,GLenum format,GLenum type,const GLvoid * data)
- void glDrawRangeElements(GLenum mode,GLuint start,GLuint end,GLsizei count,GLenum type,const GLvoid * indices)
- void glEdgeFlag(GLboolean flag)
- void glEdgeFlagPointer(GLsizei stride,const GLvoid * pointer)
- void glEnd(void)
- void glEndList(void)
- void glEndQuery(GLenum target)
- void glEvalCoord1f(GLfloat u)
- void glEvalCoord1d(GLdouble u)
- void glEvalCoord2f(GLfloat u,GLfloat v)
- void glEvalCoord2d(GLdouble u,GLdouble v)
- void glEvalMesh1(GLenum mode,GLint i1,GLint i2)
- void glEvalPoint1(GLint i)
- void glEvalPoint2(GLint i,GLint j)
- void glFeedbackBuffer(GLsizei size,GLenum type,GLfloat * buffer)
- void glFinish(void)
- void glFlush(void)
- void glFogf(GLenum pname,GLfloat param)
- void glFogi(GLenum pname,GLint param)
- void glFogfv(GLenum pname,const GLfloat * params)
- void glFogiv(GLenum pname,const GLint * params)
- void glFogCoordd(GLdouble coord)
- void glFogCoordf(GLfloat coord)

- void glFogCoorddv(GLdouble * coord)
- void glFogCoordfv(GLfloat * coord)
- void glFogCoordPointer(GLenum type,GLsizei stride,GLvoid * pointer)
- void glFrontFace(GLenum mode)
- void glFrustum(GLdouble left,GLdouble right,GLdouble bottom,GLdouble top,GLdouble nearVal,GLdouble farVal)
- void glGenBuffers(GLsizei n,GLuint * buffers)
- GLuint glGenLists(GLsizei range)
- void glGenQueries(GLsizei n,GLuint * ids)
- void glGenTextures(GLsizei n,GLuint * textures)
- void glGetBooleanv(GLenum pname,GLboolean * params)
- void glGetDoublev(GLenum pname,GLdouble * params)
- void glGetFloatv(GLenum pname,GLfloat * params)
- void glGetIntegerv(GLenum pname,GLint * params)
- void glGetActiveAttrib(GLuint program,GLuint index,GLsizei bufSize,GLsizei *length,GLint *size,GLenum *type,GLchar *name)
- void glGetActiveUniform(GLuint program,GLuint index,GLsizei bufSize,GLsizei *length,GLint *size,GLenum *type,GLchar *name)
- void glGetAttachedShaders(GLuint program,GLsizei maxCount,GLsizei *count,GLuint *shaders)
- GLint glGetUniformLocation(GLuint program,const GLchar *name)
- void glGetBufferParameteriv(GLenum target,GLenum value,GLint * data)
- void glGetBufferPointerv(GLenum target,GLenum pname,GLvoid ** params)
- void glGetBufferSubData(GLenum target,GLintptr offset,GLsizeiptr size,GLvoid * data)
- void glGetClipPlane(GLenum plane,GLdouble * equation)
- void glGetColorTable(GLenum target,GLenum format,GLenum type,GLvoid * table)
- void glGetColorTableParameterfv(GLenum target,GLenum pname,GLfloat * params)
- void glGetColorTableParameteriv(GLenum target,GLenum pname,GLint * params)
- void glGetCompressedTexImage(GLenum target,GLint lod,GLvoid * img)
- void glGetConvolutionFilter(GLenum target,GLenum format,GLenum type,GLvoid * image)
- void glGetConvolutionParameterfv(GLenum target,GLenum pname,GLfloat * params)
- void glGetConvolutionParameteriv(GLenum target,GLenum pname,GLint * params)
- GLenum glGetError(void)
- void glGetHistogram(GLenum target,GLboolean reset,GLenum format,GLenum type,GLvoid * values)
- void glGetHistogramParameterfv(GLenum target,GLenum pname,GLfloat * params)
- void glGetHistogramParameteriv(GLenum target,GLenum pname,GLint * params)
- void glGetLightfv(GLenum light,GLenum pname,GLfloat * params)
- void glGetLightiv(GLenum light,GLenum pname,GLint * params)

- void glGetMapdv(GLenum target,GLenum query,GLdouble * v)
- void glGetMapfv(GLenum target,GLenum query,GLfloat * v)
- void glGetMapiv(GLenum target,GLenum query,GLint * v)
- void glGetMaterialfv(GLenum face,GLenum pname,GLfloat * params)
- void glGetMaterialiv(GLenum face,GLenum pname,GLint * params)
- void glGetMinmax(GLenum target,GLboolean reset,GLenum format,GLenum types,GLvoid * values)
- void glGetMinmaxParameterfv(GLenum target,GLenum pname,GLfloat * params)
- void glGetMinmaxParameteriv(GLenum target,GLenum pname,GLint * params)
- void glGetPixelMapfv(GLenum map,GLfloat * data)
- void glGetPixelMapuiv(GLenum map,GLuint * data)
- void glGetPixelMapusv(GLenum map,GLushort * data)
- void glGetPointerv(GLenum pname,GLvoid ** params)
- void glGetPolygonStipple(GLubyte * pattern)
- void glGetProgramiv(GLuint program,GLenum pname,GLint *params)
- void glGetProgramInfoLog(GLuint program,GLsizei maxLength,GLsizei *length,GLchar *infoLog)
- void glGetQueryObjectiv(GLuint id,GLenum pname,GLint * params)
- void glGetQueryObjectuiv(GLuint id,GLenum pname,GLuint * params)
- void glGetQueryiv(GLenum target,GLenum pname,GLint * params)
- void glGetSeparableFilter(GLenum target,GLenum format,GLenum type,GLvoid * row,GLvoid * column,GLvoid * span)
- void glGetShaderiv(GLuint shader,GLenum pname,GLint *params)
- void glGetShaderInfoLog(GLuint shader,GLsizei maxLength,GLsizei *length,GLchar *infoLog)
- void glGetShaderSource(GLuint shader,GLsizei bufSize,GLsizei *length,GLchar *source)
- const GLubyte *glGetString(GLenum name)
- void glGetTexEnvfv(GLenum target,GLenum pname,GLfloat * params)
- void glGetTexEnviv(GLenum target,GLenum pname,GLint * params)
- void glGetTexGendv(GLenum coord,GLenum pname,GLdouble * params)
- void glGetTexGenfv(GLenum coord,GLenum pname,GLfloat * params)
- void glGetTexGeniv(GLenum coord,GLenum pname,GLint * params)
- void glGetTexImage(GLenum target,GLint level,GLenum format,GLenum type,GLvoid * img)
- void glGetTexLevelParameterfv(GLenum target,GLint level,GLenum pname,GLfloat * params)
- void glGetTexLevelParameteriv(GLenum target,GLint level,GLenum pname,GLint * params)
- void glGetTexParameterfv(GLenum target,GLenum pname,GLfloat * params)
- void glGetTexParameteriv(GLenum target,GLenum pname,GLint * params)
- void glGetUniformLocation(GLuint program,GLint location,GLfloat *params)
- void glGetUniformLocation(GLuint program,GLint location,GLint *params)

- GLint glGetUniformLocation(GLuint program,const GLchar *name)
- void glGetVertexAttribdv(GLuint index,GLenum pname,GLdouble *params)
- void glGetVertexAttribfv(GLuint index,GLenum pname,GLfloat *params)
- void glGetVertexAttribiv(GLuint index,GLenum pname,GLint *params)
- void glGetVertexAttribPointerv(GLuint index,GLenum pname,GLvoid **pointer)
- void glHint(GLenum target,GLenum mode)
- void glHistogram(GLenum target,GLsizei width,GLenum internalformat,GLboolean sink)
- void glIndexs(GLshort c)
- void glIndexi(GLint c)
- void glIndexf(GLfloat c)
- void glIndexd(GLdouble c)
- void glIndexub(GLubyte c)
- void glIndexsv(const GLshort * c)
- void glIndexiv(const GLint * c)
- void glIndexfv(const GLfloat * c)
- void glIndexdv(const GLdouble * c)
- void glIndexubv(const GLubyte * c)
- void glIndexMask(GLuint mask)
- void glIndexPointer(GLenum type,GLsizei stride,const GLvoid * pointer)
- void glInitNames(void)
- void glInterleavedArrays(GLenum format,GLsizei stride,const GLvoid * pointer)
- GLboolean glIsBuffer(GLuint buffer)
- GLboolean glIsEnabled(GLenum cap)
- GLboolean glIsList(GLuint list)
- GLboolean glIsProgram(GLuint program)
- GLboolean glIsQuery(GLuint id)
- GLboolean glIsShader(GLuint shader)
- GLboolean glIsTexture(GLuint texture)
- void glLightf(GLenum light,GLenum pname,GLfloat param)
- void glLighti(GLenum light,GLenum pname,GLint param)
- void glLightfv(GLenum light,GLenum pname,const GLfloat * params)
- void glLightiv(GLenum light,GLenum pname,const GLint * params)
- void glLightModelf(GLenum pname,GLfloat param)
- void glLightModeli(GLenum pname,GLint param)
- void glLightModelfv(GLenum pname,const GLfloat * params)
- void glLightModeliv(GLenum pname,const GLint * params)

- void glLineStipple(GLint factor,GLushort pattern)
- void glLineWidth(GLfloat width)
- void glLinkProgram(GLuint program)
- void glListBase(GLuint base)
- void glLoadIdentity(void)
- void glLoadMatrixd(const GLdouble * m)
- void glLoadMatrixf(const GLfloat * m)
- void glLoadName(GLuint name)
- void glLoadTransposeMatrixd(const GLdouble * m)
- void glLoadTransposeMatrixf(const GLfloat * m)
- void glLogicOp(GLenum opcode)
- void glMap1f(GLenum target,GLfloat u1,GLfloat u2,GLint stride,GLint order,const GLfloat * points)
- void glMap1d(GLenum target,GLdouble u1,GLdouble u2,GLint stride,GLint order,const GLdouble * points)
- void glMap2f(GLenum target,GLfloat u1,GLfloat u2,GLint ustride,GLint uorder,GLfloat v1,GLfloat v2,GLint vstride,GLint vorder,const GLfloat * points)
- void glMap2d(GLenum target,GLdouble u1,GLdouble u2,GLint ustride,GLint uorder,GLdouble v1,GLdouble v2,GLint vstride,GLint vorder,const GLdouble * points)
- void * glMapBuffer(GLenum target,GLenum access)
- void glMapGrid1d(GLint un,GLdouble u1,GLdouble u2)
- void glMapGrid1f(GLint un,GLfloat u1,GLfloat u2)
- void glMapGrid2d(GLint un,GLdouble u1,GLdouble u2,GLint vn,GLdouble v1,GLdouble v2)
- void glMapGrid2f(GLint un,GLfloat u1,GLfloat u2,GLint vn,GLfloat v1,GLfloat v2)
- void glMaterialf(GLenum face,GLenum pname,GLfloat param)
- void glMateriali(GLenum face,GLenum pname,GLint param)
- void glMatrixMode(GLenum mode)
- void glMinmax(GLenum target,GLenum internalformat,GLboolean sink)
- void glMultMatrixd(const GLdouble * m)
- void glMultMatrixf(const GLfloat * m)
- void glMultTransposeMatrixd(const GLdouble * m)
- void glMultTransposeMatrixf(const GLfloat * m)
- void glMultiDrawArrays(GLenum mode,GLint * first,GLsizei * count,GLsizei primcount)
- void glMultiDrawElements(GLenum mode,const GLsizei * count,GLenum type,const GLvoid ** indices,GLsizei primcount)
- void glMultiTexCoord1s(GLenum target,GLshort s)
- void glMultiTexCoord1i(GLenum target,GLint s)
- void glMultiTexCoord1f(GLenum target,GLfloat s)
- void glMultiTexCoord1d(GLenum target,GLdouble s)

- void glMultiTexCoord2s(GLenum target,GLshort s,GLshort t)
- void glMultiTexCoord2i(GLenum target,GLint s,GLint t)
- void glMultiTexCoord2f(GLenum target,GLfloat s,GLfloat t)
- void glMultiTexCoord2d(GLenum target,GLdouble s,GLdouble t)
- void glMultiTexCoord3s(GLenum target,GLshort s,GLshort t,GLshort r)
- void glMultiTexCoord3i(GLenum target,GLint s,GLint t,GLint r)
- void glMultiTexCoord3f(GLenum target,GLfloat s,GLfloat t,GLfloat r)
- void glMultiTexCoord3d(GLenum target,GLdouble s,GLdouble t,GLdouble r)
- void glMultiTexCoord4s(GLenum target,GLshort s,GLshort t,GLshort r,GLshort q)
- void glMultiTexCoord4i(GLenum target,GLint s,GLint t,GLint r,GLint q)
- void glMultiTexCoord4f(GLenum target,GLfloat s,GLfloat t,GLfloat r,GLfloat q)
- void glMultiTexCoord4d(GLenum target,GLdouble s,GLdouble t,GLdouble r,GLdouble q)
- void glMultiTexCoord1sv(GLenum target,const GLshort * v)
- void glMultiTexCoord1iv(GLenum target,const GLint * v)
- void glMultiTexCoord1fv(GLenum target,const GLfloat * v)
- void glMultiTexCoord1dv(GLenum target,const GLdouble * v)
- void glMultiTexCoord2sv(GLenum target,const GLshort * v)
- void glMultiTexCoord2iv(GLenum target,const GLint * v)
- void glMultiTexCoord2fv(GLenum target,const GLfloat * v)
- void glMultiTexCoord2dv(GLenum target,const GLdouble * v)
- void glMultiTexCoord3sv(GLenum target,const GLshort * v)
- void glMultiTexCoord3iv(GLenum target,const GLint * v)
- void glMultiTexCoord3fv(GLenum target,const GLfloat * v)
- void glMultiTexCoord3dv(GLenum target,const GLdouble * v)
- void glMultiTexCoord4sv(GLenum target,const GLshort * v)
- void glMultiTexCoord4iv(GLenum target,const GLint * v)
- void glMultiTexCoord4fv(GLenum target,const GLfloat * v)
- void glMultiTexCoord4dv(GLenum target,const GLdouble * v)
- void glNewList(GLuint list,GLenum mode)
- void glNormal3b(GLbyte nx,GLbyte ny,GLbyte nz)
- void glNormal3d(GLdouble nx,GLdouble ny,GLdouble nz)
- void glNormal3f(GLfloat nx,GLfloat ny,GLfloat nz)
- void glNormal3i(GLint nx,GLint ny,GLint nz)
- void glNormal3s(GLshort nx,GLshort ny,GLshort nz)
- void glNormal3bv(const GLbyte * v)
- void glNormal3dv(const GLdouble * v)

- void glNormal3fv(const GLfloat * v)
- void glNormal3iv(const GLint * v)
- void glNormal3sv(const GLshort * v)
- void glNormalPointer(GLenum type,GLsizei stride,const GLvoid * pointer)
- void glOrtho(GLdouble left,GLdouble right,GLdouble bottom,GLdouble top,GLdouble nearVal,GLdouble farVal)
- void glPassThrough(GLfloat token)
- void glPixelMapfv(GLenum map,GLsizei mapsize,const GLfloat * values)
- void glPixelMapuv(GLenum map,GLsizei mapsize,const GLuint * values)
- void glPixelMapusv(GLenum map,GLsizei mapsize,const GLushort * values)
- void glPixelStoref(GLenum pname,GLfloat param)
- void glPixelStorei(GLenum pname,GLint param)
- void glPixelTransferf(GLenum pname,GLfloat param)
- void glPixelTransferi(GLenum pname,GLint param)
- void glPixelZoom(GLfloat xfactor,GLfloat yfactor)
- void glPointParameterf(GLenum pname,GLfloat param)
- void glPointParameteri(GLenum pname,GLint param)
- void glPointSize(GLfloat size)
- void glPolygonMode(GLenum face,GLenum mode)
- void glPolygonOffset(GLfloat factor,GLfloat units)
- void glPolygonStipple(const GLubyte * pattern)
- void glPushAttrib(GLbitfield mask)
- void glPushClientAttrib(GLbitfield mask)
- void glPushMatrix(void)
- void glPushName(GLuint name)
- void glPrioritizeTextures(GLsizei n,const GLuint * textures,const GLclampf * priorities)
- void glPopMatrix(void)
- void glRasterPos2s(GLshort x,GLshort y)
- void glRasterPos2i(GLint x,GLint y)
- void glRasterPos2f(GLfloat x,GLfloat y)
- void glRasterPos2d(GLdouble x,GLdouble y)
- void glRasterPos3s(GLshort x,GLshort y,GLshort z)
- void glRasterPos3i(GLint x,GLint y,GLint z)
- void glRasterPos3f(GLfloat x,GLfloat y,GLfloat z)
- void glRasterPos3d(GLdouble x,GLdouble y,GLdouble z)
- void glRasterPos4s(GLshort x,GLshort y,GLshort z,GLshort w)

- void glRasterPos4i(GLint x,GLint y,GLint z,GLint w)
- void glRasterPos4f(GLfloat x,GLfloat y,GLfloat z,GLfloat w)
- void glRasterPos4d(GLdouble x,GLdouble y,GLdouble z,GLdouble w)
- void glReadBuffer(GLenum mode)
- void glReadPixels(GLint x,GLint y,GLsizei width,GLsizei height,GLenum format,GLenum type,GLvoid * data)
- void glRectd(GLdouble x1,GLdouble y1,GLdouble x2,GLdouble y2)
- void glRectf(GLfloat x1,GLfloat y1,GLfloat x2,GLfloat y2)
- void glRecti(GLint x1,GLint y1,GLint x2,GLint y2)
- void glRects(GLshort x1,GLshort y1,GLshort x2,GLshort y2)
- void glRectdv(const GLdouble * v1,const GLdouble * v2)
- void glRectfv(const GLfloat * v1,const GLfloat * v2)
- void glRectiv(const GLint * v1,const GLint * v2)
- void glRectsv(const GLshort * v1,const GLshort * v2)
- GLint glRenderMode(GLenum mode)
- void glResetHistogram(GLenum target)
- void glRotated(GLdouble angle,GLdouble x,GLdouble y,GLdouble z)
- void glRotatef(GLfloat angle,GLfloat x,GLfloat y,GLfloat z)
- void glSampleCoverage(GLclampf value,GLboolean invert)
- void glScaled(GLdouble x,GLdouble y,GLdouble z)
- void glScalef(GLfloat x,GLfloat y,GLfloat z)
- void glScissor(GLint x,GLint y,GLsizei width,GLsizei height)
- void glSecondaryColor3b(GLbyte red,GLbyte green,GLbyte blue)
- void glSecondaryColor3s(GLshort red,GLshort green,GLshort blue)
- void glSecondaryColor3i(GLint red,GLint green,GLint blue)
- void glSecondaryColor3f(GLfloat red,GLfloat green,GLfloat blue)
- void glSecondaryColor3d(GLdouble red,GLdouble green,GLdouble blue)
- void glSecondaryColor3ub(GLubyte red,GLubyte green,GLubyte blue)
- void glSecondaryColor3us(GLushort red,GLushort green,GLushort blue)
- void glSecondaryColor3ui(GLuint red,GLuint green,GLuint blue)
- void glSecondaryColor3bv(const GLbyte * v)
- void glSecondaryColor3sv(const GLshort * v)
- void glSecondaryColor3iv(const GLint * v)
- void glSecondaryColor3fv(const GLfloat * v)
- void glSecondaryColor3dv(const GLdouble * v)
- void glSecondaryColor3ubv(const GLubyte * v)
- void glSecondaryColor3usv(const GLushort * v)

- void glSecondaryColor3uiv(const GLuint * v)
- void glSecondaryColorPointer(GLint size,GLenum type,GLsizei stride,const GLvoid * pointer)
- void glSelectBuffer(GLsizei size,GLuint * buffer)
- void glSeparableFilter2D(GLenum target,GLenum internalformat,GLsizei width,GLsizei height,GLenum format,GLenum type,const GLvoid * row,const GLvoid * column)
- void glShadeModel(GLenum mode)
- void glShaderSource(GLuint shader,GLsizei count,const GLchar **string,const GLint *length)
- void glStencilFunc(GLenum func,GLint ref,GLuint mask)
- void glStencilFuncSeparate(GLenum face,GLenum func,GLint ref,GLuint mask)
- void glStencilMask(GLuint mask)
- void glStencilMaskSeparate(GLenum face,GLuint mask)
- void glStencilOp(GLenum sfail,GLenum dpfail,GLenum dppass)
- void glStencilOpSeparate(GLenum face,GLenum sfail,GLenum dpfail,GLenum dppass)
- void glTexCoord1s(GLshort s)
- void glTexCoord1i(GLint s)
- void glTexCoord1f(GLfloat s)
- void glTexCoord1d(GLdouble s)
- void glTexCoord2s(GLshort s,GLshort t)
- void glTexCoord2i(GLint s,GLint t)
- void glTexCoord2f(GLfloat s,GLfloat t)
- void glTexCoord2d(GLdouble s,GLdouble t)
- void glTexCoord3s(GLshort s,GLshort t,GLshort r)
- void glTexCoord3i(GLint s,GLint t,GLint r)
- void glTexCoord3f(GLfloat s,GLfloat t,GLfloat r)
- void glTexCoord3d(GLdouble s,GLdouble t,GLdouble r)
- void glTexCoord4s(GLshort s,GLshort t,GLshort r,GLshort q)
- void glTexCoord4i(GLint s,GLint t,GLint r,GLint q)
- void glTexCoord4f(GLfloat s,GLfloat t,GLfloat r,GLfloat q)
- void glTexCoord4d(GLdouble s,GLdouble t,GLdouble r,GLdouble q)
- void glTexCoord1sv(const GLshort * v)
- void glTexCoord1iv(const GLint * v)
- void glTexCoord1fv(const GLfloat * v)
- void glTexCoord1dv(const GLdouble * v)
- void glTexCoord2sv(const GLshort * v)
- void glTexCoord2iv(const GLint * v)
- void glTexCoord2fv(const GLfloat * v)

- void glTexCoord2dv(const GLdouble * v)
- void glTexCoord3sv(const GLshort * v)
- void glTexCoord3iv(const GLint * v)
- void glTexCoord3fv(const GLfloat * v)
- void glTexCoord3dv(const GLdouble * v)
- void glTexCoord4sv(const GLshort * v)
- void glTexCoord4iv(const GLint * v)
- void glTexCoord4fv(const GLfloat * v)
- void glTexCoord4dv(const GLdouble * v)
- void glTexCoordPointer(GLint size,GLenum type,GLsizei stride,const GLvoid * pointer)
- void glTexEnvf(GLenum target,GLenum pname,GLfloat param)
- void glTexEnvi(GLenum target,GLenum pname,GLint param)
- void glTexGeni(GLenum coord,GLenum pname,GLint param)
- void glTexGenf(GLenum coord,GLenum pname,GLfloat param)
- void glTexGend(GLenum coord,GLenum pname,GLdouble param)
- void glTexGeniv(GLenum coord,GLenum pname,const GLint * params)
- void glTexGenfv(GLenum coord,GLenum pname,const GLfloat * params)
- void glTexGendv(GLenum coord,GLenum pname,const GLdouble * params)
- void glTexImage1D(GLenum target,GLint level,GLint internalFormat,GLsizei width,GLint border,GLenum format,GLenum type,const GLvoid * data)
- void glTexImage2D(GLenum target,GLint level,GLint internalFormat,GLsizei width,GLsizei height,GLint border,GLenum format,GLenum type,const GLvoid * data)
- void glTexImage3D(GLenum target,GLint level,GLint internalFormat,GLsizei width,GLsizei height,GLsizei depth,GLint border,GLenum format,GLenum type,const GLvoid * data)
- void glTexParameterf(GLenum target,GLenum pname,GLfloat param)
- void glTexParameteri(GLenum target,GLenum pname,GLint param)
- void glTexParameterfv(GLenum target,GLenum pname,const GLfloat * params)
- void glTexParameteriv(GLenum target,GLenum pname,const GLint * params)
- void glTexSubImage1D(GLenum target,GLint level,GLsizei xoffset,GLsizei width,GLenum format,GLenum type,const GLvoid * data)
- void glTexSubImage2D(GLenum target,GLint level,GLsizei xoffset,GLsizei yoffset,GLsizei width,GLsizei height,GLenum format,GLenum type,const GLvoid * data)
- void glTexSubImage3D(GLenum target,GLint level,GLsizei xoffset,GLsizei yoffset,GLsizei zoffset,GLsizei width,GLsizei height,GLsizei depth,GLenum format,GLenum type,const GLvoid * data)
- void glTranslated(GLdouble x,GLdouble y,GLdouble z)
- void glTranslatef(GLfloat x,GLfloat y,GLfloat z)
- void glUniform1f(GLint location,GLfloat v0)
- void glUniform2f(GLint location,GLfloat v0,GLfloat v1)

- void glUniform3f(GLint location,GLfloat v0,GLfloat v1,GLfloat v2)
- void glUniform4f(GLint location,GLfloat v0,GLfloat v1,GLfloat v2,GLfloat v3)
- void glUniform1i(GLint location,GLint v0)
- void glUniform2i(GLint location,GLint v0,GLint v1)
- void glUniform3i(GLint location,GLint v0,GLint v1,GLint v2)
- void glUniform4i(GLint location,GLint v0,GLint v1,GLint v2,GLint v3)
- void glUniform1fv(GLint location,GLsizei count,const GLfloat *value)
- void glUniform2fv(GLint location,GLsizei count,const GLfloat *value)
- void glUniform3fv(GLint location,GLsizei count,const GLfloat *value)
- void glUniform4fv(GLint location,GLsizei count,const GLfloat *value)
- void glUniform1iv(GLint location,GLsizei count,const GLint *value)
- void glUniform2iv(GLint location,GLsizei count,const GLint *value)
- void glUniform3iv(GLint location,GLsizei count,const GLint *value)
- void glUniform4iv(GLint location,GLsizei count,const GLint *value)
- void glUniformMatrix2fv(GLint location,GLsizei count,GLboolean transpose,const GLfloat *value)
- void glUniformMatrix3fv(GLint location,GLsizei count,GLboolean transpose,const GLfloat *value)
- void glUniformMatrix4fv(GLint location,GLsizei count,GLboolean transpose,const GLfloat *value)
- void glUniformMatrix2x3fv(GLint location,GLsizei count,GLboolean transpose,const GLfloat *value)
- void glUniformMatrix3x2fv(GLint location,GLsizei count,GLboolean transpose,const GLfloat *value)
- void glUniformMatrix2x4fv(GLint location,GLsizei count,GLboolean transpose,const GLfloat *value)
- void glUniformMatrix4x2fv(GLint location,GLsizei count,GLboolean transpose,const GLfloat *value)
- void glUniformMatrix3x4fv(GLint location,GLsizei count,GLboolean transpose,const GLfloat *value)
- void glUniformMatrix4x3fv(GLint location,GLsizei count,GLboolean transpose,const GLfloat *value)
- void glUseProgram(GLuint program)
- void glValidateProgram(GLuint program)
- void glVertex2s(GLshort x,GLshort y)
- void glVertex2i(GLint x,GLint y)
- void glVertex2f(GLfloat x,GLfloat y)
- void glVertex2d(GLdouble x,GLdouble y)
- void glVertex3s(GLshort x,GLshort y,GLshort z)
- void glVertex3i(GLint x,GLint y,GLint z)
- void glVertex3f(GLfloat x,GLfloat y,GLfloat z)
- void glVertex3d(GLdouble x,GLdouble y,GLdouble z)
- void glVertex4s(GLshort x,GLshort y,GLshort z,GLshort w)
- void glVertex4i(GLint x,GLint y,GLint z,GLint w)
- void glVertex4f(GLfloat x,GLfloat y,GLfloat z,GLfloat w)

- void glVertex4d(GLdouble x,GLdouble y,GLdouble z,GLdouble w)
- void glVertex2sv(const GLshort * v)
- void glVertex2iv(const GLint * v)
- void glVertex2fv(const GLfloat * v)
- void glVertex2dv(const GLdouble * v)
- void glVertex3sv(const GLshort * v)
- void glVertex3iv(const GLint * v)
- void glVertex3fv(const GLfloat * v)
- void glVertex3dv(const GLdouble * v)
- void glVertex4sv(const GLshort * v)
- void glVertex4iv(const GLint * v)
- void glVertex4fv(const GLfloat * v)
- void glVertex4dv(const GLdouble * v)
- void glVertexAttrib1f(GLuint index,GLfloat v0)
- void glVertexAttrib1s(GLuint index,GLshort v0)
- void glVertexAttrib1d(GLuint index,GLdouble v0)
- void glVertexAttrib2f(GLuint index,GLfloat v0,GLfloat v1)
- void glVertexAttrib2s(GLuint index,GLshort v0,GLshort v1)
- void glVertexAttrib2d(GLuint index,GLdouble v0,GLdouble v1)
- void glVertexAttrib3f(GLuint index,GLfloat v0,GLfloat v1,GLfloat v2)
- void glVertexAttrib3s(GLuint index,GLshort v0,GLshort v1,GLshort v2)
- void glVertexAttrib3d(GLuint index,GLdouble v0,GLdouble v1,GLdouble v2)
- void glVertexAttrib4f(GLuint index,GLfloat v0,GLfloat v1,GLfloat v2,GLfloat v3)
- void glVertexAttrib4s(GLuint index,GLshort v0,GLshort v1,GLshort v2,GLshort v3)
- void glVertexAttrib4d(GLuint index,GLdouble v0,GLdouble v1,GLdouble v2,GLdouble v3)
- void glVertexAttrib4Nub(GLuint index,GLubyte v0,GLubyte v1,GLubyte v2,GLubyte v3)
- void glVertexAttrib1fv(GLuint index,const GLfloat *v)
- void glVertexAttrib1sv(GLuint index,const GLshort *v)
- void glVertexAttrib1dv(GLuint index,const GLdouble *v)
- void glVertexAttrib2fv(GLuint index,const GLfloat *v)
- void glVertexAttrib2sv(GLuint index,const GLshort *v)
- void glVertexAttrib2dv(GLuint index,const GLdouble *v)
- void glVertexAttrib3fv(GLuint index,const GLfloat *v)
- void glVertexAttrib3sv(GLuint index,const GLshort *v)
- void glVertexAttrib3dv(GLuint index,const GLdouble *v)
- void glVertexAttrib4fv(GLuint index,const GLfloat *v)

- void glVertexAttrib4sv(GLuint index,const GLshort *v)
- void glVertexAttrib4dv(GLuint index,const GLdouble *v)
- void glVertexAttrib4iv(GLuint index,const GLint *v)
- void glVertexAttrib4bv(GLuint index,const GLbyte *v)
- void glVertexAttrib4ubv(GLuint index,const GLubyte *v)
- void glVertexAttrib4usv(GLuint index,const GLushort *v)
- void glVertexAttrib4uiv(GLuint index,const GLuint *v)
- void glVertexAttribPointer(GLuint index,GLint size,GLenum type,GLboolean normalized,GLsizei stride,const GLvoid * pointer)
- void glVertexPointer(GLint size,GLenum type,GLsizei stride,const GLvoid * pointer)
- void glViewport(GLint x,GLint y,GLsizei width,GLsizei height)
- void glWindowPos2s(GLshort x,GLshort y)
- void glWindowPos2i(GLint x,GLint y)
- void glWindowPos2f(GLfloat x,GLfloat y)
- void glWindowPos2d(GLdouble x,GLdouble y)
- void glWindowPos3s(GLshort x,GLshort y,GLshort z)
- void glWindowPos3i(GLint x,GLint y,GLint z)
- void glWindowPos3f(GLfloat x,GLfloat y,GLfloat z)
- void glWindowPos3d(GLdouble x,GLdouble y,GLdouble z)
- void glWindowPos2sv(const GLshort * v)
- void glWindowPos2iv(const GLint * v)
- void glWindowPos2fv(const GLfloat * v)
- void glWindowPos2dv(const GLdouble * v)
- void glWindowPos3sv(const GLshort * v)
- void glWindowPos3iv(const GLint * v)
- void glWindowPos3fv(const GLfloat * v)
- void glWindowPos3dv(const GLdouble * v)
- void gluBeginCurve(GLUnurbs* nurb)
- void gluBeginPolygon(GLUtesselator* tess)
- void gluBeginSurface(GLUnurbs* nurb)
- void gluBeginTrim(GLUnurbs* nurb)
- void gluCylinder(GLUquadric* quad,GLdouble base,GLdouble top,GLdouble height,GLint slices,GLint stacks)
- void gluDeleteNurbsRenderer(GLUnurbs* nurb)
- void gluDeleteQuadric(GLUquadric* quad)
- void gluDeleteTess(GLUtesselator* tess)
- void gluDisk(GLUquadric* quad,GLdouble inner,GLdouble outer,GLint slices,GLint loops)

- void gluEndCurve(GLUnurbs* nurb)
- void gluEndPolygon(GLUtesselator* tess)
- void gluEndSurface(GLUnurbs* nurb)
- void gluEndTrim(GLUnurbs* nurb)
- const GLubyte * gluErrorString(GLenum error)
- void gluGetNurbsProperty(GLUnurbs* nurb,GLenum property,GLfloat* data)
- const GLubyte * gluGetString(GLenum name)
- void gluGetTessProperty(GLUtesselator* tess,GLenum which,GLdouble* data)
- void gluLoadSamplingMatrices(GLUnurbs* nurb,const GLfloat * model,const GLfloat * perspective,const GLint * view)
- void gluLookAt(GLdouble eyeX,GLdouble eyeY,GLdouble eyeZ,GLdouble centerX,GLdouble centerY,GLdouble centerZ,GLdouble upX,GLdouble upY,GLdouble upZ)
- GLUnurbs *gluNewNurbsRenderer(void)
- GLUquadric *gluNewQuadric(void)
- GLUtesselator* gluNewTess(void)
- void gluNextContour(GLUtesselator* tess,GLenum type)
- void gluNurbsCurve(GLUnurbs* nurb,GLint knotCount,GLfloat * knots,GLint stride,GLfloat * control,GLint order,GLenum type)
- void gluNurbsProperty(GLUnurbs* nurb,GLenum property,GLfloat value)
- void gluNurbsSurface(GLUnurbs* nurb,GLint sKnotCount,GLfloat* sKnots,GLint tKnotCount,GLfloat* tKnots,GLint sStride,GLint tStride,GLfloat* control,GLint sOrder,GLint tOrder,GLenum type)
- void gluOrtho2D(GLdouble left,GLdouble right,GLdouble bottom,GLdouble top)
- void gluPartialDisk(GLUquadric* quad,GLdouble inner,GLdouble outer,GLint slices,GLint loops,GLdouble start,GLdouble sweep)
- void gluPerspective(GLdouble fovy,GLdouble aspect,GLdouble zNear,GLdouble zFar)
- void gluPickMatrix(GLdouble x,GLdouble y,GLdouble delX,GLdouble delY,GLint * viewport)
- GLint gluProject(GLdouble objX,GLdouble objY,GLdouble objZ,const GLfloat * model,const GLfloat * proj,const GLint * view,GLdouble* winX,GLdouble* winY,GLdouble* winZ)
- void gluPwlCurve(GLUnurbs* nurb,GLint count,GLfloat* data,GLint stride,GLenum type)
- void gluQuadricDrawStyle(GLUquadric* quad,GLenum draw)
- void gluQuadricNormals(GLUquadric* quad,GLenum normal)
- void gluQuadricOrientation(GLUquadric* quad,GLenum orientation)
- void gluQuadricTexture(GLUquadric* quad,GLboolean texture)
- GLint gluScaleImage(GLenum format,GLsizei wIn,GLsizei hIn,GLenum typeIn,const void * dataIn,GLsizei wOut,GLsizei hOut,GLenum typeOut,GLvoid* dataOut)
- void gluSphere(GLUquadric* quad,GLdouble radius,GLint slices,GLint stacks)
- void gluTessBeginContour(GLUtesselator* tess)
- void gluTessBeginPolygon(GLUtesselator* tess,GLvoid* data)

- void gluTessEndContour(GLUtesselator* tess)
- void gluTessEndPolygon(GLUtesselator* tess)
- void gluTessNormal(GLUtesselator* tess,GLdouble valueX,GLdouble valueY,GLdouble valueZ)
- void gluTessProperty(GLUtesselator* tess,GLenum which,GLdouble data)
- void gluTessVertex(GLUtesselator* tess,GLdouble * location,GLvoid* data)
- GLint gluUnProject(GLdouble winX,GLdouble winY,GLdouble winZ,const GLdouble * model,const GLdouble * proj,const GLint * view,GLdouble* objX,GLdouble* objY,GLdouble* objZ)
- void glDisable(GLenum cap)
- void glDisableClientState(GLenum array)
- void glBindVertexArray(GLuint array)
- void glGenVertexArrays(GLsizei n,const GLuint * arrays)
- GLenum glewInit(void)
- GLboolean glewIsSupported(const char *name)
- GLboolean glewGetExtension(const char *name)
- const GLubyte *glewGetString(GLenum error)
- const GLubyte *glewGetString(GLenum name)

RINGQT CLASSES REFERENCE

83.1 AbstractAxis Class

Parameters : void

- Qt::Alignment alignment(void)
- QColor gridLineColor(void)
- QPen gridLinePen(void)
- void hide(void)
- bool isGridLineVisible(void)
- bool isLineVisible(void)
- bool isMinorGridLineVisible(void)
- bool isReverse(void)
- bool isTitleVisible(void)
- bool isVisible(void)
- int labelsAngle(void)
- QBrush labelsBrush(void)
- QColor labelsColor(void)
- bool labelsVisible(void)
- QPen linePen(void)
- QColor linePenColor(void)
- QColor minorGridLineColor(void)
- QPen minorGridLinePen(void)
- Qt::Orientation orientation(void)
- void setGridLineColor(QColor color)
- void setGridLinePen(QPen pen)
- void setGridLineVisible(bool visible)
- void setLabelsAngle(int angle)
- void setLabelsBrush(QBrush brush)
- void setLabelsColor(QColor color)

- void setLabelsVisible(bool visible)
- void setLinePen(QPen pen)
- void setLinePenColor(QColor color)
- void setLineVisible(bool visible)
- void setMax(QVariant max)
- void setMin(QVariant min)
- void setMinorGridLineColor(QColor color)
- void setMinorGridLinePen(QPen pen)
- void setMinorGridLineVisible(bool visible)
- void setRange(QVariant min, QVariant max)
- void setReverse(bool reverse)
- void setShadesBorderColor(QColor color)
- void setShadesBrush(QBrush brush)
- void setShadesColor(QColor color)
- void setShadesPen(QPen pen)
- void setShadesVisible(bool visible)
- void setTitleBrush(QBrush brush)
- void setTitleFont(QFont font)
- void setTitleText(QString title)
- void setTitleVisible(bool visible)
- void setVisible(bool visible)
- QColor shadesBorderColor(void)
- QBrush shadesBrush(void)
- QColor shadesColor(void)
- QPen shadesPen(void)
- bool shadesVisible(void)
- void show(void)
- QBrush titleBrush(void)
- QFont titleFont(void)
- QString titleText(void)
- void setcolorChangedEvent(const char *)
- void setgridLineColorChangedEvent(const char *)
- void setgridLinePenChangedEvent(const char *)
- void setgridVisibleChangedEvent(const char *)
- void setlabelsAngleChangedEvent(const char *)
- void setlabelsBrushChangedEvent(const char *)

- void setlabelsColorChangedEvent(const char *)
- void setlabelsEditableChangedEvent(const char *)
- void setlabelsFontChangedEvent(const char *)
- void setlabelsVisibleChangedEvent(const char *)
- void setlinePenChangedEvent(const char *)
- void setlineVisibleChangedEvent(const char *)
- void setminorGridLineColorChangedEvent(const char *)
- void setminorGridLinePenChangedEvent(const char *)
- void setminorGridVisibleChangedEvent(const char *)
- void setreverseChangedEvent(const char *)
- void setshadesBorderColorChangedEvent(const char *)
- void setshadesBrushChangedEvent(const char *)
- void setshadesColorChangedEvent(const char *)
- void setshadesPenChangedEvent(const char *)
- void setshadesVisibleChangedEvent(const char *)
- void settileBrushChangedEvent(const char *)
- void settileFontChangedEvent(const char *)
- void settileTextChangedEvent(const char *)
- void settileVisibleChangedEvent(const char *)
- void setvisibleChangedEvent(const char *)
- const char *getcolorChangedEvent(void)
- const char *getgridLineColorChangedEvent(void)
- const char *getgridLinePenChangedEvent(void)
- const char *getgridVisibleChangedEvent(void)
- const char *getlabelsAngleChangedEvent(void)
- const char *getlabelsBrushChangedEvent(void)
- const char *getlabelsColorChangedEvent(void)
- const char *getlabelsEditableChangedEvent(void)
- const char *getlabelsFontChangedEvent(void)
- const char *getlabelsVisibleChangedEvent(void)
- const char *getlinePenChangedEvent(void)
- const char *getlineVisibleChangedEvent(void)
- const char *getminorGridLineColorChangedEvent(void)
- const char *getminorGridLinePenChangedEvent(void)
- const char *getminorGridVisibleChangedEvent(void)
- const char *getreverseChangedEvent(void)

- const char *getshadesBorderColorChangedEvent(void)
- const char *getshadesBrushChangedEvent(void)
- const char *getshadesColorChangedEvent(void)
- const char *getshadesPenChangedEvent(void)
- const char *getshadesVisibleChangedEvent(void)
- const char *getttitleBrushChangedEvent(void)
- const char *getttitleFontChangedEvent(void)
- const char *getttitleTextChangedEvent(void)
- const char *getttitleVisibleChangedEvent(void)
- const char *getvisibleChangedEvent(void)

83.2 AbstractBarSeries Class

Parameters : void

Parent Class : AbstractSeries

- bool append(QBarSet *set)
- void clear(void)
- int count(void)
- bool insert(int index, QBarSet *set)
- bool isLabelsVisible(void)
- qreal labelsAngle(void)
- QString labelsFormat(void)
- QAbstractBarSeries::LabelsPosition labelsPosition(void)
- int labelsPrecision(void)
- bool remove(QBarSet *set)
- void setBarWidth(qreal width)
- void setLabelsAngle(qreal angle)
- void setLabelsFormat(QString format)
- void setLabelsPosition(QAbstractBarSeries::LabelsPosition position)
- void setLabelsPrecision(int precision)
- void setLabelsVisible(bool visible)
- bool take(QBarSet *set)
- void setbarsetsAddedEvent(const char *)
- void setbarsetsRemovedEvent(const char *)
- void setclickedEvent(const char *)
- void setcountChangedEvent(const char *)

- void setdoubleClickedEvent(const char *)
- void sethoveredEvent(const char *)
- void setlabelsAngleChangedEvent(const char *)
- void setlabelsFormatChangedEvent(const char *)
- void setlabelsPositionChangedEvent(const char *)
- void setlabelsPrecisionChangedEvent(const char *)
- void setlabelsVisibleChangedEvent(const char *)
- void setpressedEvent(const char *)
- void setreleasedEvent(const char *)
- const char *getbarsetsAddedEvent(void)
- const char *getbarsetsRemovedEvent(void)
- const char *getclickedEvent(void)
- const char *getcountChangedEvent(void)
- const char *getdoubleClickedEvent(void)
- const char *gethoveredEvent(void)
- const char *getlabelsAngleChangedEvent(void)
- const char *getlabelsFormatChangedEvent(void)
- const char *getlabelsPositionChangedEvent(void)
- const char *getlabelsPrecisionChangedEvent(void)
- const char *getlabelsVisibleChangedEvent(void)
- const char *getpressedEvent(void)
- const char *getreleasedEvent(void)

83.3 CodeEditor Class

Parameters : QWidget *

Parent Class : QPlainTextEdit

- void setCompleter(QCompleter *c)
- QCompleter *completer(void)
- void setLineNumbersAreaColor(QColor oColor)
- void setLineNumbersAreaBackColor(QColor oColor)

83.4 QAbstractAspect Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dcore-qabstractaspect.html>

Parameters : QObject *

Parent Class : QObject

- void scheduleSingleShotJob(Qt3DCore::QAspectJobPtr job)

83.5 QAbstractButton Class

C++ Reference : <http://doc.qt.io/qt-5/qabstractbutton.html>

Parameters : QWidget *parent

Parent Class : QWidget

- bool autoExclusive(void)
- bool autoRepeat(void)
- int autoRepeatDelay(void)
- int autoRepeatInterval(void)
- QButtonGroup *group(void)
- QIcon icon(void)
- QSize iconSize(void)
- bool isCheckable(void)
- bool isChecked(void)
- bool isDown(void)
- void setAutoExclusive(bool)
- void setAutoRepeat(bool)
- void setAutoRepeatDelay(int)
- void setAutoRepeatInterval(int)
- void setCheckable(bool)
- void setDown(bool)
- void setIcon(QIcon)
- void setShortcut(QKeySequence)
- void setText(QString)
- QKeySequence shortcut(void)
- QString text(void)
- void animateClick(int msec)
- void click(void)
- void setChecked(bool)
- void setIconSize(QSize)

- void toggle(void)

83.6 QAbstractCameraController Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qabstractcameracontroller.html>

Parent Class : QEntity

- float acceleration(void)
- Qt3DRender::QCamera * camera(void)
- float deceleration(void)
- float linearSpeed(void)
- float lookSpeed(void)
- void setAcceleration(float acceleration)
- void setCamera(Qt3DRender::QCamera *camera)
- void setDeceleration(float deceleration)
- void setLinearSpeed(float linearSpeed)
- void setLookSpeed(float lookSpeed)

83.7 QAbstractItemView Class

C++ Reference : <http://doc.qt.io/qt-5/qabstractitemview.html>

Parameters : QWidget *parent

Parent Class : QAbstractScrollArea

- bool alternatingRowColors(void)
- int autoScrollMargin(void)
- void closePersistentEditor(QModelIndex)
- QModelIndex currentIndex(void)
- int defaultDropAction(void)
- int dragDropMode(void)
- bool dragDropOverwriteMode(void)
- bool dragEnabled(void)
- int editTriggers(void)
- bool hasAutoScroll(void)
- int horizontalScrollMode(void)
- QSize iconSize(void)
- QModelIndex indexAt(QPoint)
- QWidget *indexWidget(QModelIndex)
- QAbstractItemDelegate *itemDelegate(QModelIndex)

- `QAbstractItemDelegate *itemDelegateForColumn(int column)`
- `QAbstractItemDelegate *itemDelegateForRow(int row)`
- `void keyboardSearch(QString)`
- `QAbstractItemModel *model(void)`
- `void openPersistentEditor(QModelIndex)`
- `QModelIndex rootIndex(void)`
- `void scrollTo(QModelIndex,QAbstractItemView::ScrollHint)`
- `int selectionBehavior(void)`
- `int selectionMode(void)`
- `QItemSelectionModel *selectionModel(void)`
- `void setAlternatingRowColors(bool enable)`
- `void setAutoScroll(bool enable)`
- `void setAutoScrollMargin(int margin)`
- `void setDefaultDropAction(Qt::DropAction dropAction)`
- `void setDragDropMode(QAbstractItemView::DragDropMode behavior)`
- `void setDragDropOverwriteMode(bool overwrite)`
- `void setDragEnabled(bool enable)`
- `void setDropIndicatorShown(bool enable)`
- `void setEditTriggers(QAbstractItemView::EditTrigger triggers)`
- `void setHorizontalScrollMode(QAbstractItemView::ScrollMode mode)`
- `void setIconSize(QSize)`
- `void setIndexWidget(QModelIndex, QWidget *widget)`
- `void.setItemDelegate(QAbstractItemDelegate *delegate)`
- `void.setItemDelegateForColumn(int column, QAbstractItemDelegate *delegate)`
- `void.setItemDelegateForRow(int row, QAbstractItemDelegate *delegate)`
- `void.setModel(QAbstractItemModel *model)`
- `void.setSelectionBehavior(QAbstractItemView::SelectionBehavior behavior)`
- `void.setSelectionMode(QAbstractItemView::SelectionMode mode)`
- `void.setSelectionModel(QItemSelectionModel *selectionModel)`
- `void.setTabKeyNavigation(bool enable)`
- `void.setTextElideMode(Qt::TextElideMode mode)`
- `void.setVerticalScrollMode(QAbstractItemView::ScrollMode mode)`
- `bool.showDropIndicator(void)`
- `int.sizeHintForColumn(int column)`
- `QSize.sizeHintForIndex(QModelIndex)`
- `int.sizeHintForRow(int row)`

- bool tabKeyNavigation(void)
- int textElideMode(void)
- int verticalScrollMode(void)
- QRect visualRect(QModelIndex)
- void clearSelection(void)
- void edit(QModelIndex)
- void scrollToBottom(void)
- void scrollToTop(void)
- void setCurrentIndex(QModelIndex)
- void update(QModelIndex)

83.8 QAbstractPrintDialog Class

C++ Reference : <http://doc.qt.io/qt-5/qabstractprintdialog.html>

Parameters : QPrinter *, QWidget *

Parent Class : QDialog

- int fromPage(void)
- int maxPage(void)
- int minPage(void)
- QAbstractPrintDialog::PrintRange printRange(void)
- QPrinter * printer(void)
- void setFromTo(int from, int to)
- void setMinMax(int min, int max)
- void setOptionTabs(QList<QWidget *> tabs)
- void setPrintRange(QAbstractPrintDialog::PrintRange range)
- int toPage(void)

83.9 QAbstractScrollArea Class

C++ Reference : <http://doc.qt.io/qt-5/qabstractscrollarea.html>

Parameters : QWidget *parent

Parent Class : QFrame

- void addScrollBarWidget(QWidget *widget, Qt::AlignmentFlag alignment)
- QWidget *cornerWidget(void)
- QScrollBar *horizontalScrollBar(void)
- int horizontalScrollBarPolicy(void)
- QSize maximumViewportSize(void)

- QWidgetList scrollBarWidgets(Qt::AlignmentFlag)
- void setCornerWidget(QWidget *widget)
- void setHorizontalScrollBar(ScrollBar *scrollBar)
- void setHorizontalScrollBarPolicy(ScrollBarPolicy)
- void setVerticalScrollBar(ScrollBar *scrollBar)
- void setVerticalScrollBarPolicy(ScrollBarPolicy)
- void setViewport(QWidget *widget)
- QScrollBar *verticalScrollBar(void)
- int verticalScrollBarPolicy(void)
- QWidget *viewport(void)

83.10 QAbstractSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qabstractseries.html>

Parameters : void

Parent Class : QObject

- bool attachAxis(QAbstractAxis *axis)
- QList<QAbstractAxis *> attachedAxes(void)
- QChart *chart(void)
- bool detachAxis(QAbstractAxis *axis)
- void hide(void)
- bool isVisible(void)
- QString name(void)
- qreal opacity(void)
- void setName(QString name)
- void setOpacity(qreal opacity)
- void setUseOpenGL(bool enable)
- void setVisible(bool visible)
- void show(void)
- bool useOpenGL(void)
- void setnameChangedEvent(const char *)
- void setopacityChangedEvent(const char *)
- void setuseOpenGLChangedEvent(const char *)
- void setvisibleChangedEvent(const char *)
- const char *getnameChangedEvent(void)
- const char *getopacityChangedEvent(void)

- const char *getuseOpenGLChangedEvent(void)
- const char *getvisibleChangedEvent(void)

83.11 QAbstractSlider Class

C++ Reference : <http://doc.qt.io/qt-5/qabstractslider.html>

Parameters : QWidget *parent

Parent Class : QWidget

- bool hasTracking(void)
- bool invertedAppearance(void)
- bool invertedControls(void)
- bool isSliderDown(void)
- int maximum(void)
- int minimum(void)
- int orientation(void)
- int pageStep(void)
- void setInvertedAppearance(bool)
- void setInvertedControls(bool)
- void setMaximum(int)
- void setMinimum(int)
- void setPageStep(int)
- void setSingleStep(int)
- void setSliderDown(bool)
- void setSliderPosition(int)
- void setTracking(bool enable)
- int singleStep(void)
- int sliderPosition(void)
- void triggerAction(QAbstractSlider::SliderAction action)
- int value(void)
- void setOrientation(Qt::Orientation)
- void setRange(int min, int max)
- void setValue(int)

83.12 QAbstractSocket Class

C++ Reference : <http://doc.qt.io/qt-5/qabstractsocket.html>

Parameters : void

Parent Class : QIODevice

- void abort(void)
- bool bind(QHostAddress address, int port, QAbstractSocket::BindFlag mode)
- void connectToHost(QString hostName, int port, QIODevice::OpenModeFlag openMode, QAbstractSocket::NetworkLayerProtocol protocol)
- void disconnectFromHost(void)
- int error(void)
- bool flush(void)
- bool isValid(void)
- QHostAddress localAddress(void)
- int localPort(void)
- int pauseMode(void)
- QHostAddress peerAddress(void)
- QString peerName(void)
- int peerPort(void)
- QNetworkProxy proxy(void)
- int readBufferSize(void)
- void resume(void)
- void setPauseMode(QAbstractSocket::PauseMode pauseMode)
- void setProxy(QNetworkProxy networkProxy)
- void setReadBufferSize(int size)
- bool setSocketDescriptor(qintptr socketDescriptor, QAbstractSocket::SocketState socketState, QIODevice::OpenModeFlag openMode)
- void setSocketOption(QAbstractSocket::SocketOption option, QVariant value)
- int *socketDescriptor(void)
- QVariant socketOption(QAbstractSocket::SocketOption option)
- int socketType(void)
- int state(void)
- bool waitForConnected(int msecs)
- bool waitForDisconnected(int msecs)
- bool atEnd(void)
- int bytesAvailable(void)
- int bytesToWrite(void)

- bool canReadLine(void)
- void close(void)
- bool isSequential(void)
- bool waitForBytesWritten(int msecs)
- bool waitForReadyRead(int msecs)
- void setconnectedEvent(const char *)
- void setdisconnectedEvent(const char *)
- void seterrorEvent(const char *)
- void sethostFoundEvent(const char *)
- void setproxyAuthenticationRequiredEvent(const char *)
- void setstateChangedEvent(const char *)
- const char *getconnectedEvent(void)
- const char *getdisconnectedEvent(void)
- const char *geterrorEvent(void)
- const char *gethostFoundEvent(void)
- const char *getproxyAuthenticationRequiredEvent(void)
- const char *getstateChangedEvent(void)

83.13 QAbstractSpinBox Class

C++ Reference : <http://doc.qt.io/qt-5/qabstractspinbox.html>

Parameters : QWidget *parent

Parent Class : QWidget

- int alignment(void)
- int buttonSymbols(void)
- int correctionMode(void)
- bool hasAcceptableInput(void)
- bool hasFrame(void)
- void interpretText(void)
- bool isAccelerated(void)
- bool keyboardTracking(void)
- void setAccelerated(bool on)
- void setAlignment(Qt::AlignmentFlag flag)
- void setButtonSymbols(QAbstractSpinBox::ButtonSymbols bs)
- void setCorrectionMode(QAbstractSpinBox::CorrectionMode cm)
- void setFrame(bool)

- void setReadOnly(bool r)
- void setSpecialValueText(QString)
- void setWrapping(bool w)
- QString specialValueText(void)
- void stepBy(int steps)
- QString text(void)
- bool wrapping(void)
- void clear(void)
- void selectAll(void)
- void stepDown(void)
- void stepUp(void)

83.14 QAction Class

C++ Reference : <http://doc.qt.io/qt-5/qaction.html>

Parameters : QWidget *parent

- QActionGroup *actionGroup(void)
- void activate(QAction::ActionEvent event)
- bool autoRepeat(void)
- QVariant data(void)
- QFont font(void)
- QIcon icon(void)
- QString iconText(void)
- bool isChecked(void)
- bool isChecked(void)
- bool isEnabled(void)
- bool isIconVisibleInMenu(void)
- bool isSeparator(void)
- bool isVisible(void)
- QMenu *menu(void)
- int menuRole(void)
- QWidget *parentWidget(void)
- int priority(void)
- void setActionGroup(QActionGroup *group)
- void setAutoRepeat(bool)
- void setCheckable(bool)

- void setData(QVariant)
- void setFont(QFont)
- void setIcon(QIcon)
- void setIconText(QString)
- void setIconVisibleInMenu(bool visible)
- void setMenu(QMenu *menu)
- void setMenuRole(QAction::MenuRole menuRole)
- void setPriority(QAction::Priority priority)
- void setSeparator(bool b)
- void setShortcut(QKeySequence)
- void setShortcutContext(Qt::ShortcutContext context)
- void setShortcuts(QKeySequence::StandardKey key)
- void setStatusTip(QString)
- void setText(QString)
- void setToolTip(QString)
- void setWhatsThis(QString)
- QKeySequence shortcut(void)
- int shortcutContext(void)
- bool showStatusText(QWidget *widget)
- QString statusTip(void)
- QString text(void)
- QString toolTip(void)
- QString whatsThis(void)
- void hover(void)
- void setChecked(bool)
- void setDisabled(bool)
- void setEnabled(bool)
- void setVisible(bool)
- void toggle(void)
- void trigger(void)
- void setClickEvent(const char *)
- const char *getClickEvent(void)

83.15 QAllEvents Class

Parameters : QWidget *

Parent Class : QWidget

- void accept(void)
- void ignore(void)
- int getKeyCode(void)
- QString getKeyText(void)
- int getModifiers(void)
- int getx(void)
- int gety(void)
- int getglobalx(void)
- int getglobaly(void)
- int getbutton(void)
- int getbuttons(void)
- void setKeyPressEvent(const char *cStr)
- void setMousePressEvent(const char *cStr)
- void setMouseButtonReleaseEvent(const char *cStr)
- void setMouseButtonDblClickEvent(const char *cStr)
- void setMouseMoveEvent(const char *cStr)
- void setCloseEvent(const char *cStr)
- void setContextMenuEvent(const char *cStr)
- void setDragEnterEvent(const char *cStr)
- void setDragLeaveEvent(const char *cStr)
- void setDragMoveEvent(const char *cStr)
- void setDropEvent(const char *cStr)
- void setEnterEvent(const char *cStr)
- void setFocusInEvent(const char *cStr)
- void setFocusOutEvent(const char *cStr)
- void setKeyReleaseEvent(const char *cStr)
- void setLeaveEvent(const char *cStr)
- void setNonClientAreaMouseButtonDblClickEvent(const char *cStr)
- void setNonClientAreaMouseButtonPressEvent(const char *cStr)
- void setNonClientAreaMouseButtonReleaseEvent(const char *cStr)
- void setNonClientAreaMouseMoveEvent(const char *cStr)
- void setMoveEvent(const char *cStr)

- void setResizeEvent(const char *cStr)
- void setWindowActivateEvent(const char *cStr)
- void setWindowBlockedEvent(const char *cStr)
- void setWindowDeactivateEvent(const char *cStr)
- void setWindowStateChangeEvent(const char *cStr)
- void setWindowUnblockedEvent(const char *cStr)
- void setPaintEvent(const char *cStr)
- void setChildAddedEvent(const char *cStr)
- void setChildPolishedEvent(const char *cStr)
- void setChildRemovedEvent(const char *cStr)
- const char *getKeyPressEvent(void)
- const char *getMouseButtonPressEvent(void)
- const char *getMouseButtonReleaseEvent(void)
- const char *getMouseButtonDblClickEvent(void)
- const char *getMouseMoveEvent(void)
- const char *getCloseEvent(void)
- const char *getContextMenuEvent(void)
- const char *getDragEnterEvent(void)
- const char *getDragLeaveEvent(void)
- const char *getDragMoveEvent(void)
- const char *getDropEvent(void)
- const char *getEnterEvent(void)
- const char *getFocusInEvent(void)
- const char *getFocusOutEvent(void)
- const char *getKeyReleaseEvent(void)
- const char *getLeaveEvent(void)
- const char *getNonClientAreaMouseButtonDblClickEvent(void)
- const char *getNonClientAreaMouseButtonPressEvent(void)
- const char *getNonClientAreaMouseButtonReleaseEvent(void)
- const char *getNonClientAreaMouseMoveEvent(void)
- const char *getMoveEvent(void)
- const char *getResizeEvent(void)
- const char *getWindowActivateEvent(void)
- const char *getWindowBlockedEvent(void)
- const char *getWindowDeactivateEvent(void)
- const char *getWindowStateChangeEvent(void)

- const char *getWindowUnblockedEvent(void)
- const char *getPaintEvent(void)
- const char *getChildAddedEvent(void)
- const char *getChildPolishedEvent(void)
- const char *getChildRemovedEvent(void)
- void setEventOutput(bool x)
- QObject *getParentObject(void)
- QWidget *getParentWidget(void)
- void setKeyPressFunc(const char *cStr)
- void setMouseButtonPressFunc(const char *cStr)
- void setMouseButtonReleaseFunc(const char *cStr)
- void setMouseButtonDblClickFunc(const char *cStr)
- void setMouseMoveFunc(const char *cStr)
- void setCloseFunc(const char *cStr)
- void setContextMenuFunc(const char *cStr)
- void setDragEnterFunc(const char *cStr)
- void setDragLeaveFunc(const char *cStr)
- void setDragMoveFunc(const char *cStr)
- void setDropFunc(const char *cStr)
- void setEnterFunc(const char *cStr)
- void setFocusInFunc(const char *cStr)
- void setFocusOutFunc(const char *cStr)
- void setKeyReleaseFunc(const char *cStr)
- void setLeaveFunc(const char *cStr)
- void setNonClientAreaMouseButtonDblClickFunc(const char *cStr)
- void setNonClientAreaMouseButtonPressFunc(const char *cStr)
- void setNonClientAreaMouseButtonReleaseFunc(const char *cStr)
- void setNonClientAreaMouseMoveFunc(const char *cStr)
- void setMoveFunc(const char *cStr)
- void setResizeFunc(const char *cStr)
- void setWindowActivateFunc(const char *cStr)
- void setWindowBlockedFunc(const char *cStr)
- void setWindowDeactivateFunc(const char *cStr)
- void setWindowStateChangeFunc(const char *cStr)
- void setWindowUnblockedFunc(const char *cStr)
- void setPaintFunc(const char *cStr)

- void setChildAddedFunc(const char *cStr)
- void setChildPolishedFunc(const char *cStr)
- void setChildRemovedFunc(const char *cStr)
- const char *getKeyPressFunc(void)
- const char *getMouseButtonPressFunc(void)
- const char *getMouseButtonReleaseFunc(void)
- const char *getMouseButtonDblClickFunc(void)
- const char *getMouseMoveFunc(void)
- const char *getCloseFunc(void)
- const char *getContextMenuFunc(void)
- const char *getDragEnterFunc(void)
- const char *getDragLeaveFunc(void)
- const char *getDragMoveFunc(void)
- const char *getDropFunc(void)
- const char *getEnterFunc(void)
- const char *getFocusInFunc(void)
- const char *getFocusOutFunc(void)
- const char *getKeyReleaseFunc(void)
- const char *getLeaveFunc(void)
- const char *getNonClientAreaMouseButtonDblClickFunc(void)
- const char *getNonClientAreaMouseButtonPressFunc(void)
- const char *getNonClientAreaMouseButtonReleaseFunc(void)
- const char *getNonClientAreaMouseMoveFunc(void)
- const char *getMoveFunc(void)
- const char *getResizeFunc(void)
- const char *getWindowActivateFunc(void)
- const char *getWindowBlockedFunc(void)
- const char *getWindowDeactivateFunc(void)
- const char *getWindowStateChangeFunc(void)
- const char *getWindowUnblockedFunc(void)
- const char *getPaintFunc(void)
- const char *getChildAddedFunc(void)
- const char *getChildPolishedFunc(void)
- const char *getChildRemovedFunc(void)
- QDropEvent *getDropEventObject(void)
- QDragMoveEvent *getDragMoveEventObject(void)

- QDragEnterEvent *getDragEnterEventObject(void)
- QDragLeaveEvent *getDragLeaveEventObject(void)
- QChildEvent *getChildEventObject(void)

83.16 QApp Class

C++ Reference : <http://doc.qt.io/qt-5/qapplication.html>

Parent Class : QGuiApplication

- void exec(void)
- void quit(void)
- void processEvents(void)
- void styleWindows(void)
- void styleWindowsVista(void)
- void styleFusion(void)
- void styleFusionBlack(void)
- void styleFusionCustom(QColor,QColor,QColor,QColor,QColor,QColor,QColor,QColor,QColor,QColor,QColor)
- void closeAllWindows(void)
- Qt::KeyboardModifiers keyboardModifiers(void)

83.17 QAreaLegendMarker Class

C++ Reference : <http://doc.qt.io/qt-5/qarealegendmarker.html>

Parent Class : QLegendMarker

- QAreaSeries * series(void)
- QLegendMarker::LegendMarkerType type(void)

83.18 QAreaSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qareaseries.html>

Parameters : QObject *

Parent Class : QAbstractSeries

- QColor borderColor(void)
- QBrush brush(void)
- QColor color(void)
- QLineSeries * lowerSeries(void)
- QPen pen(void)
- bool pointLabelsClipping(void)

- QColor pointLabelsColor(void)
- QFont pointLabelsFont(void)
- QString pointLabelsFormat(void)
- bool pointLabelsVisible(void)
- bool pointsVisible(void)
- void setBorderColor(QColor color)
- void setBrush(QBrush brush)
- void setColor(QColor color)
- void setLowerSeries(QLineSeries *series)
- void setPen(QPen pen)
- void setPointLabelsClipping(bool enabled)
- void setPointLabelsColor(QColor color)
- void setPointLabelsFont(QFont font)
- void setPointLabelsFormat(QString format)
- void setPointLabelsVisible(bool visible)
- void setPointsVisible(bool visible)
- void setUpperSeries(QLineSeries *series)
- QLineSeries * upperSeries(void)
- void setborderColorChangedEvent(const char *)
- void setclickedEvent(const char *)
- void setcolorChangedEvent(const char *)
- void setdoubleClickedEvent(const char *)
- void sethoveredEvent(const char *)
- void setpointLabelsClippingChangedEvent(const char *)
- void setpointLabelsColorChangedEvent(const char *)
- void setpointLabelsFontChangedEvent(const char *)
- void setpointLabelsFormatChangedEvent(const char *)
- void setpointLabelsVisibilityChangedEvent(const char *)
- void setpressedEvent(const char *)
- void setreleasedEvent(const char *)
- const char *getborderColorChangedEvent(void)
- const char *getclickedEvent(void)
- const char *getcolorChangedEvent(void)
- const char *getdoubleClickedEvent(void)
- const char *gethoveredEvent(void)
- const char *getpointLabelsClippingChangedEvent(void)

- const char *getpointLabelsColorChangedEvent(void)
- const char *getpointLabelsFontChangedEvent(void)
- const char *getpointLabelsFormatChangedEvent(void)
- const char *getpointLabelsVisibilityChangedEvent(void)
- const char *getpressedEvent(void)
- const char *getreleasedEvent(void)

83.19 QAspectEngine Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dcore-qaspectengine.html>

Parameters : QObject *

Parent Class : QObject

- QVector<Qt3DCore::QAbstractAspect *> aspects(void)
- QVariant executeCommand(QString command)
- void registerAspect(Qt3DCore::QAbstractAspect *aspect)
- void registerAspect_2(QString name)
- Qt3DCore::QEntityPtr rootEntity(void)
- void setRootEntity(Qt3DCore::QEntityPtr root)
- void unregisterAspect(Qt3DCore::QAbstractAspect *aspect)
- void unregisterAspect_2(QString name)

83.20 QAxBase Class

C++ Reference : <http://doc.qt.io/qt-5/qaxbase.html>

Parameters : QWidget *

Parent Class : QObject

- QVariant asVariant(void)
- QString control(void)
- void disableClassInfo(void)
- void disableEventSink(void)
- void disableMetaObject(void)
- QVariant dynamicCall(char *function)
- QVariant dynamicCall_2(char *function,QVariant)
- QVariant dynamicCall_3(char *function,QVariant,QVariant)
- QVariant dynamicCall_4(char *function,QVariant,QVariant,QVariant)
- QVariant dynamicCall_5(char *function,QVariant,QVariant,QVariant,QVariant)
- QVariant dynamicCall_6(char *function,QVariant,QVariant,QVariant,QVariant)

- QVariant dynamicCall_7(char *function,QVariant,QVariant,QVariant,QVariant,QVariant,QVariant)
- QVariant dynamicCall_8(char *function,QVariant,QVariant,QVariant,QVariant,QVariant,QVariant,QVariant)
- QVariant dynamicCall_9(char *function,QVariant,QVariant,QVariant,QVariant,QVariant,QVariant,QVariant,QVariant)
- QVariant dynamicCall_10(const char *function, QList<QVariant>)
- QString generateDocumentation(void)
- boolisNull(void)
- QAxObject *querySubObject(const char *name)
- QAxObject *querySubObject_2(const char *name,QVariant)
- QAxObject *querySubObject_3(const char *name,QVariant,QVariant)
- QAxObject *querySubObject_4(const char *name,QVariant,QVariant,QVariant)
- QAxObject *querySubObject_5(const char *name,QVariant,QVariant,QVariant,QVariant)
- QAxObject *querySubObject_6(const char *name,QVariant,QVariant,QVariant,QVariant,QVariant)
- QAxObject *querySubObject_7(const char *name,QVariant,QVariant,QVariant,QVariant,QVariant,QVariant)
- QAxObject *querySubObject_8(const char *name,QVariant,QVariant,QVariant,QVariant,QVariant,QVariant,QVariant)
- QAxObject *querySubObject_9(const char *name,QVariant,QVariant,QVariant,QVariant,QVariant,QVariant,QVariant,QVariant)
- bool setControl(QString)
- QStringList verbs(void)

83.21 QAxObject Class

C++ Reference : <http://doc.qt.io/qt-5/qaxobject.html>

Parameters : QString

Parent Class : QAxBASE

- bool doVerb(QString)

83.22 QAxWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qaxwidget.html>

Parameters : QWidget *parent, Qt::WindowFlags f

Parent Class : QAxBASE

- bool doVerb(QString)

83.23 QAxWidget2 Class

Parameters : QString c, QWidget *parent, Qt::WindowFlags f

Parent Class : QAxWidget

83.24 QBarCategoryAxis Class

C++ Reference : <http://doc.qt.io/qt-5/qbarcategoryaxis.html>

Parameters : QObject *

Parent Class : QAbstractAxis

- void append(QStringList categories)
- void append_2(QString category)
- QString at(int index)
- QStringList categories(void)
- void clear(void)
- int count(void)
- void insert(int index, QString category)
- QString max(void)
- QString min(void)
- void remove(QString category)
- void replace(QString oldCategory, QString newCategory)
- void setCategories(QStringList categories)
- void setMax(QString max)
- void setMin(QString min)
- void setRange(QString minCategory, QString maxCategory)
- void setcategoriesChangedEvent(const char *)
- void setcountChangedEvent(const char *)
- void setmaxChangedEvent(const char *)
- void setminChangedEvent(const char *)
- void setrangeChangedEvent(const char *)
- const char *getcategoriesChangedEvent(void)
- const char *getcountChangedEvent(void)
- const char *getmaxChangedEvent(void)
- const char *getminChangedEvent(void)
- const char *getrangeChangedEvent(void)

83.25 QBarLegendMarker Class

C++ Reference : <http://doc.qt.io/qt-5/qbarlegendmarker.html>

Parent Class : QLegendMarker

- QBarSet * barset(void)
- QAbstractBarSeries * series(void)

83.26 QBarSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qbarseries.html>

Parameters : QObject *

Parent Class : QAbstractBarSeries

- QAbstractSeries::SeriesType type(void)

83.27 QBarSet Class

C++ Reference : <http://doc.qt.io/qt-5/qbarset.html>

Parameters : QString,QObject *

Parent Class : QObject

- void append(qreal value)
- void append_2(QList<qreal> values)
- qreal at(int index)
- QColor borderColor(void)
- QBrush brush(void)
- QColor color(void)
- int count(void)
- void insert(int index, qreal value)
- QString label(void)
- QBrush labelBrush(void)
- QColor labelColor(void)
- QFont labelFont(void)
- QPen pen(void)
- void remove(int index, int count)
- void replace(int index, qreal value)
- void setBorderColor(QColor color)
- void setBrush(QBrush brush)
- void setColor(QColor color)

- void setLabel(QString label)
- void setLabelBrush(QBrush brush)
- void setLabelColor(QColor color)
- void setLabelFont(QFont font)
- void setPen(QPen pen)
- qreal sum(void)
- void setborderColorChangedEvent(const char *)
- void setbrushChangedEvent(const char *)
- void setclickedEvent(const char *)
- void setcolorChangedEvent(const char *)
- void setdoubleClickedEvent(const char *)
- void sethoveredEvent(const char *)
- void setlabelBrushChangedEvent(const char *)
- void setlabelChangedEvent(const char *)
- void setlabelColorChangedEvent(const char *)
- void setlabelFontChangedEvent(const char *)
- void setpenChangedEvent(const char *)
- void setpressedEvent(const char *)
- void setreleasedEvent(const char *)
- void setvalueChangedEvent(const char *)
- void setvaluesAddedEvent(const char *)
- void setvaluesRemovedEvent(const char *)
- const char *getborderColorChangedEvent(void)
- const char *getbrushChangedEvent(void)
- const char *getclickedEvent(void)
- const char *getcolorChangedEvent(void)
- const char *getdoubleClickedEvent(void)
- const char *gethoveredEvent(void)
- const char *getlabelBrushChangedEvent(void)
- const char *getlabelChangedEvent(void)
- const char *getlabelColorChangedEvent(void)
- const char *getlabelFontChangedEvent(void)
- const char *getpenChangedEvent(void)
- const char *getpressedEvent(void)
- const char *getreleasedEvent(void)
- const char *getvalueChangedEvent(void)

- const char *getvaluesAddedEvent(void)
- const char *getvaluesRemovedEvent(void)

83.28 QBitmap Class

C++ Reference : <http://doc.qt.io/qt-5/qbitmap.html>

Parameters : void

Parent Class : QPixmap

- void clear(void)
- void swap(QBitmap)
- QBitmap transformed(QTransform)
- QBitmap fromData(QSize, const uchar * bits, QImage::Format monoFormat)
- QBitmap fromImage(QImage, Qt::ImageConversionFlags flags)

83.29 QBluetoothAddress Class

C++ Reference : <http://doc.qt.io/qt-5/qbluetoothaddress.html>

Parameters : void

- void clear(void)
- boolisNull(void)
- QString toString(void)
- quint64 toUInt64(void)

83.30 QBluetoothDeviceDiscoveryAgent Class

C++ Reference : <http://doc.qt.io/qt-5/qbluetoothdevicediscoveryagent.html>

Parameters : QObject *

- QList<QBluetoothDeviceInfo> discoveredDevices(void)
- QBluetoothDeviceDiscoveryAgent::Error error(void)
- QString errorString(void)
- QBluetoothDeviceDiscoveryAgent::InquiryType inquiryType(void)
- bool isActive(void)
- void setInquiryType(QBluetoothDeviceDiscoveryAgent::InquiryType type)
- void start(void)
- void stop(void)
- void setcanceledEvent(const char *)
- void setdeviceDiscoveredEvent(const char *)

- void seterrorEvent(const char *)
- void setfinishedEvent(const char *)
- const char *getcanceledEvent(void)
- const char *getdeviceDiscoveredEvent(void)
- const char *geterrorEvent(void)
- const char *getfinishedEvent(void)

83.31 QBluetoothDeviceInfo Class

C++ Reference : <http://doc.qt.io/qt-5/qbluetoothdeviceinfo.html>

Parameters : void

- QBluetoothAddress address(void)
- bool isValid(void)
- QBluetoothDeviceInfo::MajorDeviceClass majorDeviceClass(void)
- quint8 minorDeviceClass(void)
- QString name(void)
- qint16 rssi(void)
- QBluetoothDeviceInfo::ServiceClasses serviceClasses(void)
- QList<QBluetoothUuid> serviceUuids(QBluetoothDeviceInfo::DataCompleteness *completeness)
- QBluetoothDeviceInfo::DataCompleteness serviceUuidsCompleteness(void)
- void setCached(bool cached)
- void setServiceUuids(QList<QBluetoothUuid> uuids, QBluetoothDeviceInfo::DataCompleteness completeness)

83.32 QBluetoothHostInfo Class

C++ Reference : <http://doc.qt.io/qt-5/qbluetoothhostinfo.html>

Parameters : void

- QBluetoothAddress address(void)
- QString name(void)
- void setAddress(QBluetoothAddress address)
- void setName(QString name)

83.33 QBluetoothLocalDevice Class

C++ Reference : <http://doc.qt.io/qt-5/qbluetoothlocaldevice.html>

Parameters : QObject *

- QBluetoothAddress address(void)
- QBluetoothLocalDevice::HostMode hostMode(void)
- bool isValid(void)
- QString name(void)
- QBluetoothLocalDevice::Pairing pairingStatus(QBluetoothAddress address)
- void powerOn(void)
- void requestPairing(QBluetoothAddress address, QBluetoothLocalDevice::Pairing pairing)
- void setHostMode(QBluetoothLocalDevice::HostMode mode)
- void pairingConfirmation(bool accept)
- QList<QBluetoothHostInfo> allDevices(void)
- void setdeviceConnectedEvent(const char *)
- void setdeviceDisconnectedEvent(const char *)
- void seterrorEvent(const char *)
- void sethostModeStateChangedEvent(const char *)
- void setpairingDisplayConfirmationEvent(const char *)
- void setpairingDisplayPinCodeEvent(const char *)
- void setpairingFinishedEvent(const char *)
- const char *getdeviceConnectedEvent(void)
- const char *getdeviceDisconnectedEvent(void)
- const char *geterrorEvent(void)
- const char *gethostModeStateChangedEvent(void)
- const char *getpairingDisplayConfirmationEvent(void)
- const char *getpairingDisplayPinCodeEvent(void)
- const char *getpairingFinishedEvent(void)

83.34 QBluetoothServer Class

C++ Reference : <http://doc.qt.io/qt-5/qbluetoothserver.html>

Parameters : QBluetoothServiceInfo::Protocol,QObject *

Parent Class : QObject

- void close(void)
- QBluetoothServer::Error error(void)
- bool hasPendingConnections(void)

- bool isListening(void)
- bool listen(QBluetoothAddress address, quint16 port)
- QBluetoothServiceInfo listen_2(QBluetoothUuid uuid, QString serviceName))
- int maxPendingConnections(void)
- QBluetoothSocket * nextPendingConnection(void)
- QBluetooth::SecurityFlags securityFlags(void)
- QBluetoothAddress serverAddress(void)
- quint16 serverPort(void)
- QBluetoothServiceInfo::Protocol serverType(void)
- void setMaxPendingConnections(int numConnections)
- void setSecurityFlags(QBluetooth::SecurityFlags security)
- void seterrorEvent(const char *)
- void setnewConnectionEvent(const char *)
- const char *geterrorEvent(void)
- const char *getnewConnectionEvent(void)

83.35 QBluetoothServiceDiscoveryAgent Class

C++ Reference : <http://doc.qt.io/qt-5/qbluetoothservicediscoveryagent.html>

Parameters : QObject *

Parent Class : QObject

- QList<QBluetoothServiceInfo> discoveredServices(void)
- QBluetoothServiceDiscoveryAgent::Error error(void)
- QString errorString(void)
- bool isActive(void)
- QBluetoothAddress remoteAddress(void)
- bool setRemoteAddress(QBluetoothAddress address)
- void setUuidFilter(QList<QBluetoothUuid> uuids)
- void setUuidFilter_2(QBluetoothUuid uuid)
- QList<QBluetoothUuid> uuidFilter(void)
- void clear(void)
- void start(QBluetoothServiceDiscoveryAgent::DiscoveryMode mode)
- void stop(void)
- void setcanceledEvent(const char *)
- void seterrorEvent(const char *)
- void setfinishedEvent(const char *)

- void setserviceDiscoveredEvent(const char *)
- const char *getcanceledEvent(void)
- const char *geterrorEvent(void)
- const char *getfinishedEvent(void)
- const char *getserviceDiscoveredEvent(void)

83.36 QBluetoothServiceInfo Class

C++ Reference : <http://doc.qt.io/qt-5/qbluetoothserviceinfo.html>

Parameters : void

- QVariant attribute(quint16 attributeId)
- QList<quint16> attributes(void)
- bool contains(quint16 attributeId)
- QBluetoothDeviceInfo device(void)
- bool isComplete(void)
- bool isRegistered(void)
- bool isValid(void)
- QBluetoothServiceInfo::Sequence protocolDescriptor(QBluetoothUuid::ProtocolUuid protocol)
- int protocolServiceMultiplexer(void)
- bool registerService(QBluetoothAddress localAdapter))
- void removeAttribute(quint16 attributeId)
- int serverChannel(void)
- quint8 serviceAvailability(void)
- QList<QBluetoothUuid> serviceClassUuids(void)
- QString serviceDescription(void)
- QString serviceName(void)
- QString serviceProvider(void)
- QBluetoothUuid serviceUuid(void)
- void setAttribute(quint16 attributeId, QVariant value)
- void setAttribute_2(quint16 attributeId, QBluetoothUuid value)
- void setAttribute_3(quint16 attributeId, QBluetoothServiceInfo::Sequence value)
- void setDevice(QBluetoothDeviceInfo device)
- void setServiceAvailability(quint8 availability)
- void setServiceDescription(QString description)
- void setServiceName(QString name)
- void setServiceProvider(QString provider)

- void setServiceUuid(QBluetoothUuid uuid)
- bool unregisterService(void)

83.37 QBluetoothSocket Class

C++ Reference : <http://doc.qt.io/qt-5/qbluetoothsocket.html>

Parameters : QBluetoothServiceInfo::Protocol,QObject *

Parent Class : QIODevice

- void abort(void)
- void connectToService(QBluetoothServiceInfo service, QIODevice::OpenMode openMode)
- void connectToService_2(QBluetoothAddress address, QBluetoothUuid uuid, QIODevice::OpenMode openMode)
- void connectToService_3(QBluetoothAddress address, quint16 port, QIODevice::OpenMode openMode)
- void disconnectFromService(void)
- QBluetoothSocket::SocketError error(void)
- QString errorString(void)
- QBluetoothAddress localAddress(void)
- QString localName(void)
- quint16 localPort(void)
- QBluetoothAddress peerAddress(void)
- QString peerName(void)
- quint16 peerPort(void)
- bool setSocketDescriptor(int socketDescriptor, QBluetoothServiceInfo::Protocol socketType, QBluetoothSocket::SocketState socketState, QIODevice::OpenMode openMode)
- int socketDescriptor(void)
- QBluetoothServiceInfo::Protocol socketType(void)
- QBluetoothSocket::SocketState state(void)
- void setconnectedEvent(const char *)
- void setdisconnectedEvent(const char *)
- void seterrorEvent(const char *)
- void setstateChangedEvent(const char *)
- const char *getconnectedEvent(void)
- const char *getdisconnectedEvent(void)
- const char *geterrorEvent(void)
- const char *getstateChangedEvent(void)

83.38 QBluetoothTransferManager Class

C++ Reference : <http://doc.qt.io/qt-5/qbluetoothtransfermanager.html>

Parameters : QObject *

Parent Class : QObject

- QBluetoothTransferReply * put(QBluetoothTransferRequest request, QIODevice *data)
- void setfinishedEvent(const char *)
- const char *getfinishedEvent(void)

83.39 QBluetoothTransferReply Class

C++ Reference : <http://doc.qt.io/qt-5/qbluetoothtransferreply.html>

Parameters : QObject *

Parent Class : QObject

- QBluetoothTransferManager * manager(void)
- QBluetoothTransferRequest request(void)
- void abort(void)
- void seterrorEvent(const char *)
- void setfinishedEvent(const char *)
- void settransferProgressEvent(const char *)
- const char *geterrorEvent(void)
- const char *getfinishedEvent(void)
- const char *gettransferProgressEvent(void)

83.40 QBluetoothTransferRequest Class

C++ Reference : <http://doc.qt.io/qt-5/qbluetoothtransferrequest.html>

Parameters : QBluetoothAddress

- QBluetoothAddress address(void)
- QVariant attribute(QBluetoothTransferRequest::Attribute code, QVariant defaultValue))
- void setAttribute(QBluetoothTransferRequest::Attribute code, QVariant value)

83.41 QBluetoothUuid Class

C++ Reference : <http://doc.qt.io/qt-5/qbluetoothuuid.html>

Parameters : void

Parent Class : QUuid

- int minimumSize(void)
- quint16 toUInt16(bool *ok)
- quint32 toUInt32(bool *ok)
- quint128 toUInt128(void)

83.42 QBoxLayout Class

C++ Reference : <http://doc.qt.io/qt-5/qboxlayout.html>

Parameters : QBoxLayout::Direction dir, QWidget *parent

Parent Class : QLayout

- void addLayout(QLayout * layout, int stretch)
- void addSpacerItem(QSpacerItem * spacerItem)
- void addSpacing(int size)
- void addStretch(int stretch)
- void addStrut(int size)
- void addWidget(QWidget * widget, int stretch , Qt::Alignment alignment)
- QBoxLayout::Direction direction(void)
- void insertLayout(int index, QLayout * layout, int stretch)
- void insertSpacerItem(int index, QSpacerItem * spacerItem)
- void insertSpacing(int index, int size)
- void insertStretch(int index, int stretch)
- void insertWidget(int index, QWidget * widget, int stretch , Qt::Alignment alignment)
- void setDirection(QBoxLayout::Direction direction)
- void setSpacing(int spacing)
- void setStretch(int index, int stretch)
- bool setStretchFactor(QWidget * widget, int stretch)
- bool setStretchFactor_2(FlowLayout * layout, int stretch)
- int spacing(void)
- int stretch(int index)

83.43 QBoxPlotLegendMarker Class

C++ Reference : <http://doc.qt.io/qt-5/qboxplotlegendmarker.html>

Parent Class : QLegendMarker

- QBoxPlotSeries * series(void)
- QLegendMarker::LegendMarkerType type(void)

83.44 QBoxPlotSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qboxplotseries.html>

Parameters : QObject *

Parent Class : QAbstractSeries

- bool append(QBoxSet *set)
- bool append_2(QList<QBoxSet *> sets)
- bool boxOutlineVisible(void)
- QList<QBoxSet *> boxSets(void)
- qreal boxWidth(void)
- QBrush brush(void)
- void clear(void)
- int count(void)
- bool insert(int index, QBoxSet *set)
- QPen pen(void)
- bool remove(QBoxSet *set)
- void setBoxOutlineVisible(bool visible)
- void setBoxWidth(qreal width)
- void setBrush(QBrush brush)
- void setPen(QPen pen)
- bool take(QBoxSet *set)
- QAbstractSeries::SeriesType type(void)
- void setboxOutlineVisibilityChangedEvent(const char *)
- void setboxWidthChangedEvent(const char *)
- void setboxsetsAddedEvent(const char *)
- void setboxsetsRemovedEvent(const char *)
- void setbrushChangedEvent(const char *)
- void setclickedEvent(const char *)
- void setcountChangedEvent(const char *)
- void setdoubleClickedEvent(const char *)

- void sethoveredEvent(const char *)
- void setpenChangedEvent(const char *)
- void setpressedEvent(const char *)
- void setreleasedEvent(const char *)
- const char *getboxOutlineVisibilityChangedEvent(void)
- const char *getboxWidthChangedEvent(void)
- const char *getboxsetsAddedEvent(void)
- const char *getboxsetsRemovedEvent(void)
- const char *getbrushChangedEvent(void)
- const char *getclickedEvent(void)
- const char *getcountChangedEvent(void)
- const char *getdoubleClickedEvent(void)
- const char *gethoveredEvent(void)
- const char *getpenChangedEvent(void)
- const char *getpressedEvent(void)
- const char *getreleasedEvent(void)

83.45 QBoxSet Class

C++ Reference : <http://doc.qt.io/qt-5/qboxset.html>

Parameters : QString,QObject *

Parent Class : QObject

- void append(qreal value)
- void append_2(QList<qreal> values)
- qreal at(int index)
- QBrush brush(void)
- void clear(void)
- int count(void)
- QString label(void)
- QPen pen(void)
- void setBrush(QBrush brush)
- void setLabel(QString label)
- void setPen(QPen pen)
- void setValue(int index, qreal value)
- void setbrushChangedEvent(const char *)
- void setclearedEvent(const char *)

- void setclickedEvent(const char *)
- void setdoubleClickedEvent(const char *)
- void sethoveredEvent(const char *)
- void setpenChangedEvent(const char *)
- void setpressedEvent(const char *)
- void setreleasedEvent(const char *)
- void setvalueChangedEvent(const char *)
- void setvaluesChangedEvent(const char *)
- const char *getbrushChangedEvent(void)
- const char *getclearedEvent(void)
- const char *getclickedEvent(void)
- const char *getdoubleClickedEvent(void)
- const char *gethoveredEvent(void)
- const char *getpenChangedEvent(void)
- const char *getpressedEvent(void)
- const char *getreleasedEvent(void)
- const char *getvalueChangedEvent(void)
- const char *getvaluesChangedEvent(void)

83.46 QBrush Class

C++ Reference : <http://doc.qt.io/qt-5/qbrush.html>

Parameters : void

- QColor color(void)
- QGradient *gradient(void)
- bool isOpaque(void)
- QMatrix matrix(void)
- void setColor(QColor)
- void setMatrix(QMatrix)
- void setStyle(Qt::BrushStyle style)
- void setTexture(QPixmap)
- void setTextureImage(QImage)
- void setTransform(QTransform)
- int style(void)
- void swap(QBrush)
- QPixmap texture(void)

- QImage textureImage(void)
- QTransform transform(void)

83.47 QBuffer Class

C++ Reference : <http://doc.qt.io/qt-5/qbuffer.html>

Parameters : QObject *

Parent Class : QIODevice

- QByteArray buffer(void)
- QByteArray data(void)
- void setBuffer(QByteArray *byteArray)
- void setData(QByteArray data)
- void setData_2(char *data, int size)

83.48 QButtonGroup Class

C++ Reference : <http://doc.qt.io/qt-5/qbuttongroup.html>

Parameters : QObject *parent

- void addButton(QAbstractButton *button, int id)
- QAbstractButton *button(int id)
- QAbstractButton *checkedButton(void)
- int checkedId(void)
- bool exclusive(void)
- int id(QAbstractButton *button)
- void removeButton(QAbstractButton *button)
- void setExclusive(bool)
- void setId(QAbstractButton *button, int id)
- void setbuttonClickedEvent(const char *)
- void setbuttonPressedEvent(const char *)
- void setbuttonReleasedEvent(const char *)
- const char *getbuttonClickedEvent(void)
- const char *getbuttonPressedEvent(void)
- const char *getbuttonReleasedEvent(void)

83.49 QByteArray Class

C++ Reference : <http://doc.qt.io/qt-5/qbytearray.html>

Parameters : void

- QByteArray append(const char *str)
- char at(int i)
- int capacity(void)
- void chop(int n)
- void clear(void)
- const char *constData(void)
- bool contains(const char *str)
- int count(const char *str)
- const char *data(void)
- bool endsWith(const char *str)
- QByteArray fill(char ch, int size)
- int indexOf(const char *str, int from)
- QByteArray insert(int i, const char *str, int len)
- bool isEmpty(void)
- boolisNull(void)
- int lastIndexOf(const char *str, int from)
- QByteArray left(int len)
- QByteArray leftJustified(int width, char fill, bool truncate)
- int length(void)
- QByteArray mid(int pos, int len)
- QByteArray prepend(const char *str, int len)
- void push_back(const char *str)
- void push_front(const char *str)
- QByteArray remove(int pos, int len)
- QByteArray repeated(int times)
- QByteArray replace(int pos, int len, const char *after, int alen)
- void reserve(int size)
- void resize(int size)
- QByteArray right(int len)
- QByteArray rightJustified(int width, char fill, bool truncate)
- QByteArray setNum(int n, int base)
- QByteArray setRawData(const char *data, uint size)

- QByteArray simplified(void)
- int size(void)
- void squeeze(void)
- bool startsWith(const char *str)
- void swap(QByteArray other)
- QByteArray toBase64(void)
- double toDouble(bool * ok)
- float toFloat(bool * ok)
- QByteArray toHex(void)
- int toInt(bool *ok, int base)
- long toLong(bool *ok, int base)
- qlonglong toLongLong(bool *ok, int base)
- QByteArray toLower(void)
- QByteArray toPercentEncoding(QByteArray,QByteArray, char percent)
- short toShort(bool *ok, int base)
- int toUInt(bool *ok, int base)
- int toULong(bool *ok, int base)
- int toULongLong(bool * ok, int base)
- int toUShort(bool * ok, int base)
- QByteArray toUpper(void)
- QByteArray trimmed(void)
- void truncate(int pos)
- QByteArray fromBase64(QByteArray)
- QByteArray fromHex(QByteArray)
- QByteArray fromPercentEncoding(QByteArray, char percent)
- QByteArray fromRawData(const char *data, int size)
- QByteArray number(int n, int base)

83.50 QCalendarWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qcalendarwidget.html>

Parameters : QWidget *

Parent Class : QWidget

- int dateEditAcceptDelay(void)
- QMap<QDate, QTextCharFormat> dateTextFormat(void)
- QTextCharFormat dateTextFormat_2(QDate date)

- `Qt::DayOfWeek firstDayOfWeek(void)`
- `QTextCharFormat headerTextFormat(void)`
- `QCalendarWidget::HorizontalHeaderFormat horizontalHeaderFormat(void)`
- `bool isDateEditEnabled(void)`
- `bool isGridVisible(void)`
- `bool isNavigationBarVisible(void)`
- `QDate maximumDate(void)`
- `QDate minimumDate(void)`
- `int monthShown(void)`
- `QDate selectedDate(void)`
- `QCalendarWidget::SelectionMode selectionMode(void)`
- `void setDateEditAcceptDelay(int delay)`
- `void setDateEditEnabled(bool enable)`
- `void setDateTextFormat(QDate date, QTextCharFormat format)`
- `void setFirstDayOfWeek(Qt::DayOfWeek dayOfWeek)`
- `void setHeaderTextFormat(QTextCharFormat format)`
- `void setHorizontalHeaderFormat(QCalendarWidget::HorizontalHeaderFormat format)`
- `void setMaximumDate(QDate date)`
- `void setMinimumDate(QDate date)`
- `void setSelectionMode(QCalendarWidget::SelectionMode mode)`
- `void setVerticalHeaderFormat(QCalendarWidget::VerticalHeaderFormat format)`
- `void setWeekdayTextFormat(Qt::DayOfWeek dayOfWeek, QTextCharFormat format)`
- `QCalendarWidget::VerticalHeaderFormat verticalHeaderFormat(void)`
- `QTextCharFormat weekdayTextFormat(Qt::DayOfWeek dayOfWeek)`
- `int yearShown(void)`
- `void setCurrentPage(int year, int month)`
- `void setDateRange(QDate min, QDate max)`
- `void setGridVisible(bool show)`
- `void setNavigationBarVisible(bool visible)`
- `void setSelectedDate(QDate date)`
- `void showNextMonth(void)`
- `void showNextYear(void)`
- `void showPreviousMonth(void)`
- `void showPreviousYear(void)`
- `void showSelectedDate(void)`
- `void showToday(void)`

- void setactivatedEvent(const char *)
- void setclickedEvent(const char *)
- void setcurrentPageChangedEvent(const char *)
- void setselectionChangedEvent(const char *)
- const char *getactivatedEvent(void)
- const char *getclickedEvent(void)
- const char *getcurrentPageChangedEvent(void)
- const char *getselectionChangedEvent(void)

83.51 QCamera Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qcamera.html>

Parameters : void

Parent Class : QMediaObject

- QCamera::CaptureModes captureMode(void)
- QCamera::Error error(void)
- QString errorString(void)
- QCameraExposure * exposure(void)
- QCameraFocus * focus(void)
- QCameraImageProcessing * imageProcessing(void)
- bool isCaptureModeSupported(QCamera::CaptureModes mode)
- QCamera::LockStatus lockStatus(void)
- QCamera::LockStatus lockStatus_2(QCamera::LockType lockType)
- QCamera::LockTypes requestedLocks(void)
- void setViewfinder(QVideoWidget * viewfinder)
- void setViewfinder_2(QGraphicsVideoItem * viewfinder)
- void setViewfinder_3(QAbstractVideoSurface * surface)
- QCamera::State state(void)
- QCamera::Status status(void)
- QCamera::LockTypes supportedLocks(void)
- void load(void)
- void searchAndLock(void)
- void searchAndLock_2(QCamera::LockTypes locks)
- void setCaptureMode(QCamera::CaptureModes mode)
- void start(void)
- void stop(void)

- void unload(void)
- void unlock(void)
- void unlock_2(QCamera::LockTypes locks)

83.52 QCameralmageCapture Class

C++ Reference : <http://doc.qt.io/qt-5/qcameralmagecapture.html>

Parameters : QMediaObject * mediaObject

- QMultimedia::AvailabilityStatus availability(void)
- QVideoFrame::PixelFormat bufferFormat(void)
- QCameralmageCapture::CaptureDestinations captureDestination(void)
- QImageEncoderSettings encodingSettings(void)
- QCameralmageCapture::Error error(void)
- QString errorString(void)
- QString imageCodecDescription(QString codec)
- bool isAvailable(void)
- bool isCaptureDestinationSupported(QCameralmageCapture::CaptureDestinations destination)
- bool isReadyForCapture(void)
- void setBufferFormat(QVideoFrame::PixelFormat format)
- void setCaptureDestination(QCameralmageCapture::CaptureDestinations destination)
- void setEncodingSettings(QImageEncoderSettings settings)
- QList<QVideoFrame::PixelFormat> supportedBufferFormats(void)
- QStringList supportedImageCodecs(void)
- QList<QSize> supportedResolutions(QImageEncoderSettings settings , bool * continuous)
- void cancelCapture(void)
- int capture(QString file)

83.53 QCameralens Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qcameralens.html>

Parameters : Qt3DCore::QNode *

- float aspectRatio(void)
- float bottom(void)
- float exposure(void)
- float farPlane(void)
- float fieldOfView(void)
- float left(void)

- float nearPlane(void)
- QMatrix4x4 projectionMatrix(void)
- Qt3DRender::QCameraLens::ProjectionType projectionType(void)
- float right(void)
- void setFrustumProjection(float left, float right, float bottom, float top, float nearPlane, float farPlane)
- void setOrthographicProjection(float left, float right, float bottom, float top, float nearPlane, float farPlane)
- void setPerspectiveProjection(float fieldOfView, float aspectRatio, float nearPlane, float farPlane)
- float top(void)
- void setBottom(float bottom)
- void setExposure(float exposure)
- void setFarPlane(float farPlane)
- void setFieldOfView(float fieldOfView)
- void setLeft(float left)
- void setNearPlane(float nearPlane)
- void setProjectionMatrix(QMatrix4x4 projectionMatrix)
- void setProjectionType(Qt3DRender::QCameraLens::ProjectionType projectionType)
- void setRight(float right)
- void setTop(float top)

83.54 QCameraSelector Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qcameraselector.html>

Parameters : Qt3DCore::QNode *

- Qt3DCore::QEntity * camera(void)
- void setCamera(Qt3DCore::QEntity *camera)

83.55 QCameraViewfinder Class

C++ Reference : <http://doc.qt.io/qt-5/qcameraviewfinder.html>

Parameters : QWidget *

Parent Class : QVideoWidget

83.56 QCandlestickLegendMarker Class

C++ Reference : <http://doc.qt.io/qt-5/qcandlesticklegendmarker.html>

Parent Class : QLegendMarker

- QCandlestickSeries * series(void)
- QLegendMarker::LegendMarkerType type(void)

83.57 QCandlestickModelMapper Class

C++ Reference : <http://doc.qt.io/qt-5/qcandlestickmodelmapper.html>

Parameters : QObject *

Parent Class : QObject

- QAbstractItemModel * model(void)
- Qt::Orientation orientation(void)
- QCandlestickSeries * series(void)
- void setModel(QAbstractItemModel *model)
- void setSeries(QCandlestickSeries *series)
- void setmodelReplacedEvent(const char *)
- void setseriesReplacedEvent(const char *)
- const char *getmodelReplacedEvent(void)
- const char *getseriesReplacedEvent(void)

83.58 QCandlestickSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qcandlestickseries.html>

Parameters : QObject *

Parent Class : QAbstractSeries

- bool append(QCandlestickSet *set)
- bool append_2(QList<QCandlestickSet *> sets)
- bool bodyOutlineVisible(void)
- qreal bodyWidth(void)
- QBrush brush(void)
- bool capsVisible(void)
- qreal capsWidth(void)
- void clear(void)
- int count(void)
- QColor decreasingColor(void)

- QColor increasingColor(void)
- bool insert(int index, QCandlestickSet *set)
- qreal maximumColumnWidth(void)
- qreal minimumColumnWidth(void)
- QPen pen(void)
- bool remove(QCandlestickSet *set)
- bool remove_2(QList<QCandlestickSet *> sets)
- void setBodyOutlineVisible(bool bodyOutlineVisible)
- void setBodyWidth(qreal bodyWidth)
- void setBrush(QBrush brush)
- void setCapsVisible(bool capsVisible)
- void setCapsWidth(qreal capsWidth)
- void setDecreasingColor(QColor decreasingColor)
- void setIncreasingColor(QColor increasingColor)
- void setMaximumColumnWidth(qreal maximumColumnWidth)
- void setMinimumColumnWidth(qreal minimumColumnWidth)
- void setPen(QPen pen)
- QList<QCandlestickSet *> sets(void)
- bool take(QCandlestickSet *set)
- void setbodyOutlineVisibilityChangedEvent(const char *)
- void setbodyWidthChangedEvent(const char *)
- void setbrushChangedEvent(const char *)
- void setcandlestickSetsAddedEvent(const char *)
- void setcandlestickSetsRemovedEvent(const char *)
- void setcapsVisibilityChangedEvent(const char *)
- void setcapsWidthChangedEvent(const char *)
- void setclickedEvent(const char *)
- void setcountChangedEvent(const char *)
- void setdecreasingColorChangedEvent(const char *)
- void setdoubleClickedEvent(const char *)
- void sethoveredEvent(const char *)
- void setincreasingColorChangedEvent(const char *)
- void setmaximumColumnWidthChangedEvent(const char *)
- void setminimumColumnWidthChangedEvent(const char *)
- void setpenChangedEvent(const char *)
- void setpressedEvent(const char *)

- void setreleasedEvent(const char *)
- const char *getbodyOutlineVisibilityChangedEvent(void)
- const char *getbodyWidthChangedEvent(void)
- const char *getbrushChangedEvent(void)
- const char *getcandlestickSetsAddedEvent(void)
- const char *getcandlestickSetsRemovedEvent(void)
- const char *getcapsVisibilityChangedEvent(void)
- const char *getcapsWidthChangedEvent(void)
- const char *getclickedEvent(void)
- const char *getcountChangedEvent(void)
- const char *getdecreasingColorChangedEvent(void)
- const char *getdoubleClickedEvent(void)
- const char *gethoveredEvent(void)
- const char *getincreasingColorChangedEvent(void)
- const char *getmaximumColumnWidthChangedEvent(void)
- const char *getminimumColumnWidthChangedEvent(void)
- const char *getpenChangedEvent(void)
- const char *getpressedEvent(void)
- const char *getreleasedEvent(void)

83.59 QCandlestickSet Class

C++ Reference : <http://doc.qt.io/qt-5/qcandlestickset.html>

Parameters : qreal,QObject *

Parent Class : QObject

- QBrush brush(void)
- qreal close(void)
- qreal high(void)
- qreal low(void)
- qreal open(void)
- QPen pen(void)
- void setBrush(QBrush brush)
- void setClose(qreal close)
- void setHigh(qreal high)
- void setLow(qreal low)
- void setOpen(qreal open)

- void setPen(QPen pen)
- void setTimestamp(qreal timestamp)
- qreal timestamp(void)
- void setbrushChangedEvent(const char *)
- void setclickedEvent(const char *)
- void setcloseChangedEvent(const char *)
- void setdoubleClickedEvent(const char *)
- void sethighChangedEvent(const char *)
- void sethoveredEvent(const char *)
- void setlowChangedEvent(const char *)
- void setopenChangedEvent(const char *)
- void setpenChangedEvent(const char *)
- void setpressedEvent(const char *)
- void setreleasedEvent(const char *)
- void settimestampChangedEvent(const char *)
- const char *getbrushChangedEvent(void)
- const char *getclickedEvent(void)
- const char *getcloseChangedEvent(void)
- const char *getdoubleClickedEvent(void)
- const char *gethighChangedEvent(void)
- const char *gethoveredEvent(void)
- const char *getlowChangedEvent(void)
- const char *getopenChangedEvent(void)
- const char *getpenChangedEvent(void)
- const char *getpressedEvent(void)
- const char *getreleasedEvent(void)
- const char *gettimestepChangedEvent(void)

83.60 QCategoryAxis Class

C++ Reference : <http://doc.qt.io/qt-5/qcategoryaxis.html>

Parameters : QObject *

Parent Class : QValueAxis

- void append(QString categoryLabel, qreal categoryEndValue)
- QStringList categoriesLabels(void)
- int count(void)

- qreal endValue(QString categoryLabel)
- QCATEGORYAXIS::AXISLABELSPosition labelsPosition(void)
- void remove(QString categoryLabel)
- void replaceLabel(QString oldLabel, QString newLabel)
- void setLabelsPosition(QCATEGORYAXIS::AXISLABELSPosition position)
- void setStartValue(qreal min)
- qreal startValue(QString categoryLabel)
- void setCategoriesChangedEvent(const char *)
- void setLabelsPositionChangedEvent(const char *)
- const char *getCategoriesChangedEvent(void)
- const char *getLabelsPositionChangedEvent(void)

83.61 QChar Class

C++ Reference : <http://doc.qt.io/qt-5/qchar.html>

Parameters : int

- QChar::Category category(void)
- uchar cell(void)
- unsigned char combiningClass(void)
- QString decomposition(void)
- QChar::Decomposition decompositionTag(void)
- int digitValue(void)
- QChar::Direction direction(void)
- bool hasMirrored(void)
- bool isDigit(void)
- bool isHighSurrogate(void)
- bool isLetter(void)
- bool isLetterOrNumber(void)
- bool isLowSurrogate(void)
- bool isLower(void)
- bool isMark(void)
- bool isNonCharacter(void)
- bool isNull(void)
- bool isNumber(void)
- bool isPrint(void)
- bool isPunct(void)

- bool isSpace(void)
- bool isSurrogate(void)
- bool isSymbol(void)
- bool isTitleCase(void)
- bool isUpper(void)
- QChar mirroredChar(void)
- uchar row(void)
- QChar::Script script(void)
- QChar toCaseFolded(void)
- char toLatin1(void)
- QChar toLower(void)
- QChar toTitleCase(void)
- QChar toUpper(void)
- ushort unicode(void)
- ushort unicode_2(void)
- QChar::UnicodeVersion unicodeVersion(void)
- QChar::Category category_2(uint ucs4)
- unsigned char combiningClass_2(uint ucs4)
- QChar::UnicodeVersion currentUnicodeVersion(void)
- QString decomposition_2(uint ucs4)
- QChar::Decomposition decompositionTag_2(uint ucs4)
- int digitValue_2(uint ucs4)
- QChar::Direction direction_2(uint ucs4)
- QChar fromLatin1(char c)
- bool hasMirrored_2(uint ucs4)
- ushort highSurrogate(uint ucs4)
- bool isDigit_2(uint ucs4)
- bool isHighSurrogate_2(uint ucs4)
- bool isLetter_2(uint ucs4)
- bool isLetterOrNumber_2(uint ucs4)
- bool isLowSurrogate_2(uint ucs4)
- bool isLower_2(uint ucs4)
- bool isMark_2(uint ucs4)
- bool isNonCharacter_2(uint ucs4)
- bool isNumber_2(uint ucs4)
- bool isPrint_2(uint ucs4)

- bool isPunct_2(uint ucs4)
- bool isSpace_2(uint ucs4)
- bool isSurrogate_2(uint ucs4)
- bool isSymbol_2(uint ucs4)
- bool isTitleCase_2(uint ucs4)
- bool isUpper_2(uint ucs4)
- ushort lowSurrogate(uint ucs4)
- uint mirroredChar_2(uint ucs4)
- bool requiresSurrogates(uint ucs4)
- QChar::Script script_2(uint ucs4)
- uint surrogateToUcs4(ushort high, ushort low)
- uint surrogateToUcs4_2(QChar high, QChar low)
- uint toCaseFolded_2(uint ucs4)
- uint toLower_2(uint ucs4)
- uint toTitleCase_2(uint ucs4)
- uint toUpper_2(uint ucs4)
- QChar::UnicodeVersion unicodeVersion_2(uint ucs4)

83.62 QChart Class

C++ Reference : <http://doc.qt.io/qt-5/qchart.html>

Parameters : QGraphicsItem *,Qt::WindowFlags

Parent Class : QGraphicsWidget

- void addAxis(QAbstractAxis *axis, Qt::Alignment alignment)
- void addSeries(QAbstractSeries *series)
- int animationDuration(void)
- QEasingCurve animationEasingCurve(void)
- QChart::AnimationOptions animationOptions(void)
- QList<QAbstractAxis *> axes(Qt::Orientations orientation, QAbstractSeries *series)
- QBrush backgroundBrush(void)
- QPen backgroundPen(void)
- qreal backgroundRoundness(void)
- QChart::ChartType chartType(void)
- void createDefaultAxes(void)
- bool isBackgroundVisible(void)
- bool isDropShadowEnabled(void)

- bool isPlotAreaBackgroundVisible(void)
- bool isZoomed(void)
- QLegend *legend(void)
- QLocale locale(void)
- bool localizeNumbers(void)
- QPointF mapToPosition(QPointF value, QAbstractSeries *series)
- QPointF mapToValue(QPointF position, QAbstractSeries *series)
- QMargins margins(void)
- QRectF plotArea(void)
- QBrush plotAreaBackgroundBrush(void)
- QPen plotAreaBackgroundPen(void)
- void removeAllSeries(void)
- void removeAxis(QAbstractAxis *axis)
- void removeSeries(QAbstractSeries *series)
- void scroll(qreal dx, qreal dy)
- QList<QAbstractSeries *> series(void)
- void setAnimationDuration(int msecs)
- void setAnimationEasingCurve(QEasingCurve curve)
- void setAnimationOptions(QChart::AnimationOptions options)
- void setBackgroundBrush(QBrush brush)
- void setBackgroundPen(QPen pen)
- void setBackgroundRoundness(qreal diameter)
- void setBackgroundVisible(bool visible)
- void setDropShadowEnabled(bool enabled)
- void setLocale(QLocale locale)
- void setLocalizeNumbers(bool localize)
- void setMargins(QMargins margins)
- void setPlotArea(QRectF rect)
- void setPlotAreaBackgroundBrush(QBrush brush)
- void setPlotAreaBackgroundPen(QPen pen)
- void setPlotAreaBackgroundVisible(bool visible)
- void setTheme(QChart::ChartTheme theme)
- void setTitle(QString title)
- void setTitleBrush(QBrush brush)
- void setTitleFont(QFont font)
- QChart::ChartTheme theme(void)

- QString title(void)
- QBrush titleBrush(void)
- QFont titleFont(void)
- void zoom(qreal factor)
- void zoomIn(void)
- void zoomIn_2(QRectF rect)
- void zoomOut(void)
- void zoomReset(void)
- void setplotAreaChangedEvent(const char *)
- const char *getplotAreaChangedEvent(void)

83.63 QChartView Class

C++ Reference : <http://doc.qt.io/qt-5/qchartview.html>

Parameters : QWidget *

Parent Class : QGraphicsView

- QChart * chart(void)
- QChartView::RubberBands rubberBand(void)
- void setChart(QChart *chart)
- void setRubberBand(QChartView::RubberBands rubberBand)

83.64 QCheckBox Class

C++ Reference : <http://doc.qt.io/qt-5/qcheckbox.html>

Parameters : QWidget *parent

Parent Class : QAbstractButton

- int checkState(void)
- bool isTristate(void)
- void setCheckState(Qt::CheckState state)
- void setTristate(bool y)
- QSize minimumSizeHint(void)
- QSize sizeHint(void)
- void setstateChangedEvent(const char *)
- void setclickedEvent(const char *)
- void setpressedEvent(const char *)
- void setreleasedEvent(const char *)
- void settoggledEvent(const char *)

- const char *getstateChangedEvent(void)
- const char *getclickedEvent(void)
- const char *getpressedEvent(void)
- const char *getreleasedEvent(void)
- const char *gettoggledEvent(void)

83.65 QChildEvent Class

C++ Reference : <http://doc.qt.io/qt-5/qchildevent.html>

Parameters : QEvent::Type,QObject *

Parent Class : QEvent

- bool added(void)
- QObject *child(void)
- bool polished(void)
- bool removed(void)

83.66 QClipboard Class

C++ Reference : <http://doc.qt.io/qt-5/qclipboard.html>

- void clear(QClipboard::Mode mode)
- QImage image(QClipboard::Mode mode)
- QMimeData * mimeData(QClipboard::Mode mode)
- bool ownsClipboard(void)
- bool ownsFindBuffer(void)
- bool ownsSelection(void)
- QPixmap pixmap(QClipboard::Mode mode)
- void setImage(QImage image, QClipboard::Mode mode)
- void setMimeData(QMimeData * src, QClipboard::Mode mode)
- void setPixmap(QPixmap pixmap, QClipboard::Mode mode)
- void setText(QString text, QClipboard::Mode mode)
- bool supportsFindBuffer(void)
- bool supportsSelection(void)
- QString text(QClipboard::Mode mode)

83.67 QColor Class

C++ Reference : <http://doc.qt.io/qt-5/qcolor.html>

Parameters : void

- int alpha(void)
- double alphaF(void)
- int black(void)
- double blackF(void)
- int blue(void)
- double blueF(void)
- QColor convertTo(QColor::Spec colorSpec)
- int cyan(void)
- double cyanF(void)
- QColor darker(int factor)
- void getCMYK(int *c, int *m, int *y, int *k, int *a)
- void getCMYKF(qreal *c, qreal *m, qreal *y, qreal *k, qreal *a)
- void getHSL(int *h, int *s, int *l, int *a)
- void getHSLF(qreal *h, qreal *s, qreal *l, qreal *a)
- void getHSV(int *h, int *s, int *v, int *a)
- void getHSVF(qreal *h, qreal *s, qreal *v, qreal *a)
- void getRGB(int *r, int *g, int *b, int *a)
- void getRGBF(qreal *r, qreal *g, qreal *b, qreal *a)
- int green(void)
- double greenF(void)
- int hslHue(void)
- double hslHueF(void)
- int hslSaturation(void)
- double hslSaturationF(void)
- int hsvHue(void)
- double hsvHueF(void)
- int hsvSaturation(void)
- double hsvSaturationF(void)
- int hue(void)
- double hueF(void)
- bool isValid(void)
- QColor lighter(int factor)

- int lightness(void)
- double lightnessF(void)
- int magenta(void)
- double magentaF(void)
- QString name(void)
- int red(void)
- double redF(void)
- QRgb rgb(void)
- QRgb rgba(void)
- int saturation(void)
- double saturationF(void)
- void setAlpha(int alpha)
- void setAlphaF(double alpha)
- void setBlue(int blue)
- void setBlueF(double blue)
- void setCmyk(int c, int m, int y, int k, int a)
- void setCmykF(double c, double m, double y, double k, double a)
- void setGreen(int green)
- void setGreenF(double green)
- void setHsl(int h, int s, int l, int a)
- void setHslF(double h, double s, double l, double a)
- void setHsv(int h, int s, int v, int a)
- void setHsvF(double h, double s, double v, double a)
- void setNamedColor(QString)
- void setRed(int red)
- void setRedF(double red)
- void setRgb(int r, int g, int b, int a)
- void setRgbF(double r, double g, double b, double a)
- void setRgba(QRgb rgba)
- int spec(void)
- QColor toCmyk(void)
- QColor toHsl(void)
- QColor toHsv(void)
- QColor toRgb(void)
- int value(void)
- double valueF(void)

- int yellow(void)
- double yellowF(void)
- QStringList colorNames(void)
- QColor fromCmyk(int c, int m, int y, int k, int a)
- QColor fromCmykF(double c, double m, double y, double k, double a)
- QColor fromHsl(int h, int s, int l, int a)
- QColor fromHslF(double h, double s, double l, double a)
- QColor fromHsv(int h, int s, int v, int a)
- QColor fromHsvF(double h, double s, double v, double a)
- QColor fromRgb(int r, int g, int b, int a)
- QColor fromRgbF(double r, double g, double b, double a)
- QColor fromRgba(QRgb rgba)
- bool isValidColor(QString)

83.68 QColorDialog Class

C++ Reference : <http://doc.qt.io/qt-5/qcolordialog.html>

Parameters : void

Parent Class : QDialog

- QColor currentColor(void)
- void open(QObject * receiver, char * member)
- QColorDialog::ColorDialogOptions options(void)
- QColor selectedColor(void)
- void setCurrentColor(QColor color)
- void setOption(QColorDialog::ColorDialogOption option, bool on)
- void setOptions(QColorDialog::ColorDialogOptions options)
- bool testOption(QColorDialog::ColorDialogOption option)
- QColor customColor(int index)
- int customCount(void)
- QColor getColor_2(QColor initial, QWidget * parent, QString title, QColorDialog::ColorDialogOptions options)
- void setCustomColor(int index, QColor color)
- void setStandardColor(int index, QColor color)
- QColor standardColor(int index)
- void setcolorSelectedEvent(const char *)
- void setcurrentColorChangedEvent(const char *)
- const char *getcolorSelectedEvent(void)

- const char *getcurrentColorChangedEvent(void)
- int getcolor(void)

83.69 QComboBox Class

C++ Reference : <http://doc.qt.io/qt-5/qcombobox.html>

Parameters : QWidget *

Parent Class : QWidget

- void addItem(QString,int)
- QCompleter *completer(void)
- int count(void)
- int currentIndex(void)
- QString currentText(void)
- bool duplicatesEnabled(void)
- int findData(QVariant, int role, Qt::MatchFlag flags)
- int findText(QString, Qt::MatchFlag flags)
- bool hasFrame(void)
- void hidePopup(void)
- QSize iconSize(void)
- void insertItem(int index, QString, QVariant)
- bool isEditable(void)
- QVariant itemData(int index, int role)
- QAbstractItemDelegate *itemDelegate(void)
- QIcon itemIcon(int index)
- QString itemText(int index)
- QLineEdit *lineEdit(void)
- int maxCount(void)
- int maxVisibleItems(void)
- int minimumContentsLength(void)
- QAbstractItemModel *model(void)
- int modelColumn(void)
- void removeItem(int index)
- QModelIndex rootModelIndex(void)
- void setCompleter(QCompleter *completer)
- void setDuplicatesEnabled(bool enable)
- void setEditable(bool editable)

- void setFrame(bool)
- void setIconSize(QSize)
- void setItemDelegate(QAbstractItemDelegate *delegate)
- void setItemIcon(int index, QIcon)
- void setItemText(int index, QString)
- void setLineEdit(QLineEdit *edit)
- void setMaxCount(int max)
- void setMaxVisibleItems(int maxItems)
- void setMinimumContentsLength(int characters)
- void setModel(QAbstractItemModel *model)
- void setModelColumn(int visibleColumn)
- void setRootModelIndex(QModelIndex)
- void setView(QAbstractItemView *itemView)
- void showPopup(void)
- QAbstractItemView *view(void)
- void clear(void)
- void clearEditText(void)
- void setCurrentIndex(int index)
- void setEditText(QString)
- void setactivatedEvent(const char *)
- void setcurrentIndexChangedEvent(const char *)
- void seteditTextChangedEvent(const char *)
- void sethighlightedEvent(const char *)
- const char *getactivatedEvent(void)
- const char *getcurrentIndexChangedEvent(void)
- const char *geteditTextChangedEvent(void)
- const char *gethighlightedEvent(void)

83.70 QCompleter Class

C++ Reference : <http://doc.qt.io/qt-5/qcompleter.html>

Parameters : QObject *parent

Parent Class : QObject

- Qt::CaseSensitivity caseSensitivity(void)
- int completionColumn(void)
- int completionCount(void)

- `QCompleter::CompletionMode completionMode(void)`
- `QAbstractItemModel *completionModel(void)`
- `QString completionPrefix(void)`
- `int completionRole(void)`
- `QString currentCompletion(void)`
- `QModelIndex currentIndex(void)`
- `int currentRow(void)`
- `Qt::MatchFlags filterMode(void)`
- `int maxVisibleItems(void)`
- `QAbstractItemModel * model(void)`
- `QCompleter::ModelSorting modelSorting(void)`
- `QAbstractItemView * popup(void)`
- `void setCaseSensitivity(Qt::CaseSensitivity caseSensitivity)`
- `void setCompletionColumn(int column)`
- `void setCompletionMode(QCompleter::CompletionMode mode)`
- `void setCompletionRole(int role)`
- `bool setCurrentRow(int row)`
- `void setFilterMode(Qt::MatchFlags filterMode)`
- `void setMaxVisibleItems(int maxItems)`
- `void setModel(QAbstractItemModel *model)`
- `void setModelSorting(QCompleter::ModelSorting sorting)`
- `void setPopup(QAbstractItemView *popup)`
- `void setWidget(QWidget *widget)`
- `QWidget * widget(void)`
- `bool wrapAround(void)`
- `void complete(QRect rect)`
- `void setCompletionPrefix(QString prefix)`
- `void setWrapAround(bool wrap)`

83.71 QCompleter2 Class

Parameters : `QAbstractItemModel *model, QObject *parent`

Parent Class : `QCompleter`

83.72 QCompleter3 Class

Parameters : QStringList list, QObject *parent

Parent Class : QCompleter

83.73 QConeGeometry Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qconegeometry.html>

Parameters : Qt3DCore::QNode *

- float bottomRadius(void)
- bool hasBottomEndcap(void)
- bool hasTopEndcap(void)
- Qt3DRender::QAttribute * indexAttribute(void)
- float length(void)
- Qt3DRender::QAttribute * normalAttribute(void)
- Qt3DRender::QAttribute * positionAttribute(void)
- int rings(void)
- int slices(void)
- Qt3DRender::QAttribute * texCoordAttribute(void)
- float topRadius(void)
- void updateIndices(void)
- void updateVertices(void)
- void setBottomRadius(float bottomRadius)
- void setHasBottomEndcap(bool hasBottomEndcap)
- void setHasTopEndcap(bool hasTopEndcap)
- void setLength(float length)
- void setRings(int rings)
- void setSlices(int slices)
- void setTopRadius(float topRadius)

83.74 QConeMesh Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qconemesh.html>

Parameters : Qt3DCore::QNode *

- float bottomRadius(void)
- bool hasBottomEndcap(void)
- bool hasTopEndcap(void)
- float length(void)
- int rings(void)
- int slices(void)
- float topRadius(void)
- void setBottomRadius(float bottomRadius)
- void setHasBottomEndcap(bool hasBottomEndcap)
- void setHasTopEndcap(bool hasTopEndcap)
- void setLength(float length)
- void setRings(int rings)
- void setSlices(int slices)
- void setTopRadius(float topRadius)

83.75 QCoreApplication Class

C++ Reference : <http://doc.qt.io/qt-5/qcoreapplication.html>

Parent Class : QObject

- void installNativeEventFilter(QAbstractNativeEventFilter *filterObj)
- void removeNativeEventFilter(QAbstractNativeEventFilter *filterObject)
- void quit(void)
- void addLibraryPath(QString path)
- QString applicationDirPath(void)
- QString applicationFilePath(void)
- QString applicationName(void)
- qint64 applicationPid(void)
- QString applicationVersion(void)
- QStringList arguments(void)
- bool closingDown(void)
- QAbstractEventDispatcher * eventDispatcher(void)
- int exec(void)
- void exit(int returnCode)

- bool installTranslator(QTranslator *translationFile)
- QCoreApplication * instance(void)
- bool isQuitLockEnabled(void)
- QStringList libraryPaths(void)
- QString organizationDomain(void)
- QString organizationName(void)
- void postEvent(QObject *receiver, QEvent *event, int priority)
- void processEvents(QEventLoop::ProcessEventsFlags flags)
- void processEvents_2(QEventLoop::ProcessEventsFlags flags, int maxtime)
- void removeLibraryPath(QString path)
- void removePostedEvents(QObject *receiver, int eventType)
- bool removeTranslator(QTranslator *translationFile)
- bool sendEvent(QObject *receiver, QEvent *event)
- void sendPostedEvents(QObject *receiver, int event_type)
- void setApplicationName(QString application)
- void setApplicationVersion(QString version)
- void setAttribute(Qt::ApplicationAttribute attribute, bool on)
- void setEventDispatcher(QAbstractEventDispatcher *eventDispatcher)
- void setLibraryPaths(QStringList paths)
- void setOrganizationDomain(QString orgDomain)
- void setOrganizationName(QString orgName)
- void setQuitLockEnabled(bool enabled)
- bool startingUp(void)
- bool testAttribute(Qt::ApplicationAttribute attribute)
- QString translate(char *context, char *sourceText, char *disambiguation, int n)

83.76 QCuboidMesh Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qcuboidmesh.html>

Parameters : Qt3DCore::QNode *

- float xExtent(void)
- QSize xyMeshResolution(void)
- QSize xzMeshResolution(void)
- float yExtent(void)
- QSize yzMeshResolution(void)
- float zExtent(void)

- void setXExtent(float xExtent)
- void setXYMeshResolution(QSize resolution)
- void setXZMeshResolution(QSize resolution)
- void setYExtent(float yExtent)
- void setYZMeshResolution(QSize resolution)
- void setZExtent(float zExtent)

83.77 QCullFace Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qcullface.html>

Parameters : Qt3DCore::QNode *

- Qt3DRender::QCullFace::CullingMode mode(void)
- void setMode(Qt3DRender::QCullFace::CullingMode mode)

83.78 QCursor Class

C++ Reference : <http://doc.qt.io/qt-5/qcursor.html>

Parameters : void

- QBitmap *bitmap(void)
- QPoint hotSpot(void)
- QBitmap *mask(void)
- QPixmap pixmap(void)
- void setShape(Qt::CursorShape shape)
- Qt::CursorShape shape(void)
- QPoint pos(void)
- QPoint pos_2(QScreen *)
- void setPos(int x, int y)
- void setPos_2(QScreen *screen, int x, int y)
- void setPos_3(QPoint)
- void setPos_4(QScreen *screen, QPoint)

83.79 QCylinderMesh Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qcylindermesh.html>

Parameters : Qt3DCore::QNode *

- float length(void)
- float radius(void)
- int rings(void)
- int slices(void)
- void setLength(float length)
- void setRadius(float radius)
- void setRings(int rings)
- void setSlices(int slices)

83.80 QDate Class

C++ Reference : <http://doc.qt.io/qt-5/qdate.html>

Parameters : void

- QDate addDays(int ndays)
- QDate addMonths(int nmonths)
- QDate addYears(int nyears)
- int day(void)
- int dayOfWeek(void)
- int dayOfYear(void)
- int daysInMonth(void)
- int daysInYear(void)
- int daysTo(QDate)
- void getDate(int * year, int * month, int * day)
- boolisNull(void)
- boolisValid(void)
- intmonth(void)
- bool setDate(int year, int month, int day)
- int toJulianDay(void)
- QString toString(QString)
- int weekNumber(int * yearNumber)
- int year(void)
- QDate currentDate(void)
- QDate fromJulianDay(int jd)

- QDate fromString(QString, QString)
- bool isLeapYear(int year)
- QString longDayName(int weekday)
- QString longMonthName(int month)
- QString shortDayName(int weekday)
- QString shortMonthName(int month)

83.81 QDateEdit Class

C++ Reference : <http://doc.qt.io/qt-5/qdateedit.html>

Parameters : QWidget *parent

Parent Class : QDateTimeEdit

83.82 QDateTime Class

C++ Reference : <http://doc.qt.io/qt-5/qdatetime.html>

Parameters : void

- QDateTime addDays(int ndays)
- QDateTime addMSecs(qint64 msecs)
- QDateTime addMonths(int nmonths)
- QDateTime addSecs(int s)
- QDateTime addYears(int nyears)
- QDate date(void)
- int daysTo(QDateTime other)
- boolisNull(void)
- boolisValid(void)
- qint64 msecsTo(QDateTime other)
- int secsTo(QDateTime other)
- void setDate(QDate date)
- void setMSecsSinceEpoch(qint64 msecs)
- void setTime(QTime time)
- void setTimeSpec(Qt::TimeSpec spec)
- void setTime_t(uint seconds)
- QTime time(void)
- Qt::TimeSpec timeSpec(void)
- QDateTime toLocalTime(void)
- qint64 toMSecsSinceEpoch(void)

- `QString toString(QString format)`
- `QString toString_2(Qt::DateFormat format)`
- `QDateTime toTimeSpec(Qt::TimeSpec specification)`
- `uint toTime_t(void)`
- `QDateTime toUTC(void)`
- `QDateTime currentDate(void)`
- `QDateTime currentDateUtc(void)`
- `qint64 currentMSecsSinceEpoch(void)`
- `QDateTime fromMSecsSinceEpoch(qint64 msecs)`
- `QDateTime fromString(QString string, Qt::DateFormat format)`
- `QDateTime fromString_2(QString string, QString format)`
- `QDateTime fromTime_t(uint seconds)`

83.83 QDateTimeAxis Class

C++ Reference : <http://doc.qt.io/qt-5/qdatetimexaxis.html>

Parameters : `QObject *`

Parent Class : `QAbstractAxis`

- `QString format(void)`
- `QDateTime max(void)`
- `QDateTime min(void)`
- `void setFormat(QString format)`
- `void setMax(QDateTime max)`
- `void setMin(QDateTime min)`
- `void setRange(QDateTime min, QDateTime max)`
- `void setTickCount(int count)`
- `int tickCount(void)`
- `void setformatChangedEvent(const char *)`
- `void setmaxChangedEvent(const char *)`
- `void setminChangedEvent(const char *)`
- `void setrangeChangedEvent(const char *)`
- `void settickCountChangedEvent(const char *)`
- `const char *getformatChangedEvent(void)`
- `const char *getmaxChangedEvent(void)`
- `const char *getminChangedEvent(void)`
- `const char *getrangeChangedEvent(void)`

- const char *gettickCountChangedEvent(void)

83.84 QDateEdit Class

C++ Reference : <http://doc.qt.io/qt-5/qdateedit.html>

Parameters : QWidget *parent

Parent Class : QAbstractSpinBox

- bool calendarPopup(void)
- QCalendarWidget *calendarWidget(void)
- void clearMaximumDate(void)
- void clearMaximumDateTime(void)
- void clearMaximumTime(void)
- void clearMinimumDate(void)
- void clearMinimumDateTime(void)
- void clearMinimumTime(void)
- int currentSection(void)
- int currentSectionIndex(void)
- QDate date(void)
- QDateTime dateTime(void)
- QString displayFormat(void)
- int displayedSections(void)
- QDate maximumDate(void)
- QDateTime maximumDateTime(void)
- QTime maximumTime(void)
- QDate minimumDate(void)
- QDateTime minimumDateTime(void)
- QTime minimumTime(void)
- int sectionAt(int index)
- int sectionCount(void)
- QString sectionText(QDateEdit::Section section)
- void setCalendarPopup(bool enable)
- void setCalendarWidget(QCalendarWidget *calendarWidget)
- void setCurrentSection(QDateEdit::Section section)
- void setCurrentSectionIndex(int index)
- void setDateRange(QDate,QDate)
- void setTimeRange(QDateTime,QDateTime)

- void setDisplayFormat(QString)
- void setMaximumDate(QDate)
- void setMaximumDateTime(QDateTime)
- void setMaximumTime(QTime)
- void setMinimumDate(QDate)
- void setMinimumDateTime(QDateTime)
- void setMinimumTime(QTime)
- void setSelectedSection(QDateTimeEdit::Section section)
- void setTimeRange(QTime,QTime)
- void setTimeSpec(Qt::TimeSpec spec)
- QTime time(void)
- Qt::TimeSpec timeSpec(void)
- void setDate(QDate)
- void setDateDateTime(QDateTime)
- void setTime(QTime)

83.85 QDepthTest Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qdepthtest.html>

Parameters : Qt3DCore::QNode *

- Qt3DRender::QDepthTest::DepthFunction depthFunction(void)
- void setDepthFunction(Qt3DRender::QDepthTest::DepthFunction depthFunction)

83.86 QDesktopServices Class

C++ Reference : <http://doc.qt.io/qt-5/qdesktopservices.html>

- bool openUrl(QUrl)
- void setUrlHandler(QString, QObject *receiver, const char *method)
- void unsetUrlHandler(QString)

83.87 QDesktopWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qdesktopwidget.html>

Parameters : void

Parent Class : QWidget

- QRect availableGeometry(int screen)
- bool isVirtualDesktop(void)
- int primaryScreen(void)
- QWidget *screen(int screen)
- int screenCount(void)
- QRect screenGeometry(int screen)
- int screenNumber(QWidget *widget)

83.88 QDial Class

C++ Reference : <http://doc.qt.io/qt-5/qdial.html>

Parameters : QWidget *parent

Parent Class : QAbstractSlider

- int notchSize(void)
- qreal notchTarget(void)
- bool notchesVisible(void)
- void setNotchTarget(double target)
- bool wrapping(void)
- QSize minimumSizeHint(void)
- QSize sizeHint(void)
- void setNotchesVisible(bool visible)
- void setWrapping(bool on)
- void setactionTriggeredEvent(const char *)
- void setrangeChangedEvent(const char *)
- void setsliderMovedEvent(const char *)
- void setsliderPressedEvent(const char *)
- void setsliderReleasedEvent(const char *)
- void setvalueChangedEvent(const char *)
- const char *getactionTriggeredEvent(void)
- const char *getrangeChangedEvent(void)
- const char *getsliderMovedEvent(void)
- const char *getsliderPressedEvent(void)

- const char *getsliderReleasedEvent(void)
- const char *getvalueChangedEvent(void)

83.89 QDialog Class

C++ Reference : <http://doc.qt.io/qt-5/qdialog.html>

Parameters : QWidget *parent

Parent Class : QWidget

- bool isSizeGripEnabled(void)
- int result(void)
- void setModal(bool modal)
- void setResult(int i)
- void setSizeGripEnabled(bool)
- void accept(void)
- void done(int r) # In RingQt use : void donedialog(int r)
- int exec(void)
- void open(void)
- void reject(void)

83.90 QDiffuseSpecularMaterial Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qdiffusespecularmaterial.html>

Parameters : Qt3DCore::QNode *

- QColor ambient(void)
- QVariant diffuse(void)
- bool isAlphaBlendingEnabled(void)
- QVariant normal(void)
- float shininess(void)
- QVariant specular(void)
- float textureScale(void)
- void setAlphaBlendingEnabled(bool enabled)
- void setAmbient(QColor ambient)
- void setDiffuse(QVariant diffuse)
- void setNormal(QVariant normal)
- void setShininess(float shininess)
- void setSpecular(QVariant specular)
- void setTextureScale(float textureScale)

83.91 QDir Class

C++ Reference : <http://doc.qt.io/qt-5/qdir.html>

Parameters : void

- QString absoluteFilePath(QString fileName)
- QString absolutePath(void)
- QString canonicalPath(void)
- bool cd(QString dirName)
- bool cdUp(void)
- uint count(void)
- QString dirName(void)
- QFileInfoList entryInfoList(QStringList nameFilters, QDir::Filters filters, QDir::SortFlags sort)
- QFileInfoList entryInfoList_2(QDir::Filters filters, QDir::SortFlags sort)
- QStringList entryList(QStringList nameQDir::Filters, QDir::Filters filters, QDir::SortFlags sort)
- QStringList entryList_2(QDir::Filters filters, QDir::SortFlags sort)
- bool exists(QString name)
- bool exists_2(void)
- QString filePath(QString fileName)
- QDir::Filters filter(void)
- bool isAbsolute(void)
- bool isReadable(void)
- bool isRelative(void)
- bool isRoot(void)
- bool makeAbsolute(void)
- bool mkdir(QString dirName)
- bool mkpath(QString dirPath)
- QStringList nameFilters(void)
- QString path(void)
- void refresh(void)
- QString relativeFilePath(QString fileName)
- bool remove(QString fileName)
- bool removeRecursively(void)
- bool rename(QString oldName, QString newName)
- bool rmdir(QString dirName)
- bool rmpath(QString dirPath)
- void setFilter(QDir::Filters filters)

- void setNameFilters(QStringList nameQDir::Filters)
- void setPath(QString path)
- void setSorting(QDir::SortFlags sort)
- QDir::SortFlags sorting(void)
- void swap(QDir other)
- void addSearchPath(QString prefix, QString path)
- QString cleanPath(QString path)
- QDir current(void)
- QString currentPath(void)
- QList<QFileInfo> drives(void)
- QString fromNativeSeparators(QString pathName)
- QDir home(void)
- QString homePath(void)
- bool isAbsolutePath(QString path)
- bool isRelativePath(QString path)
- bool match(QString filter, QString fileName)
- bool match_2(QStringList filters, QString fileName)
- QDir root(void)
- QString rootPath(void)
- QStringList searchPaths(QString prefix)
- QChar separator(void)
- bool setCurrent(QString path)
- void setSearchPaths(QString prefix, QStringList searchPaths)
- QDir temp(void)
- QString tempPath(void)
- QString toNativeSeparators(QString pathName)

83.92 QDirModel Class

C++ Reference : <http://doc.qt.io/qt-5/qdirmodel.html>

Parameters : void

- QIcon fileIcon(QModelIndex)
- QFileInfo fileInfo(QModelIndex)
- QString fileName(QModelIndex)
- QString filePath(QModelIndex)
- int filter(void)

- QFileIconProvider *iconProvider(void)
- QModelIndex index(QString path, int column)
- bool isDir(QModelIndex)
- bool isReadOnly(void)
- bool lazyChildCount(void)
- QModelIndex mkdir(QModelIndex parent, QString name)
- QStringList nameFilters(void)
- bool remove(QModelIndex index)
- bool resolveSymlinks(void)
- bool rmdir(QModelIndex index)
- void setFilter(QDir::Filter filters)
- void setIconProvider(QFileIconProvider *provider)
- void setLazyChildCount(bool enable)
- void setNameFilters(QStringList filters)
- void setReadOnly(bool enable)
- void setResolveSymlinks(bool enable)
- void setSorting(QDir::SortFlag sort)
- int sorting(void)
- void refresh(QModelIndex parent)

83.93 QDockWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qdockwidget.html>

Parameters : QWidget *parent,Qt::WindowType flag

Parent Class : QWidget

- int allowedAreas(void)
- int features(void)
- bool isAreaAllowed(Qt::DockWidgetArea area)
- bool isFloating(void)
- void setAllowedAreas(Qt::DockWidgetArea areas)
- void setFeatures(QDockWidget::DockWidgetFeature features)
- void setFloating(bool floating)
- void setTitleBarWidget(QWidget *widget)
- void setWidget(QWidget *widget)
- QWidget *titleBarWidget(void)
- QAction *toggleViewAction(void)

- QWidget *widget(void)
- void allowedAreasChanged(Qt::DockWidgetArea allowedAreas)
- void dockLocationChanged(Qt::DockWidgetArea area)
- void featuresChanged(QDockWidget::DockWidgetFeature features)
- void topLevelChanged(bool topLevel)
- void visibilityChanged(bool visible)
- void setallowedAreasChangedEvent(const char *)
- void setdockLocationChangedEvent(const char *)
- void setfeaturesChangedEvent(const char *)
- void settopLevelChangedEvent(const char *)
- void setvisibilityChangedEvent(const char *)
- const char *getallowedAreasChangedEvent(void)
- const char *getdockLocationChangedEvent(void)
- const char *getfeaturesChangedEvent(void)
- const char *gettopLevelChangedEvent(void)
- const char *getvisibilityChangedEvent(void)

83.94 QDrag Class

C++ Reference : <http://doc.qt.io/qt-5/qdrag.html>

Parameters : QObject *

Parent Class : QObject

- Qt::DropAction defaultAction(void)
- QPixmap dragCursor(Qt::DropAction action)
- Qt::DropAction exec(Qt::DropActions supportedActions)
- Qt::DropAction exec_2(Qt::DropActions supportedActions, Qt::DropAction defaultDropAction)
- QPoint hotSpot(void)
- QMimeData *mimeData(void)
- QPixmap pixmap(void)
- void setDragCursor(QPixmap cursor, Qt::DropAction action)
- void setHotSpot(QPoint hotspot)
- void setMimeData(QMimeData * data)
- void setPixmap(QPixmap pixmap)
- QObject * source(void)
- Qt::DropActions supportedActions(void)
- QObject * target(void)

- void setactionChangedEvent(const char *)
- void settargetChangedEvent(const char *)
- const char *getactionChangedEvent(void)
- const char *getttargetChangedEvent(void)

83.95 QDragEnterEvent Class

C++ Reference : <http://doc.qt.io/qt-5/qdragenterevent.html>

Parameters : QPoint,Qt::DropActions,const QMimeData *,Qt::MouseButtons,Qt::KeyboardModifiers

Parent Class : QDragMoveEvent

83.96 QDragLeaveEvent Class

C++ Reference : <http://doc.qt.io/qt-5/qdragleaveevent.html>

Parameters : void

Parent Class : QEvent

83.97 QDragMoveEvent Class

C++ Reference : <http://doc.qt.io/qt-5/qdragmoveevent.html>

Parameters : QPoint,Qt::DropActions,const QMimeData *,Qt::MouseButtons,Qt::KeyboardModifiers,QEvent::Type

Parent Class : QDropEvent

- void accept(QRect rectangle)
- void accept_2(void)
- QRect answerRect(void)
- void ignore(QRect rectangle)
- void ignore_2(void)

83.98 QDropEvent Class

C++ Reference : <http://doc.qt.io/qt-5/qdropevent.html>

Parameters : QPointF,Qt::DropActions,const QMimeData *,Qt::MouseButtons,Qt::KeyboardModifiers,QEvent::Type

Parent Class : QEvent

- void acceptProposedAction(void)
- Qt::DropAction dropAction(void)
- Qt::KeyboardModifiers keyboardModifiers(void)
- QMimeData * mimeData(void)

- Qt::MouseButtons mouseButtons(void)
- QPoint pos(void)
- QPointF posF(void)
- Qt::DropActions possibleActions(void)
- Qt::DropAction proposedAction(void)
- void setDropAction(Qt::DropAction action)
- QObject * source(void)

83.99 QEffect Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qeffect.html>

Parameters : Qt3DCore::QNode *

- void addParameter(Qt3DRender::QParameter *parameter)
- void addTechnique(Qt3DRender::QTechnique *t)
- QVector<Qt3DRender::QParameter *> parameters(void)
- void removeParameter(Qt3DRender::QParameter *parameter)
- void removeTechnique(Qt3DRender::QTechnique *t)
- QVector<Qt3DRender::QTechnique *> techniques(void)

83.100 QEntity Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dcore-qentity.html>

Parameters : Qt3DCore::QNode *

Parent Class : QNode

- void addComponent(Qt3DCore::QComponent *comp)
- Qt3DCore::QComponentVector components(void)
- Qt3DCore::QEntity * parentEntity(void)
- void removeComponent(Qt3DCore::QComponent *comp)

83.101 QEvent Class

C++ Reference : <http://doc.qt.io/qt-5/qevent.html>

Parameters : QEvent::Type Type

- void accept(void)
- void ignore(void)
- bool isAccepted(void)
- void setAccepted(bool accepted)

- bool spontaneous(void)
- int type(void)

83.102 QExtrudedTextMesh Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qextrudedtextmesh.html>

Parameters : Qt3DCore::QNode *

- float depth(void)
- QFont font(void)
- QString text(void)
- void setDepth(float depth)
- void setFont(QFont font)
- void setText(QString text)

83.103 QFile Class

C++ Reference : <http://doc.qt.io/qt-5/qfile.html>

Parameters : void

Parent Class : QFileDevice

- bool copy(QString newName)
- bool exists(void)
- bool link(QString linkName)
- bool open(FILE *fh, QIODevice::OpenMode mode, QFile::FileHandleFlags handleFlags)
- bool open_2(int fd, QIODevice::OpenMode mode, QFile::FileHandleFlags handleFlags)
- bool open_3(QIODevice::OpenMode mode)
- bool remove(void)
- bool rename(QString newName)
- void setFileName(QString name)
- QString symLinkTarget(void)
- bool copy_2(QString fileName, QString newName)
- QString decodeName(QByteArray localFileName)
- QString decodeName_2(char *localFileName)
- QByteArray encodeName(QString fileName)
- bool exists_2(QString fileName)
- bool link_2(QString fileName, QString linkName)
- QFile::Permissions permissions(QString fileName)
- bool remove_2(QString fileName)

- bool rename_2(QString oldName, QString newName)
- bool resize(QString fileName, qint64 sz)
- bool setPermissions(QString fileName, QFile::Permissions permissions)
- QString symLinkTarget_2(QString fileName)

83.104 QFile2 Class

Parameters : QString

Parent Class : QFile

83.105 QFileDevice Class

C++ Reference : <http://doc.qt.io/qt-5/qfiledevice.html>

Parent Class : QIODevice

- QFileDevice::FileError error(void)
- bool flush(void)
- int handle(void)
- uchar * map(qint64 offset, qint64 size, QFileDevice::MemoryMapFlags flags)
- QFileDevice::Permissions permissions(void)
- bool resize(qint64 sz)
- QString fileName(void)
- bool unmap(uchar *address)
- void unsetError(void)

83.106 QFileDialog Class

C++ Reference : <http://doc.qt.io/qt-5/qfiledialog.html>

Parameters : QWidget *parent

Parent Class : QDialog

- QFileDialog::AcceptMode acceptMode(void)
- QString defaultSuffix(void)
- QDir directory(void)
- QUrl directoryUrl(void)
- QFileDialog:: FileMode fileMode(void)
- QDir::Filters filter(void)
- QStringList history(void)
- QFileIconProvider * iconProvider(void)

- `QAbstractItemDelegate * itemDelegate(void)`
- `QString labelText(QFileDialog::DialogLabel label)`
- `QStringList mimeTypeFilters(void)`
- `QStringList nameFilters(void)`
- `void open(QObject * receiver, char * member)`
- `QFileDialog::Options options(void)`
- `QAbstractProxyModel * proxyModel(void)`
- `bool restoreState(QByteArray state)`
- `QByteArray saveState(void)`
- `void selectFile(QString filename)`
- `void selectMimeTypeFilter(QString filter)`
- `void selectNameFilter(QString filter)`
- `void selectUrl(QUrl url)`
- `QStringList selectedFiles(void)`
- `QString selectedNameFilter(void)`
- `QList<QUrl> selectedUrls(void)`
- `void setAcceptMode(QFileDialog::AcceptMode mode)`
- `void setDefaultSuffix(QString suffix)`
- `void setDirectory(QString directory)`
- `void setDirectory_2(QDir directory)`
- `void setDirectoryUrl(QUrl directory)`
- `void set FileMode(QFileDialog:: FileMode mode)`
- `void setFilter(QDir::Filters filters)`
- `void setHistory(QStringList paths)`
- `void setIconProvider(QFileIconProvider * provider)`
- `void.setItemDelegate(QAbstractItemDelegate * delegate)`
- `void.setLabelText(QFileDialog::DialogLabel label, QString text)`
- `void.setMimeTypeFilters(QStringList filters)`
- `void.setNameFilter(QString filter)`
- `void.setNameFilters(QStringList filters)`
- `void.setOption(QFileDialog::Option option, bool on)`
- `void.setOptions(QFileDialog::Options options)`
- `void.setProxyModel(QAbstractProxyModel * proxyModel)`
- `void.setSidebarUrls(QList<QUrl> urls)`
- `void.setViewMode(QFileDialog::ViewMode mode)`
- `QList<QUrl> sidebarUrls(void)`

- bool testOption(QFileDialog::Option option)
- QFileDialog::ViewMode viewMode(void)
- QString getExistingDirectory(QWidget * parent, QString caption, QString dir, QFileDialog::Options options)
- QUrl getExistingDirectoryUrl(QWidget * parent, QString caption, QUrl dir, QFileDialog::Options options, QStringList supportedSchemes)
- QString getOpenFileName(QWidget * parent, QString caption, QString dir, QString filter)
- QString getOpenFileName_2(QWidget * parent, QString caption, QString dir, QString filter, QString * selectedFilter, QFileDialog::Options options)
- QStringList getOpenFileNames(QWidget * parent, QString caption, QString dir, QString filter, QString * selectedFilter, QFileDialog::Options options)
- QUrl getOpenFileUrl(QWidget * parent, QString caption, QUrl dir, QString filter, QString * selectedFilter, QFileDialog::Options options, QStringList supportedSchemes)
- QList<QUrl> getOpenFileUrls(QWidget * parent, QString caption, QUrl dir, QString filter, QString * selectedFilter, QFileDialog::Options options, QStringList supportedSchemes)
- QString getSaveFileName(QWidget * parent, QString caption, QString dir, QString filter)
- QString getSaveFileName_2(QWidget * parent, QString caption, QString dir, QString filter, QString * selectedFilter, QFileDialog::Options options)
- QUrl getSaveFileUrl(QWidget * parent, QString caption, QUrl dir, QString filter, QString * selectedFilter, QFileDialog::Options options, QStringList supportedSchemes)
- void setcurrentChangedEvent(const char *)
- void setcurrentUrlChangedEvent(const char *)
- void setdirectoryEnteredEvent(const char *)
- void setdirectoryUrlEnteredEvent(const char *)
- void setfileSelectedEvent(const char *)
- void setfilesSelectedEvent(const char *)
- void setfilterSelectedEvent(const char *)
- void seturlSelectedEvent(const char *)
- void seturlsSelectedEvent(const char *)
- const char *getcurrentChangedEvent(void)
- const char *getcurrentUrlChangedEvent(void)
- const char *getdirectoryEnteredEvent(void)
- const char *getdirectoryUrlEnteredEvent(void)
- const char *getFileSelectedEvent(void)
- const char *getfilesSelectedEvent(void)
- const char *getfilterSelectedEvent(void)
- const char *geturlSelectedEvent(void)
- const char *geturlsSelectedEvent(void)

83.107 QFileInfo Class

C++ Reference : <http://doc.qt.io/qt-5/qfileinfo.html>

Parameters : void

- QDir absoluteDir(void)
- QString absoluteFilePath(void)
- QString absolutePath(void)
- QString baseName(void)
- QString bundleName(void)
- bool caching(void)
- QString canonicalFilePath(void)
- QString canonicalPath(void)
- QString completeBaseName(void)
- QString completeSuffix(void)
- QDateTime created(void)
- QDir dir(void)
- bool exists(void)
- QString fileName(void)
- QString filePath(void)
- QString group(void)
- int groupId(void)
- bool isAbsolute(void)
- bool isBundle(void)
- bool isDir(void)
- bool isExecutable(void)
- bool isFile(void)
- bool isHidden(void)
- bool isNativePath(void)
- bool isReadable(void)
- bool isRelative(void)
- bool isRoot(void)
- bool isSymLink(void)
- bool isWritable(void)
- QDateTime lastModified(void)
- QDateTime lastRead(void)
- bool makeAbsolute(void)

- QString owner(void)
- uint ownerId(void)
- QString path(void)
- bool permission(QFileDevice::Permission permissions)
- int permissions(void)
- void refresh(void)
- void setCaching(bool enable)
- void setFile(QString)
- int size(void)
- QString suffix(void)
- void swap(QFileInfo)
- QString symLinkTarget(void)

83.108 QFileSystemModel Class

C++ Reference : <http://doc.qt.io/qt-5/qfilesystemmodel.html>

Parameters : void

- QIcon fileIcon(QModelIndex)
- QFileInfo fileInfo(QModelIndex)
- QString fileName(QModelIndex)
- QString filePath(QModelIndex)
- int filter(void)
- QFileIconProvider *iconProvider(void)
- QModelIndex index(QString, int column)
- bool isDir(QModelIndex)
- bool isReadOnly(void)
- QDateTime lastModified(QModelIndex)
- QModelIndex mkdir(QModelIndex,QString)
- QVariant myComputer(int role)
- bool nameFilterDisables(void)
- QStringList nameFilters(void)
- int permissions(QModelIndex)
- bool remove(QModelIndex)
- bool resolveSymlinks(void)
- bool rmdir(QModelIndex)
- QDir rootDirectory(void)

- `QString rootPath(void)`
- `void setFilter(QDir::Filter filters)`
- `void setIconProvider(QFileIconProvider *provider)`
- `void setNameFilterDisables(bool enable)`
- `void setNameFilters(QStringList)`
- `void setReadOnly(bool enable)`
- `void setResolveSymlinks(bool enable)`
- `QModelIndex setRootPath(QString)`
- `int size(QModelIndex)`
- `QString type(QModelIndex)`
- `bool canFetchMore(QModelIndex)`
- `int columnCount(void)`
- `QVariant data(QModelIndex index, int role)`
- `bool dropMimeData(QMimeData *data, Qt::DropAction action, int row, int column, QModelIndex parent)`
- `void fetchMore(QModelIndex parent)`
- `int flags(QModelIndex index)`
- `bool hasChildren(QModelIndex parent)`
- `QVariant headerData(int section, Qt::Orientation orientation, int role)`
- `QMimeData * mimeData(QModelIndexList indexes)`
- `QStringList mimeTypes(void)`
- `QModelIndex parent(QModelIndex index)`
- `int rowCount(QModelIndex parent)`
- `bool setData(QModelIndex idx, QVariant value, int role)`
- `void sort(int column, Qt::SortOrder order)`
- `int supportedDropActions(void)`

83.109 QFirstPersonCameraController Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qfirstpersoncameracontroller.html>

Parameters : `Qt3DCore::QNode *`

Parent Class : `QAbstractCameraController`

83.110 QFont Class

C++ Reference : <http://doc.qt.io/qt-5/qfont.html>

Parameters : QString, int, int, bool

- bool bold(void)
- int capitalization(void)
- QString defaultFamily(void)
- bool exactMatch(void)
- QString family(void)
- bool fixedPitch(void)
- bool fromString(QString)
- int hintingPreference(void)
- bool isCopyOf(QFont)
- bool italic(void)
- bool kerning(void)
- QString key(void)
- QString lastResortFamily(void)
- QString lastResortFont(void)
- double letterSpacing(void)
- int letterSpacingType(void)
- bool overline(void)
- int pixelSize(void)
- int pointSize(void)
- double pointSizeF(void)
- bool rawMode(void)
- QString rawName(void)
- QFont resolve(QFont)
- void setBold(bool enable)
- void setCapitalization(QFont::Capitalization caps)
- void setFamily(QString)
- void setFixedPitch(bool enable)
- void setHintingPreference(QFont::HintingPreference hintingPreference)
- void setItalic(bool enable)
- void setKerning(bool enable)
- void setLetterSpacing(QFont::SpacingType type, double spacing)
- void setOverline(bool enable)

- void setPixelSize(int pixelSize)
- void setPointSize(int pointSize)
- void setPointSizeF(double pointSize)
- void setRawMode(bool enable)
- void setRawName(QString)
- void setStretch(int factor)
- void setStrikeOut(bool enable)
- void setStyle(QFont::Style style)
- void setStyleHint(QFont::StyleHint hint, QFont::StyleStrategy strategy)
- void setStyleName(QString)
- void setStyleStrategy(QFont::StyleStrategy s)
- void setUnderline(bool enable)
- void setWeight(int weight)
- void setWordSpacing(double spacing)
- int stretch(void)
- bool strikeOut(void)
- int style(void)
- int styleHint(void)
- QString styleName(void)
- int styleStrategy(void)
- QString toString(void)
- bool underline(void)
- int weight(void)
- double wordSpacing(void)
- void insertSubstitution(QString,QString)
- void insertSubstitutions(QString,QStringList)
- QString substitute(QString)
- QStringList substitutes(QString)
- QStringList substitutions(void)

83.111 QFontDialog Class

C++ Reference : <http://doc.qt.io/qt-5/qfontdialog.html>

Parameters : void

Parent Class : QDialog

- QFont currentFont(void)
- void open(QObject * receiver, char * member)
- QFontDialog::FontDialogOptions options(void)
- QFont selectedFont(void)
- void setCurrentFont(QFont font)
- void setOption(QFontDialog::FontDialogOption option, bool on)
- void setOptions(QFontDialog::FontDialogOptions options)
- bool testOption(QFontDialog::FontDialogOption option)
- QFont getFont_2(bool * ok, QFont initial, QWidget * parent, QString title, QFontDialog::FontDialogOptions options)
- QFont getFont_3(bool * ok, QWidget * parent)
- void setcurrentFontChangedEvent(const char *)
- void setfontSelectedEvent(const char *)
- const char *getcurrentFontChangedEvent(void)
- const char *getfontSelectedEvent(void)
- int getfont(void)

83.112 QFontMetrics Class

C++ Reference : <http://doc.qt.io/qt-5/qfontmetrics.html>

Parameters : QFont

- int ascent(void)
- int averageCharWidth(void)
- QRect boundingRect(QChar ch)
- QRect boundingRect_2(QString text)
- QRect boundingRect_3(int x, int y, int width, int height, int flags, QString text, int tabStops , int * tabArray)
- QRect boundingRect_4(QRect rect, int flags, QString text, int tabStops , int * tabArray)
- int descent(void)
- QString elidedText(QString text, Qt::TextElideMode mode, int width, int flags)
- int height(void)
- bool inFont(QChar ch)
- bool inFontUcs4(uint character)

- int leading(void)
- int leftBearing(QChar ch)
- int lineSpacing(void)
- int lineWidth(void)
- int maxWidth(void)
- int minLeftBearing(void)
- int minRightBearing(void)
- int overlinePos(void)
- int rightBearing(QChar ch)
- QSize size(int flags, QString text, int tabStops , int * tabArray)
- int strikeOutPos(void)
- QRect tightBoundingRect(QString text)
- int underlinePos(void)
- int width(QString text, int len)
- int width_2(QChar ch)
- int xHeight(void)

83.113 QForwardRenderer Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qforwardrenderer.html>

Parameters : Qt3DCore::QNode *

- Qt3DCore::QEntity * camera(void)
- QColor clearColor(void)
- QSize externalRenderTargetSize(void)
- float gamma(void)
- bool isFrustumCullingEnabled(void)
- QObject * surface(void)
- QRectF viewportRect(void)
- void setCamera(Qt3DCore::QEntity *camera)
- void setClearColor(QColor clearColor)
- void setExternalRenderTargetSize(QSize size)
- void setFrustumCullingEnabled(bool enabled)
- void setGamma(float gamma)
- void setSurface(QObject *surface)
- void setViewportRect(QRectF viewportRect)

83.114 QFrame Class

C++ Reference : <http://doc.qt.io/qt-5/qframe.html>

Parameters : QWidget *parent, Qt::WindowType flag

Parent Class : QWidget

- QRect frameRect(void)
- int frameShadow(void)
- int frameShape(void)
- int frameStyle(void)
- int frameWidth(void)
- int lineWidth(void)
- int midLineWidth(void)
- void setFrameRect(QRect)
- void setFrameShadow(QFrame::Shadow)
- void setFrameShape(QFrame::Shape)
- void setFrameStyle(int style)
- void setLineWidth(int)
- void setMidLineWidth(int)
- QSize sizeHint(void)

83.115 QFrame2 Class

Parameters : void

Parent Class : QFrame

83.116 QFrame3 Class

Parameters : QWidget *parent

Parent Class : QFrame

83.117 QFrameAction Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dlogic-qframeaction.html>

Parameters : Qt3DCore::QNode *

- void settriggeredEvent(const char *)
- const char *gettriggeredEvent(void)

83.118 QGeoAddress Class

C++ Reference : <http://doc.qt.io/qt-5/qgeoaddress.html>

Parameters : void

- QString city(void)
- void clear(void)
- QString country(void)
- QString countryCode(void)
- QString county(void)
- QString district(void)
- bool isEmpty(void)
- bool isTextGenerated(void)
- QString postalCode(void)
- void setCity(QString city)
- void setCountry(QString country)
- void setCountryCode(QString countryCode)
- void setCounty(QString county)
- void setDistrict(QString district)
- void setPostalCode(QString postalCode)
- void setState(QString state)
- void setStreet(QString street)
- void setText(QString text)
- QString state(void)
- QString street(void)
- QString text(void)

83.119 QGeoAreaMonitorInfo Class

C++ Reference : <http://doc.qt.io/qt-5/qgeoareamonitorinfo.html>

Parameters : QString

- QGeoShape area(void)
- QDateTime expiration(void)
- QString identifier(void)
- bool isPersistent(void)
- bool isValid(void)
- QString name(void)
- QVariantMap notificationParameters(void)

- void setArea(QGeoShape newShape)
- void setExpiration(QDateTime expiry)
- void setName(QString name)
- void setNotificationParameters(QVariantMap parameters)
- void setPersistent(bool isPersistent)

83.120 QGeoAreaMonitorSource Class

C++ Reference : <http://doc.qt.io/qt-5/qgeoareamonitorsource.html>

Parameters : QObject *

Parent Class : QObject

- QString sourceName(void)
- QStringList availableSources(void)
- QGeoAreaMonitorSource * createDefaultSource(QObject * parent)
- QGeoAreaMonitorSource * createSource(QString sourceName, QObject * parent)

83.121 QGeoCircle Class

C++ Reference : <http://doc.qt.io/qt-5/qgeocircle.html>

Parameters : void

- QGeoCoordinate center(void)
- qreal radius(void)
- void setCenter(QGeoCoordinate center)
- void setRadius(qreal radius)
- void translate(double degreesLatitude, double degreesLongitude)
- QGeoCircle translated(double degreesLatitude, double degreesLongitude)

83.122 QGeoCoordinate Class

C++ Reference : <http://doc.qt.io/qt-5/qgeocoordinate.html>

Parameters : void

- double altitude(void)
- QGeoCoordinate atDistanceAndAzimuth(qreal distance, qreal azimuth, qreal distanceUp)
- qreal azimuthTo(QGeoCoordinate other)
- qreal distanceTo(QGeoCoordinate other)
- bool isValid(void)
- double latitude(void)

- double longitude(void)
- void setAltitude(double altitude)
- void setLatitude(double latitude)
- void setLongitude(double longitude)
- QString toString(QGeoCoordinate::CoordinateFormat format)
- QGeoCoordinate::CoordinateType type(void)

83.123 QGeoPositionInfo Class

C++ Reference : <http://doc.qt.io/qt-5/qgeopositioninfo.html>

Parameters : void

- qreal attribute(QGeoPositionInfo::Attribute attribute)
- QGeoCoordinate coordinate(void)
- bool hasAttribute(QGeoPositionInfo::Attribute attribute)
- bool isValid(void)
- void removeAttribute(QGeoPositionInfo::Attribute attribute)
- void setAttribute(QGeoPositionInfo::Attribute attribute, qreal value)
- void setCoordinate(QGeoCoordinate coordinate)
- void setTimestamp(QDateTime timestamp)
- QDateTime timestamp(void)

83.124 QGeoPositionInfoSource Class

C++ Reference : <http://doc.qt.io/qt-5/qgeopositioninfosource.html>

Parent Class : QObject

- QGeoPositionInfoSource::PositioningMethods preferredPositioningMethods(void)
- QString sourceName(void)
- int updateInterval(void)
- void seterrorEvent(const char *)
- void setpositionUpdatedEvent(const char *)
- void setupdateTimeoutEvent(const char *)
- const char *geterrorEvent(void)
- const char *getpositionUpdatedEvent(void)
- const char *getupdateTimeoutEvent(void)
- QStringList availableSources(void)
- QGeoPositionInfoSource *createDefaultSource(QObject *parent)
- QGeoPositionInfoSource *createSource(QString sourceName, QObject *parent)

83.125 QGeoRectangle Class

C++ Reference : <http://doc.qt.io/qt-5/qgeorectangle.html>

Parameters : void

Parent Class : QGeoShape

- QGeoCoordinate bottomLeft(void)
- QGeoCoordinate bottomRight(void)
- QGeoCoordinate center(void)
- bool contains(QGeoRectangle rectangle)
- double height(void)
- bool intersects(QGeoRectangle rectangle)
- void setBottomLeft(QGeoCoordinate bottomLeft)
- void setBottomRight(QGeoCoordinate bottomRight)
- void setCenter(QGeoCoordinate center)
- void setHeight(double degreesHeight)
- void setTopLeft(QGeoCoordinate topLeft)
- void setTopRight(QGeoCoordinate topRight)
- void setWidth(double degreesWidth)
- QGeoCoordinate topLeft(void)
- QGeoCoordinate topRight(void)
- void translate(double degreesLatitude, double degreesLongitude)
- QGeoRectangle translated(double degreesLatitude, double degreesLongitude)
- QGeoRectangle united(QGeoRectangle rectangle)
- double width(void)

83.126 QGeoSatelliteInfo Class

C++ Reference : <http://doc.qt.io/qt-5/qgeosatelliteinfo.html>

Parameters : void

- qreal attribute(QGeoSatelliteInfo::Attribute attribute)
- bool hasAttribute(QGeoSatelliteInfo::Attribute attribute)
- void removeAttribute(QGeoSatelliteInfo::Attribute attribute)
- int satelliteIdentifier(void)
- QGeoSatelliteInfo::SatelliteSystem satelliteSystem(void)
- void setAttribute(QGeoSatelliteInfo::Attribute attribute, qreal value)
- void setSatelliteIdentifier(int satId)
- void setSatelliteSystem(QGeoSatelliteInfo::SatelliteSystem system)

- void setSignalStrength(int signalStrength)
- int signalStrength(void)

83.127 QGeoSatelliteInfoSource Class

C++ Reference : <http://doc.qt.io/qt-5/qgeosatelliteinfosource.html>

- QString sourceName(void)
- int updateInterval(void)

83.128 QGeoShape Class

C++ Reference : <http://doc.qt.io/qt-5/qgeoshape.html>

Parameters : void

- bool contains(QGeoCoordinate coordinate)
- bool isEmpty(void)
- bool isValid(void)
- QGeoShape::ShapeType type(void)

83.129 QGoochMaterial Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qgoochmaterial.html>

Parameters : Qt3DCore::QNode *

- float alpha(void)
- float beta(void)
- QColor cool(void)
- QColor diffuse(void)
- float shininess(void)
- QColor specular(void)
- QColor warm(void)
- void setAlpha(float alpha)
- void setBeta(float beta)
- void setCool(QColor cool)
- void setDiffuse(QColor diffuse)
- void setShininess(float shininess)
- void setSpecular(QColor specular)
- void setWarm(QColor warm)

83.130 QGradient Class

C++ Reference : <http://doc.qt.io/qt-5/qgradient.html>

Parameters : void

- QGradient::CoordinateMode coordinateMode(void)
- void setColorAt(qreal position, QColor color)
- void setCoordinateMode(QGradient::CoordinateMode mode)
- void setSpread(QGradient::Spread method)
- void setStops(QGradientStops stopPoints)
- QGradient::Spread spread(void)
- QGradientStops stops(void)
- QGradient::Type type(void)

83.131 QGraphicsScene Class

C++ Reference : <http://doc.qt.io/qt-5/qgraphicsscene.html>

Parameters : QObject *

Parent Class : QObject

- QGraphicsItem * activePanel(void)
- QGraphicsWidget * activeWindow(void)
- QGraphicsEllipseItem * addEllipse(QRectF rect, QPen pen, QBrush brush)
- QGraphicsEllipseItem * addEllipse_2(qreal x, qreal y, qreal w, qreal h, QPen pen, QBrush brush)
- void addItem(QGraphicsItem *item)
- QGraphicsLineItem * addLine(QLineF line, QPen pen)
- QGraphicsLineItem * addLine_2(qreal x1, qreal y1, qreal x2, qreal y2, QPen pen)
- QGraphicsPathItem * addPath(QPainterPath path, QPen pen, QBrush brush)
- QGraphicsPixmapItem * addPixmap(QPixmap pixmap)
- QGraphicsPolygonItem * addPolygon(QPolygonF polygon, QPen pen, QBrush brush)
- QGraphicsRectItem * addRect(QRectF rect, QPen pen, QBrush brush)
- QGraphicsRectItem * addRect_2(qreal x, qreal y, qreal w, qreal h, QPen pen, QBrush brush)
- QGraphicsSimpleTextItem * addSimpleText(QString text, QFont font)
- QGraphicsTextItem * addText(QString text, QFont font)
- QGraphicsProxyWidget * addWidget(QWidget *widget, Qt::WindowFlags wFlags)
- QBrush backgroundBrush(void)
- int bspTreeDepth(void)
- void clearFocus(void)
- QList<QGraphicsItem *> collidingItems(QGraphicsItem *item, Qt::ItemSelectionMode mode)

- `QGraphicsItemGroup * createItemGroup(QList<QGraphicsItem *> items)`
- `void destroyItemGroup(QGraphicsItemGroup *group)`
- `QGraphicsItem * focusItem(void)`
- `QBrush foregroundBrush(void)`
- `bool hasFocus(void)`
- `qreal height(void)`
- `QVariant inputMethodQuery(Qt::InputMethodQuery query)`
- `void invalidate(qreal x, qreal y, qreal w, qreal h, QGraphicsScene::SceneLayers layers)`
- `bool isActive(void)`
- `QGraphicsItem * itemAt(QPointF position, QTransform deviceTransform)`
- `QGraphicsItem * itemAt_2(qreal x, qreal y, QTransform deviceTransform)`
- `QGraphicsScene::ItemIndexMethod itemIndexMethod(void)`
- `QList<QGraphicsItem *> items(Qt::SortOrder order)`
- `QList<QGraphicsItem *> items_2(QPointF pos, Qt::ItemSelectionMode mode, Qt::SortOrder order, QTransform deviceTransform)`
- `QList<QGraphicsItem *> items_3(QRectF rect, Qt::ItemSelectionMode mode, Qt::SortOrder order, QTransform deviceTransform)`
- `QList<QGraphicsItem *> items_4(QPolygonF polygon, Qt::ItemSelectionMode mode, Qt::SortOrder order, QTransform deviceTransform)`
- `QList<QGraphicsItem *> items_5(QPainterPath path, Qt::ItemSelectionMode mode, Qt::SortOrder order, QTransform deviceTransform)`
- `QList<QGraphicsItem *> items_6(qreal x, qreal y, qreal w, qreal h, Qt::ItemSelectionMode mode, Qt::SortOrder order, QTransform deviceTransform)`
- `QRectF itemsBoundingRect(void)`
- `qreal minimumRenderSize(void)`
- `QGraphicsItem * mouseGrabberItem(void)`
- `QPalette palette(void)`
- `void removeItem(QGraphicsItem *item)`
- `void render(QPainter *painter, QRectF target, QRectF source, Qt::AspectRatioMode aspectRatioMode)`
- `QRectF sceneRect(void)`
- `QList<QGraphicsItem *> selectedItems(void)`
- `QPainterPath selectionArea(void)`
- `bool sendEvent(QGraphicsItem *item, QEvent *event)`
- `void setActivePanel(QGraphicsItem *item)`
- `void setActiveWindow(QGraphicsWidget *widget)`
- `void setBackgroundBrush(QBrush brush)`
- `void setBspTreeDepth(int depth)`
- `void setFocus(Qt::FocusReason focusReason)`

- void setFocusItem(QGraphicsItem *item, Qt::FocusReason focusReason)
- void setForegroundBrush(QBrush brush)
- void setItemIndexMethod(QGraphicsScene::ItemIndexMethod method)
- void setMinimumRenderSize(qreal minSize)
- void setPalette(QPalette palette)
- void setSceneRect(QRectF rect)
- void setSceneRect_2(qreal x, qreal y, qreal w, qreal h)
- void setSelectionArea(QPainterPath path, QTransform deviceTransform)
- void setSelectionArea_2(QPainterPath path, Qt::ItemSelectionMode mode, QTransform deviceTransform)
- void setSelectionArea_3(QPainterPath path, Qt::ItemSelectionOperation selectionOperation, Qt::ItemSelectionMode mode, QTransform deviceTransform)
- void setStickyFocus(bool enabled)
- void setStyle(QStyle *style)
- bool stickyFocus(void)
- QStyle * style(void)
- void update(qreal x, qreal y, qreal w, qreal h)
- QList<QGraphicsView *> views(void)
- qreal width(void)
- void advance(void)
- void clear(void)
- void clearSelection(void)
- void invalidate_2(QRectF rect, QGraphicsScene::SceneLayers layers)
- void update_2(QRectF rect)
- void setchangedEvent(const char *)
- void setfocusItemChangedEvent(const char *)
- void setsceneRectChangedEvent(const char *)
- void setselectionChangedEvent(const char *)
- const char *getchangedEvent(void)
- const char *getfocusItemChangedEvent(void)
- const char *getsceneRectChangedEvent(void)
- const char *getselectionChangedEvent(void)

83.132 QGraphicsVideoItem Class

C++ Reference : <http://doc.qt.io/qt-5/qgraphicsvideoitem.html>

Parameters : void

- Qt::AspectRatioMode aspectRatioMode(void)
- QSizeF nativeSize(void)
- QPointF offset(void)
- void setAspectRatioMode(Qt::AspectRatioMode mode)
- void setOffset(QPointF offset)
- void setSize(QSizeF size)
- QSizeF size(void)

83.133 QGraphicsView Class

C++ Reference : <http://doc.qt.io/qt-5/qgraphicsview.html>

Parameters : QWidget *

Parent Class : QAbstractScrollArea

- Qt::Alignment alignment(void)
- QBrush backgroundBrush(void)
- QGraphicsView::CacheMode cacheMode(void)
- void centerOn(QPointF pos)
- void centerOn_2(qreal x, qreal y)
- void centerOn_3(QGraphicsItem *item)
- QGraphicsView::DragMode dragMode(void)
- void ensureVisible(QRectF rect, int xmargin, int ymargin)
- void ensureVisible_2(qreal x, qreal y, qreal w, qreal h, int xmargin, int ymargin)
- void ensureVisible_3(QGraphicsItem *item, int xmargin, int ymargin)
- void fitInView(QRectF rect, Qt::AspectRatioMode aspectRatioMode)
- void fitInView_2(qreal x, qreal y, qreal w, qreal h, Qt::AspectRatioMode aspectRatioMode)
- void fitInView_3(QGraphicsItem *item, Qt::AspectRatioMode aspectRatioMode)
- QBrush foregroundBrush(void)
- bool isInteractive(void)
- bool isTransformed(void)
- QGraphicsItem * itemAt(QPoint pos)
- QGraphicsItem * itemAt_2(int x, int y)
- QList<QGraphicsItem *> items(void)
- QList<QGraphicsItem *> items_2(QPoint pos)

- QList<QGraphicsItem *> items_3(int x, int y)
- QList<QGraphicsItem *> items_4(QRect rect, Qt::ItemSelectionMode mode)
- QList<QGraphicsItem *> items_5(int x, int y, int w, int h, Qt::ItemSelectionMode mode)
- QList<QGraphicsItem *> items_6(QPolygon polygon, Qt::ItemSelectionMode mode)
- QList<QGraphicsItem *> items_7(QPainterPath path, Qt::ItemSelectionMode mode)
- QPoint mapFromScene(QPointF point)
- QPolygon mapFromScene_2(QRectF rect)
- QPolygon mapFromScene_3(QPolygonF polygon)
- QPainterPath mapFromScene_4(QPainterPath path)
- QPoint mapFromScene_5(qreal x, qreal y)
- QPolygon mapFromScene_6(qreal x, qreal y, qreal w, qreal h)
- QPointF mapToScene(QPoint point)
- QPolygonF mapToScene_2(QRect rect)
- QPolygonF mapToScene_3(QPolygon polygon)
- QPainterPath mapToScene_4(QPainterPath path)
- QPointF mapToScene_5(int x, int y)
- QPolygonF mapToScene_6(int x, int y, int w, int h)
- QMatrix matrix(void)
- QGraphicsView::OptimizationFlags optimizationFlags(void)
- void render(QPainter *painter, QRectF target, QRect source, Qt::AspectRatioMode aspectRatioMode)
- QPainter::RenderHints renderHints(void)
- void resetCachedContent(void)
- void resetMatrix(void)
- void resetTransform(void)
- QGraphicsView::ViewportAnchor resizeAnchor(void)
- void rotate(qreal angle)
- QRect rubberBandRect(void)
- Qt::ItemSelectionMode rubberBandSelectionMode(void)
- void scale(qreal sx, qreal sy)
- QGraphicsScene * scene(void)
- QRectF sceneRect(void)
- void setAlignment(Qt::Alignment alignment)
- void setBackgroundBrush(QBrush brush)
- void setCacheMode(QGraphicsView::CacheMode mode)
- void setDragMode(QGraphicsView::DragMode mode)
- void setForegroundBrush(QBrush brush)

- void setInteractive(bool allowed)
- void setMatrix(QMatrix matrix, bool combine)
- void setOptimizationFlag(QGraphicsView::OptimizationFlag flag, bool enabled)
- void setOptimizationFlags(QGraphicsView::OptimizationFlags flags)
- void setRenderHint(QPainter::RenderHint hint, bool enabled)
- void setRenderHints(QPainter::RenderHints hints)
- void setResizeAnchor(QGraphicsView::ViewportAnchor anchor)
- void setRubberBandSelectionMode(Qt::ItemSelectionMode mode)
- void setScene(QGraphicsScene *scene)
- void setSceneRect(QRectF rect)
- void setSceneRect_2(qreal x, qreal y, qreal w, qreal h)
- void setTransform(QTransform matrix, bool combine)
- void setTransformationAnchor(QGraphicsView::ViewportAnchor anchor)
- void setViewportUpdateMode(QGraphicsView::ViewportUpdateMode mode)
- void shear(qreal sh, qreal sv)
- QTransform transform(void)
- QGraphicsView::ViewportAnchor transformationAnchor(void)
- void translate(qreal dx, qreal dy)
- QTransform viewportTransform(void)
- QGraphicsView::ViewportUpdateMode viewportUpdateMode(void)
- void invalidateScene(QRectF rect, QGraphicsScene::SceneLayers layers)
- void updateScene(QList<QRectF> rects)
- void updateSceneRect(QRectF rect)

83.134 QGridLayout Class

C++ Reference : <http://doc.qt.io/qt-5/qgridlayout.html>

Parameters : void

- void addItem(QLayoutItem * item, int row, int column, int rowSpan , int columnSpan , Qt::Alignment alignment)
- void addLayout(QLayout * layout, int row, int column, Qt::Alignment alignment)
- void addLayout_2(QLayout * layout, int row, int column, int rowSpan, int columnSpan, Qt::Alignment alignment)
- void addWidget(QWidget * widget, int row, int column, Qt::Alignment alignment)
- void addWidget_2(QWidget * widget, int fromRow, int fromColumn, int rowSpan, int columnSpan, Qt::Alignment alignment)
- QRect cellRect(int row, int column)

- int columnCount(void)
- int columnMinimumWidth(int column)
- int columnStretch(int column)
- void getItemPosition(int index, int * row, int * column, int * rowSpan, int * columnSpan)
- int horizontalSpacing(void)
- QLayoutItem * itemAtPosition(int row, int column)
- Qt::Corner originCorner(void)
- int rowCount(void)
- int rowMinimumHeight(int row)
- int rowStretch(int row)
- void setColumnMinimumWidth(int column, int minSize)
- void setColumnStretch(int column, int stretch)
- void setHorizontalSpacing(int spacing)
- void setOriginCorner(Qt::Corner corner)
- void setRowMinimumHeight(int row, int minSize)
- void setRowStretch(int row, int stretch)
- void setSpacing(int spacing)
- void setVerticalSpacing(int spacing)
- int spacing(void)
- int verticalSpacing(void)

83.135 QGuiApplication Class

C++ Reference : <http://doc.qt.io/qt-5/qguiapplication.html>

Parent Class : QCoreApplication

Parameters : int,char **

- qreal devicePixelRatio(void)
- bool isSavingSession(void)
- bool isSessionRestored(void)
- QString sessionId(void)
- QString sessionKey(void)
- QList<QWindow> allWindows(void)
- QString applicationDisplayName(void)
- Qt::ApplicationState applicationState(void)
- void changeOverrideCursor(QCursor cursor)
- QClipboard * clipboard(void)

- bool desktopSettingsAware(void)
- int exec(void)
- QObject * focusObject(void)
- QWindow * focusWindow(void)
- QFont font(void)
- QInputMethod * inputMethod(void)
- bool isLeftToRight(void)
- bool isRightToLeft(void)
- Qt::KeyboardModifiers keyboardModifiers(void)
- Qt::LayoutDirection layoutDirection(void)
- QWindow * modalWindow(void)
- Qt::MouseButtons mouseButtons(void)
- QCursor * overrideCursor(void)
- QPalette palette(void)
- QString platformName(void)
- QPlatformNativeInterface * platformNativeInterface(void)
- QScreen * primaryScreen(void)
- Qt::KeyboardModifiers queryKeyboardModifiers(void)
- bool quitOnLastWindowClosed(void)
- void restoreOverrideCursor(void)
- QList<QScreen *> screens(void)
- void setApplicationDisplayName(QString name)
- void setDesktopSettingsAware(bool on)
- void setFont(QFont font)
- void setLayoutDirection(Qt::LayoutDirection direction)
- void setOverrideCursor(QCursor cursor)
- void setPalette(QPalette pal)
- void setQuitOnLastWindowClosed(bool quit)
- QStyleHints * styleHints(void)
- void sync(void)
- QWindow * topLevelAt(QPoint pos)
- QWindowList topLevelWindows(void)
- void setapplicationDisplayNameChangedEvent(const char *)
- void setapplicationStateChangedEvent(const char *)
- void setcommitDataRequestEvent(const char *)
- void setfocusObjectChangedEvent(const char *)

- void setfocusWindowChangedEvent(const char *)
- void setfontDatabaseChangedEvent(const char *)
- void setlastWindowClosedEvent(const char *)
- void setlayoutDirectionChangedEvent(const char *)
- void setpaletteChangedEvent(const char *)
- void setprimaryScreenChangedEvent(const char *)
- void setsaveStateRequestEvent(const char *)
- void setscreenAddedEvent(const char *)
- void setscreenRemovedEvent(const char *)
- const char *getapplicationDisplayNameChangedEvent(void)
- const char *getapplicationStateChangedEvent(void)
- const char *getcommitDataRequestEvent(void)
- const char *getfocusObjectChangedEvent(void)
- const char *getfocusWindowChangedEvent(void)
- const char *getfontDatabaseChangedEvent(void)
- const char *getLastWindowClosedEvent(void)
- const char *getlayoutDirectionChangedEvent(void)
- const char *getpaletteChangedEvent(void)
- const char *getprimaryScreenChangedEvent(void)
- const char *getsaveStateRequestEvent(void)
- const char *getscreenAddedEvent(void)
- const char *getscreenRemovedEvent(void)

83.136 QHBarModelMapper Class

C++ Reference : <http://doc.qt.io/qt-5/qhbarmodelmapper.html>

Parameters : QObject *

Parent Class : QObject

- int columnCount(void)
- int firstBarSetRow(void)
- int firstColumn(void)
- int lastBarSetRow(void)
- QAbstractItemModel * model(void)
- QAbstractBarSeries * series(void)
- void setColumnCount(int columnCount)
- void setFirstBarSetRow(int firstBarSetRow)

- void setFirstColumn(int firstColumn)
- void setLastBarSetRow(int lastBarSetRow)
- void setModel(QAbstractItemModel *model)
- void setSeries(QAbstractBarSeries *series)
- void setcolumnCountChangedEvent(const char *)
- void setfirstBarSetRowChangedEvent(const char *)
- void setfirstColumnChangedEvent(const char *)
- void setlastBarSetRowChangedEvent(const char *)
- void setmodelReplacedEvent(const char *)
- void setseriesReplacedEvent(const char *)
- const char *getcolumnCountChangedEvent(void)
- const char *getfirstBarSetRowChangedEvent(void)
- const char *getfirstColumnChangedEvent(void)
- const char *getLastBarSetRowChangedEvent(void)
- const char *getmodelReplacedEvent(void)
- const char *getseriesReplacedEvent(void)

83.137 QHBoxLayout Class

C++ Reference : <http://doc.qt.io/qt-5/qhboxlayout.html>

Parameters : void

Parent Class : QBoxLayout

- void addWidget(QWidget *)
- void addLayout(FlowLayout *)

83.138 QHBoxPlotModelMapper Class

C++ Reference : <http://doc.qt.io/qt-5/qhboxplotmodelmapper.html>

Parameters : QObject *

Parent Class : QObject

- int columnCount(void)
- int firstBoxSetRow(void)
- int firstColumn(void)
- int lastBoxSetRow(void)
- QAbstractItemModel * model(void)
- QBoxPlotSeries * series(void)
- void setColumnCount(int rowCount)

- void setFirstBoxSetRow(int firstBoxSetRow)
- void setFirstColumn(int firstColumn)
- void setLastBoxSetRow(int lastBoxSetRow)
- void setModel(QAbstractItemModel *model)
- void setSeries(QBoxPlotSeries *series)
- void setcolumnCountChangedEvent(const char *)
- void setfirstBoxSetRowChangedEvent(const char *)
- void setfirstColumnChangedEvent(const char *)
- void setlastBoxSetRowChangedEvent(const char *)
- void setmodelReplacedEvent(const char *)
- void setsseriesReplacedEvent(const char *)
- const char *getcolumnCountChangedEvent(void)
- const char *getfirstBoxSetRowChangedEvent(void)
- const char *getfirstColumnChangedEvent(void)
- const char *getlastBoxSetRowChangedEvent(void)
- const char *getmodelReplacedEvent(void)
- const char *getseriesReplacedEvent(void)

83.139 QCandlestickModelMapper Class

C++ Reference : <http://doc.qt.io/qt-5/qhcandlestickmodelmapper.html>

Parameters : QObject *

Parent Class : QCandlestickModelMapper

- int closeColumn(void)
- int firstSetRow(void)
- int highColumn(void)
- int lastSetRow(void)
- int lowColumn(void)
- int openColumn(void)
- void setCloseColumn(int closeColumn)
- void setFirstSetRow(int firstSetRow)
- void setHighColumn(int highColumn)
- void setLastSetRow(int lastSetRow)
- void setLowColumn(int lowColumn)
- void setOpenColumn(int openColumn)
- void setTimestampColumn(int timestampColumn)

- int timestampColumn(void)
- void setcloseColumnChangedEvent(const char *)
- void setfirstSetRowChangedEvent(const char *)
- void sethighColumnChangedEvent(const char *)
- void setlastSetRowChangedEvent(const char *)
- void setlowColumnChangedEvent(const char *)
- void setopenColumnChangedEvent(const char *)
- void settimestampColumnChangedEvent(const char *)
- const char *getcloseColumnChangedEvent(void)
- const char *getfirstSetRowChangedEvent(void)
- const char *gethighColumnChangedEvent(void)
- const char *getLastSetRowChangedEvent(void)
- const char *getlowColumnChangedEvent(void)
- const char *getopenColumnChangedEvent(void)
- const char *gettstampColumnChangedEvent(void)

83.140 QHPieModelMapper Class

C++ Reference : <http://doc.qt.io/qt-5/qhpiemodelmapper.html>

Parameters : QObject *

Parent Class : QPieModelMapper

- int columnCount(void)
- int firstColumn(void)
- int labelsRow(void)
- QAbstractItemModel * model(void)
- QPieSeries * series(void)
- void setColumnCount(int columnCount)
- void setFirstColumn(int firstColumn)
- void setLabelsRow(int labelsRow)
- void setModel(QAbstractItemModel *model)
- void setSeries(QPieSeries *series)
- void setValuesRow(int valuesRow)
- int valuesRow(void)
- void setcolumnCountChangedEvent(const char *)
- void setfirstColumnChangedEvent(const char *)
- void setlabelsRowChangedEvent(const char *)

- void setmodelReplacedEvent(const char *)
- void setsseriesReplacedEvent(const char *)
- void setvaluesRowChangedEvent(const char *)
- const char *getcolumnCountChangedEvent(void)
- const char *getfirstColumnChangedEvent(void)
- const char *getlabelsRowChangedEvent(void)
- const char *getmodelReplacedEvent(void)
- const char *getseriesReplacedEvent(void)
- const char *getvaluesRowChangedEvent(void)

83.141 QHXYModelMapper Class

C++ Reference : <http://doc.qt.io/qt-5/qhxymodelmapper.html>

Parameters : QObject *

Parent Class : QXYModelMapper

- int columnCount(void)
- int firstColumn(void)
- QAbstractItemModel * model(void)
- QXYSeries * series(void)
- void setColumnCount(int columnCount)
- void setFirstColumn(int firstColumn)
- void setModel(QAbstractItemModel *model)
- void setSeries(QXYSeries *series)
- void setXRow(int xRow)
- void setYRow(int yRow)
- int xRow(void)
- int yRow(void)
- void setcolumnCountChangedEvent(const char *)
- void setfirstColumnChangedEvent(const char *)
- void setmodelReplacedEvent(const char *)
- void setsseriesReplacedEvent(const char *)
- void setxRowChangedEvent(const char *)
- void setyRowChangedEvent(const char *)
- const char *getcolumnCountChangedEvent(void)
- const char *getfirstColumnChangedEvent(void)
- const char *getmodelReplacedEvent(void)

- const char *getseriesReplacedEvent(void)
- const char *getxRowChangedEvent(void)
- const char *getyRowChangedEvent(void)

83.142 QHeaderView Class

C++ Reference : <http://doc.qt.io/qt-5/qheaderview.html>

Parameters : Qt::Orientation, QWidget *

Parent Class : QAbstractItemView

- bool cascadingSectionResizes(void)
- int count(void)
- Qt::Alignment defaultAlignment(void)
- int defaultSectionSize(void)
- int hiddenSectionCount(void)
- void hideSection(int logicalIndex)
- bool highlightSections(void)
- bool isSectionHidden(int logicalIndex)
- bool isSortIndicatorShown(void)
- int length(void)
- int logicalIndex(int visualIndex)
- int logicalIndexAt(int position)
- int logicalIndexAt_2(int x, int y)
- int logicalIndexAt_3(QPoint pos)
- int maximumSectionSize(void)
- int minimumSectionSize_2(void)
- void moveSection(int from, int to)
- int offset(void)
- Qt::Orientation orientation(void)
- int resizeContentsPrecision(void)
- void resizeSection(int logicalIndex, int size)
- void resizeSections(QHeaderView::ResizeMode mode)
- bool restoreState(QByteArray state)
- QByteArray saveState(void)
- int sectionPosition(int logicalIndex)
- QHeaderView::ResizeMode sectionResizeMode(int logicalIndex)
- int sectionSize(int logicalIndex)

- int sectionSizeHint(int logicalIndex)
- int sectionViewportPosition(int logicalIndex)
- bool sectionsClickable(void)
- bool sectionsHidden(void)
- bool sectionsMovable(void)
- bool sectionsMoved(void)
- void setCascadingSectionResizes(bool enable)
- void setDefaultAlignment(Qt::Alignment alignment)
- void setDefaultSectionSize(int size)
- void setHighlightSections(bool highlight)
- void setMaximumSectionSize(int size)
- void setMinimumSectionSize(int size)
- void setResizeContentsPrecision(int precision)
- void setSectionHidden(int logicalIndex, bool hide)
- void setSectionResizeMode(QHeaderView::ResizeMode mode)
- void setSectionResizeMode_2(int logicalIndex, QHeaderView::ResizeMode mode)
- void setSectionsClickable(bool clickable)
- void setSectionsMovable(bool movable)
- void setSortIndicator(int logicalIndex, Qt::SortOrder order)
- void setSortIndicatorShown(bool show)
- void setStretchLastSection(bool stretch)
- void showSection(int logicalIndex)
- Qt::SortOrder sortIndicatorOrder(void)
- int sortIndicatorSection(void)
- bool stretchLastSection(void)
- int stretchSectionCount(void)
- void swapSections(int first, int second)
- int visualIndex(int logicalIndex)
- int visualIndexAt(int position)
- void headerDataChanged(Qt::Orientation orientation, int logicalFirst, int logicalLast)
- void setOffset(int offset)
- void setOffsetToLastSection(void)
- void setOffsetToSectionPosition(int visualSectionNumber)
- void setgeometriesChangedEvent(const char *)
- void setsectionClickedEvent(const char *)
- void setsectionCountChangedEvent(const char *)

- void setsectionDoubleClickedEvent(const char *)
- void setsectionEnteredEvent(const char *)
- void setsectionHandleDoubleClickedEvent(const char *)
- void setsectionMovedEvent(const char *)
- void setsectionPressedEvent(const char *)
- void setsectionResizedEvent(const char *)
- void setsortIndicatorChangedEvent(const char *)
- const char *getgeometriesChangedEvent(void)
- const char *getsectionClickedEvent(void)
- const char *getsectionCountChangedEvent(void)
- const char *getsectionDoubleClickedEvent(void)
- const char *getsectionEnteredEvent(void)
- const char *getsectionHandleDoubleClickedEvent(void)
- const char *getsectionMovedEvent(void)
- const char *getsectionPressedEvent(void)
- const char *getsectionResizedEvent(void)
- const char *getsortIndicatorChangedEvent(void)
- void geteventparameters(void)

83.143 QHorizontalBarSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qhorizontalbarseries.html>

Parameters : QObject *

Parent Class : QAbstractBarSeries

- QAbstractSeries::SeriesType type(void)

83.144 QHorizontalPercentBarSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qhorizontalpercentbarseries.html>

Parameters : QObject *

Parent Class : QAbstractBarSeries

- QAbstractSeries::SeriesType type(void)

83.145 QHorizontalStackedBarSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qhorizontalstackedbarseries.html>

Parameters : QObject *

Parent Class : QAbstractBarSeries

- QAbstractSeries::SeriesType type(void)

83.146 QHostAddress Class

C++ Reference : <http://doc.qt.io/qt-5/qhostaddress.html>

Parameters : void

- void clear(void)
- bool isInSubnet(QHostAddress, int netmask)
- boolisNull(void)
- int protocol(void)
- QString scopeId(void)
- bool setAddress(QString)
- int toIPv4Address(void)
- Q_IPV6ADDR toIPv6Address(void)
- QString toString(void)

83.147 QHostInfo Class

C++ Reference : <http://doc.qt.io/qt-5/qhostinfo.html>

Parameters : void

- int error(void)
- QString errorString(void)
- QString hostName(void)
- int lookupId(void)
- void setError(QHostInfo::HostInfoError error)
- void setErrorString(QString)
- void setHostName(QString)
- void setLookupId(int id)
- void abortHostLookup(int id)
- QHostInfo fromName(QString)
- QString localDomainName(void)
- QString localHostName(void)

83.148 QIODevice Class

C++ Reference : <http://doc.qt.io/qt-5/qiodevice.html>

Parameters : void

Parent Class : QObject

- QString errorString(void)
- bool getChar(char *c)
- bool isOpen(void)
- bool isReadable(void)
- bool isTextModeEnabled(void)
- bool isWritable(void)
- int openMode(void)
- int peek(char *data, int maxSize)
- int read(char *data, int maxSize)
- int readLine(char *data, int maxSize)
- void ungetChar(char c)
- int write(const char *data, int maxSize)
- bool atEnd(void)
- bool canReadLine(void)
- void close(void)
- bool open(QIODevice::OpenMode flags)
- qint64 pos(void)
- bool seek(qint64 pos)
- qint64 size(void)
- void setaboutToCloseEvent(const char *)
- void setbytesWrittenEvent(const char *)
- void setreadChannelFinishedEvent(const char *)
- void setreadyReadEvent(const char *)
- const char *getaboutToCloseEvent(void)
- const char *getbytesWrittenEvent(void)
- const char *getreadChannelFinishedEvent(void)
- const char *getreadyReadEvent(void)

83.149 QIcon Class

C++ Reference : <http://doc.qt.io/qt-5/qicon.html>

Parameters : QPixmap

83.150 QImage Class

C++ Reference : <http://doc.qt.io/qt-5/qimage.html>

Parameters : void

- bool allGray(void)
- int bitPlaneCount(void)
- uchar *bits(void)
- int byteCount(void)
- int bytesPerLine(void)
- qint64 cacheKey(void)
- QRgb color(int i)
- int colorCount(void)
- const uchar *constBits(void)
- const uchar *constScanLine(int i)
- QImage convertToFormat(QImage::Format format, Qt::ImageConversionFlags flags)
- QImage copy(int x, int y, int width, int height)
- QImage createAlphaMask(Qt::ImageConversionFlags flags)
- QImage createHeuristicMask(bool clipTight)
- QImage createMaskFromColor(QRgb color, Qt::MaskMode mode)
- int depth(void)
- int dotsPerMeterX(void)
- int dotsPerMeterY(void)
- void fill(QColor)
- QImage::Format format(void)
- bool hasAlphaChannel(void)
- int height(void)
- void invertPixels(QImage::InvertMode mode)
- bool isGrayscale(void)
- boolisNull(void)
- bool load(QString, const char *format) # In RingQt use : bool loadimage(QString, const char *format)
- bool loadFromData(QByteArray, const char * format)
- QImage mirrored(bool horizontal, bool vertical)

- QPoint offset(void)
- QRgb pixel(int x, int y)
- int pixelIndex(int x, int y)
- QRect rect(void)
- QImage rgbSwapped(void)
- bool save(QString, const char * format, int quality)
- QImage scaled(int width, int height, Qt::AspectRatioMode aspectRatioMode, Qt::TransformationMode transformMode)
- QImage scaledToHeight(int height, Qt::TransformationMode mode)
- QImage scaledToWidth(int width, Qt::TransformationMode mode)
- uchar *scanLine(int i)
- void setColor(int index, QRgb colorValue)
- void setColorCount(int colorCount)
- void setDotsPerMeterX(int x)
- void setDotsPerMeterY(int y)
- void setOffset(QPoint)
- void setPixel(int x, int y, uint index_or_rgb)
- void setText(QString,QString)
- QSize size(void)
- void swap(QImage)
- QString text(QString)
- QStringList textKeys(void)
- QImage transformed(QMatrix, Qt::TransformationMode mode)
- bool valid(int x, int y)
- int width(void)

83.151 QInputAspect Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dinput-qinputaspect.html>

Parameters : QObject *

- QStringList availablePhysicalDevices(void)
- Qt3DInput::QAbstractPhysicalDevice * createPhysicalDevice(QString name)

83.152 QInputDialog Class

C++ Reference : <http://doc.qt.io/qt-5/qinputdialog.html>

Parameters : QWidget *

Parent Class : QDialog

- QString cancelButtonText(void)
- QStringList comboBoxItems(void)
- int doubleDecimals(void)
- double doubleMaximum(void)
- double doubleMinimum(void)
- double doubleValue(void)
- int inputMode(void)
- int intMaximum(void)
- int intMinimum(void)
- int intStep(void)
- int intValue(void)
- bool isComboBoxEditable(void)
- QString labelText(void)
- QString okButtonText(void)
- void open(QObject *receiver, const char *member)
- int options(void)
- void setCancelButtonText(QString)
- void setComboBoxEditable(bool editable)
- void setComboBoxItems(QStringList)
- void setDoubleDecimals(int decimals)
- void setDoubleMaximum(double max)
- void setDoubleMinimum(double min)
- void setDoubleRange(double min, double max)
- void setDoubleValue(double value)
- void setInputMode(QInputDialog::InputMode mode)
- void setIntMaximum(int max)
- void setIntMinimum(int min)
- void setIntRange(int min, int max)
- void setIntStep(int step)
- void setIntValue(int value)
- void setLabelText(QString)

- void setOkButtonText(QString)
- void setOption(QInputDialog::InputDialogOption option, bool on)
- void setOptions(QInputDialog::InputDialogOption options)
- void setTextEchoMode(QLineEdit::EchoMode mode)
- void setTextValue(QString)
- bool testOption(QInputDialog::InputDialogOption option)
- int textEchoMode(void)
- QString textValue(void)
- double getDouble(QWidget *parent,QString,QString, double value, double min, double max , int decimals, bool *ok, Qt::WindowType flags)
- int getInt(QWidget *parent,QString,QString, int value, int min, int max, int step, bool *ok, Qt::WindowType flags)

83.153 QJsonArray Class

C++ Reference : <http://doc.qt.io/qt-5/qjsonarray.html>

Parameters : void

- void append(QJsonValue value)
- QJsonValue at(int i)
- bool contains(QJsonValue value)
- int count(void)
- bool empty(void)
- QJsonValue first(void)
- void insert(int i, QJsonValue value)
- bool isEmpty(void)
- QJsonValue last(void)
- void pop_back(void)
- void pop_front(void)
- void prepend(QJsonValue value)
- void push_back(QJsonValue value)
- void push_front(QJsonValue value)
- void removeAt(int i)
- void removeFirst(void)
- void removeLast(void)
- void replace(int i, QJsonValue value)
- int size(void)
- QJsonValue takeAt(int i)

- QVariantList toVariantList(void)
- QJsonArray fromStringList(QStringList list)
- QJsonArray fromVariantList(QVariantList list)

83.154 QJsonDocument Class

C++ Reference : <http://doc.qt.io/qt-5/qjsondocument.html>

Parameters : void

- QJsonArray array(void)
- bool isArray(void)
- bool isEmpty(void)
- boolisNull(void)
- bool isObject(void)
- QJsonObject object(void)
- const char * rawData(int * size)
- void setArray(QJsonArray array)
- void setObject(QJsonObject object)
- QByteArray toBinaryData(void)
- QByteArray toJson(QJsonDocument::JsonFormat format)
- QVariant toVariant(void)
- QJsonDocument fromBinaryData(QByteArray data, QJsonDocument::DataValidation validation)
- QJsonDocument fromJson(QByteArray json, QJsonParseError * error)
- QJsonDocument fromRawData(char * data, int size, QJsonDocument::DataValidation validation)
- QJsonDocument fromVariant(QVariant variant)

83.155 QJsonObject Class

C++ Reference : <http://doc.qt.io/qt-5/qjsonobject.html>

Parameters : void

- bool contains(QString key)
- int count(void)
- bool empty(void)
- bool isEmpty(void)
- QStringList keys(void)
- int length(void)
- void remove(QString key)
- int size(void)

- `QJsonValue take(QString key)`
- `QVariantMap toVariantMap(void)`
- `QJsonValue value(QString key)`
- `QJsonObject fromVariantMap(QVariantMap map)`

83.156 QJsonParseError Class

C++ Reference : <http://doc.qt.io/qt-5/qjsonparseerror.html>

Parameters : void

- `QString errorString(void)`

83.157 QJsonValue Class

C++ Reference : <http://doc.qt.io/qt-5/qjsonvalue.html>

Parameters : void

- `bool isArray(void)`
- `bool isBool(void)`
- `bool isDouble(void)`
- `bool isNull(void)`
- `bool isObject(void)`
- `bool isString(void)`
- `bool isUndefined(void)`
- `QJsonArray toArray(QJsonArray defaultValue)`
- `QJsonArray toArray_2(void)`
- `bool toBool(bool defaultValue)`
- `double toDouble(double defaultValue)`
- `int toInt(int defaultValue)`
- `QJsonObject toObject(QJsonObject defaultValue)`
- `QJsonObject toObject_2(void)`
- `QString toString(QString defaultValue)`
- `QVariant toVariant(void)`
- `QJsonValue::Type type(void)`
- `QJsonValue fromVariant(QVariant variant)`

83.158 QKeySequence Class

C++ Reference : <http://doc.qt.io/qt-5/qkeysequence.html>

Parameters : QString

83.159 QLCDNumber Class

C++ Reference : <http://doc.qt.io/qt-5/qlcdnumber.html>

Parameters : QWidget *

Parent Class : QFrame

- bool checkOverflow(double num)
- int digitCount(void)
- int intValue(void)
- int mode(void)
- int segmentStyle(void)
- void setDigitCount(int numDigits)
- void setMode(QLCDNumber::Mode)
- void setSegmentStyle(QLCDNumber::SegmentStyle)
- bool smallDecimalPoint(void)
- double value(void)
- void display(double)
- void setBinMode(void)
- void setDecMode(void)
- void setHexMode(void)
- void setOctMode(void)
- void setSmallDecimalPoint(bool)

83.160 QLabel Class

C++ Reference : <http://doc.qt.io/qt-5/qlabel.html>

Parameters : QWidget *

Parent Class : QWidget

- int alignment(void)
- QWidget *buddy(void)
- bool hasScaledContents(void)
- bool hasSelectedText(void)
- int indent(void)

- int margin(void)
- QMovie *movie(void)
- bool openExternalLinks(void)
- QPicture *picture(void)
- QPixmap *pixmap(void)
- QString selectedText(void)
- int selectionStart(void)
- void setAlignment(Qt::AlignmentFlag)
- void setBuddy(QWidget *buddy)
- void setIndent(int)
- void setMargin(int)
- void setOpenExternalLinks(bool open)
- void setScaledContents(bool)
- void setSelection(int start, int length)
- void setTextFormat(Qt::TextFormat)
- void setTextInteractionFlags(Qt::TextInteractionFlag flags)
- void setWordWrap(bool on)
- QString text(void)
- int textFormat(void)
- int textInteractionFlags(void)
- bool wordWrap(void)
- void clear(void)
- void setMovie(QMovie *movie)
- void setNum(double num)
- void setPicture(QPicture)
- void setPixmap(QPixmap)
- void setText(QString)

83.161 QLayout Class

C++ Reference : <http://doc.qt.io/qt-5/qlayout.html>

Parameters : QWidget *

Parent Class : QObject

- bool activate(void)
- void addWidget(QWidget *w)
- QMargins contentsMargins(void)

- QRect contentsRect(void)
- void getContentsMargins(int *left, int *top, int *right, int *bottom)
- bool isEnabled(void)
- QWidget *menuBar(void)
- QWidget *parentWidget(void)
- void removeItem(QLayoutItem *item)
- void removeWidget(QWidget *widget)
- bool setAlignment(QWidget *w, Qt::Alignment alignment)
- void setAlignment_2(Qt::Alignment alignment)
- bool setAlignment_3(QLayout *l, Qt::Alignment alignment)
- void setContentsMargins(int left, int top, int right, int bottom)
- void setContentsMargins_2(QMargins margins)
- void setEnabled(bool enable)
- void setMenuBar(QWidget *widget)
- void setSizeConstraint(QLayout::SizeConstraint)
- void setSpacing(int)
- QLayout::SizeConstraint sizeConstraint(void)
- int spacing(void)
- void update(void)
- QSize closestAcceptableSize(QWidget * widget, QSize size)

83.162 QLegend Class

C++ Reference : <http://doc.qt.io/qt-5/qlegend.html>

Parent Class : QGraphicsWidget

- Qt::Alignment alignment(void)
- void attachToChart(void)
- QColor borderColor(void)
- QBrush brush(void)
- QColor color(void)
- void detachFromChart(void)
- QFont font(void)
- bool isAttachedToChart(void)
- bool isBackgroundVisible(void)
- QBrush labelBrush(void)
- QColor labelColor(void)

- `QLegend::MarkerShape markerShape(void)`
- `QList<QLegendMarker *> markers(QAbstractSeries *series)`
- `QPen pen(void)`
- `bool reverseMarkers(void)`
- `void setAlignment(Qt::Alignment alignment)`
- `void setBackgroundVisible(bool visible)`
- `void setBorderColor(QColor color)`
- `void setBrush(QBrush brush)`
- `void setColor(QColor color)`
- `void setFont(QFont font)`
- `void setLabelBrush(QBrush brush)`
- `void setLabelColor(QColor color)`
- `void setMarkerShape(QLegend::MarkerShape shape)`
- `void setPen(QPen pen)`
- `void setReverseMarkers(bool reverseMarkers)`
- `void setShowToolTips(bool show)`
- `bool showToolTips(void)`

83.163 QLegendMarker Class

C++ Reference : <http://doc.qt.io/qt-5/qlegendmarker.html>

Parameters : void

Parent Class : QObject

- `QBrush brush(void)`
- `QFont font(void)`
- `bool isVisible(void)`
- `QString label(void)`
- `QBrush labelBrush(void)`
- `QPen pen(void)`
- `QAbstractSeries * series(void)`
- `void setBrush(QBrush brush)`
- `void setFont(QFont font)`
- `void setLabel(QString label)`
- `void setLabelBrush(QBrush brush)`
- `void setPen(QPen pen)`
- `void setShape(QLegend::MarkerShape shape)`

- void setVisible(bool visible)
- QLegend::MarkerShape shape(void)
- void setbrushChangedEvent(const char *)
- void setclickedEvent(const char *)
- void setfontChangedEvent(const char *)
- void sethoveredEvent(const char *)
- void setlabelBrushChangedEvent(const char *)
- void setlabelChangedEvent(const char *)
- void setpenChangedEvent(const char *)
- void setshapeChangedEvent(const char *)
- void setvisibleChangedEvent(const char *)
- const char *getbrushChangedEvent(void)
- const char *getclickedEvent(void)
- const char *getfontChangedEvent(void)
- const char *gethoveredEvent(void)
- const char *getlabelBrushChangedEvent(void)
- const char *getlabelChangedEvent(void)
- const char *getpenChangedEvent(void)
- const char *getshapeChangedEvent(void)
- const char *getvisibleChangedEvent(void)

83.164 QLineEdit Class

C++ Reference : <http://doc.qt.io/qt-5/qlineedit.html>

Parameters : QWidget *

Parent Class : QWidget

- int alignment(void)
- void backspace(void)
- QCompleter *completer(void)
- QMenu *createStandardContextMenu(void)
- void cursorBackward(bool mark, int steps)
- void cursorForward(bool mark, int steps)
- int cursorMoveStyle(void)
- int cursorPosition(void)
- int cursorPositionAt(QPoint)
- void cursorWordBackward(bool mark)

- void cursorWordForward(bool mark)
- void del(void)
- void deselect(void)
- QString displayText(void)
- bool dragEnabled(void)
- int echoMode(void)
- void end(bool mark) # In RingQt use : void endtext(bool mark)
- void getTextMargins(int *left, int *top, int *right, int *bottom)
- bool hasAcceptableInput(void)
- bool hasFrame(void)
- bool hasSelectedText(void)
- void home(bool mark)
- QString inputMask(void)
- void insert(QString)
- bool isModified(void)
- bool isReadOnly(void)
- bool isRedoAvailable(void)
- bool isUndoAvailable(void)
- int maxLength(void)
- QString placeholderText(void)
- QString selectedText(void)
- int selectionStart(void)
- void setAlignment(Qt::AlignmentFlag flag)
- void setCompleter(QCompleter *c)
- void setCursorMoveStyle(Qt::CursorMoveStyle style)
- void setCursorPosition(int)
- void setDragEnabled(bool b)
- void setEchoMode(QLineEdit::EchoMode)
- void setFrame(bool)
- void setInputMask(QString)
- void setMaxLength(int)
- void setModified(bool)
- void setPlaceholderText(QString)
- void setReadOnly(bool)
- void setSelection(int start, int length)
- void setTextMargins(int left, int top, int right, int bottom)

- void setValidator(QValidator *v)
- QString text(void)
- QMargins textMargins(void)
- QValidator *validator(void)
- void clear(void)
- void copy(void)
- void cut(void)
- void paste(void)
- void redo(void)
- void selectAll(void)
- void setText(QString)
- void undo(void)
- void setTextChangedEvent(const char *)
- void setcursorPositionChangedEvent(const char *)
- void seteditingFinishedEvent(const char *)
- void setreturnPressedEvent(const char *)
- void setselectionChangedEvent(const char *)
- void settextEditedEvent(const char *)
- const char *getTextChangedEvent(void)
- const char *getcursorPositionChangedEvent(void)
- const char *geteditingFinishedEvent(void)
- const char *getreturnPressedEvent(void)
- const char *getselectionChangedEvent(void)
- const char *gettextEditedEvent(void)

83.165 QLineSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qlineseries.html>

Parameters : QObject *

Parent Class : QXYSeries

- QAbstractSeries::SeriesType type(void)

83.166 QLinearGradient Class

C++ Reference : <http://doc.qt.io/qt-5/qlineargradient.html>

Parameters : void

Parent Class : QGradient

- QPointF finalStop(void)
- void setFinalStop(QPointF stop)
- void setFinalStop_2(qreal x,qreal y)
- void setStart(QPointF start)
- void setStart_2(qreal x,qreal y)
- QPointF start(void)

83.167 QListView Class

C++ Reference : <http://doc.qt.io/qt-5/qlistview.html>

Parameters : QWidget *

Parent Class : QAbstractItemView

- int batchSize(void)
- void clearPropertyFlags(void)
- QListView::Flow flow(void)
- QSize gridSize(void)
- bool isRowHidden(int row)
- bool isSelectionRectVisible(void)
- bool isWrapping(void)
- QListView::LayoutMode layoutMode(void)
- int modelColumn(void)
- QListView::Movement movement(void)
- QListView::ResizeMode resizeMode(void)
- void setBatchSize(int batchSize)
- void setFlow(QListView::Flow flow)
- void setGridSize(QSize size)
- void setLayoutMode(QListView::LayoutMode mode)
- void setModelColumn(int column)
- void setMovement(QListView::Movement movement)
- void setResizeMode(QListView::ResizeMode mode)
- void setRowHidden(int row, bool hide)
- void setSelectionRectVisible(bool show)

- void setSpacing(int space)
- void setUniformItemSizes(bool enable)
- void setViewMode(QListView::ViewMode mode)
- void setWordWrap(bool on)
- void setWrapping(bool enable)
- int spacing(void)
- bool uniformItemSizes(void)
- QListView::ViewMode viewMode(void)
- bool wordWrap(void)

83.168 QListWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qlistwidget.html>

Parameters : QWidget *

Parent Class : QListView

- void addItem(QString)
- int count(void)
- void editItem(QListWidgetItem *item)
- bool isSortingEnabled(void)
- QListWidgetItem *item(int row)
- QListWidgetItem *itemAt(int x, int y)
- QWidget *itemWidget(QListWidgetItem *item)
- void openPersistentEditor(QListWidgetItem *item)
- void removeItemWidget(QListWidgetItem *item)
- int row(QListWidgetItem *item)
- void setCurrentRow(int row, QItemSelectionModel::SelectionFlag command)
- void setItemWidget(QListWidgetItem *item, QWidget *widget)
- void setSortingEnabled(bool enable)
- void sortItems(Qt::SortOrder order)
- QListWidgetItem *takeItem(int row)
- QRect visualItemRect(QListWidgetItem *item)
- void clear(void)
- void scrollToItem(QListWidgetItem *item, QAbstractItemView::ScrollHint hint)
- void setcurrentItemChangedEvent(const char *)
- void setcurrentRowChangedEvent(const char *)
- void setcurrentTextChangedEvent(const char *)

- void setitemActivatedEvent(const char *)
- void setitemChangedEvent(const char *)
- void setitemClickedEvent(const char *)
- void setitemDoubleClickedEvent(const char *)
- void setitemEnteredEvent(const char *)
- void setitemPressedEvent(const char *)
- void setitemSelectionChangedEvent(const char *)
- const char *getcurrentItemChangedEvent(void)
- const char *getcurrentRowChangedEvent(void)
- const char *getcurrentTextChangedEvent(void)
- const char *getitemActivatedEvent(void)
- const char *getitemChangedEvent(void)
- const char *getitemClickedEvent(void)
- const char *getitemDoubleClickedEvent(void)
- const char *getitemEnteredEvent(void)
- const char *getitemPressedEvent(void)
- const char *getitemSelectionChangedEvent(void)

83.169 QListWidgetItem Class

C++ Reference : <http://doc.qt.io/qt-5/qlistwidgetitem.html>

Parameters : void

- QBrush background(void)
- Qt::CheckState checkState(void)
- Qt::ItemFlags flags(void)
- QFont font(void)
- QBrush foreground(void)
- QIcon icon(void)
- bool isHidden(void)
- bool isSelected(void)
- QListWidget *listWidget(void)
- void setBackground(QBrush brush)
- void setCheckState(Qt::CheckState state)
- void setFlags(Qt::ItemFlags flags)
- void setFont(QFont font)
- void setForeground(QBrush brush)

- void setHidden(bool hide)
- void setIcon(QIcon icon)
- void setSelected(bool select)
- void setSizeHint(QSize size)
- void setStatusTip(QString statusTip)
- void setText(QString text)
- void setTextAlignment(int alignment)
- void setToolTip(QString toolTip)
- void setWhatsThis(QString whatsThis)
- QSize sizeHint(void)
- QString statusTip(void)
- QString text(void)
- int textAlignment(void)
- QString toolTip(void)
- int type(void)
- QString whatsThis(void)

83.170 QLogValueAxis Class

C++ Reference : <http://doc.qt.io/qt-5/qlogvalueaxis.html>

Parameters : QObject *

Parent Class : QAbstractAxis

- qreal base(void)
- QString labelFormat(void)
- qreal max(void)
- qreal min(void)
- int minorTickCount(void)
- void setBase(qreal base)
- void setLabelFormat(QString format)
- void setMax(qreal max)
- void setMin(qreal min)
- void setMinorTickCount(int minorTickCount)
- void setRange(qreal min, qreal max)
- int tickCount(void)
- void setbaseChangedEvent(const char *)
- void setlabelFormatChangedEvent(const char *)

- void setmaxChangedEvent(const char *)
- void setminChangedEvent(const char *)
- void setminorTickCountChangedEvent(const char *)
- void setrangeChangedEvent(const char *)
- void settickCountChangedEvent(const char *)
- const char *getbaseChangedEvent(void)
- const char *getlabelFormatChangedEvent(void)
- const char *getmaxChangedEvent(void)
- const char *getminChangedEvent(void)
- const char *getminorTickCountChangedEvent(void)
- const char *getrangeChangedEvent(void)
- const char *gettickCountChangedEvent(void)

83.171 QLogicAspect Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dlogic-qlogicaspect.html>

Parameters : QObject *

Parent Class : Qt3DCore::QAbstractAspect

83.172 QMainWindow Class

C++ Reference : <http://doc.qt.io/qt-5/qmainwindow.html>

Parameters : void

Parent Class : QWidget

- void addDockWidget(Qt::DockWidgetArea area, QDockWidget *dockwidget, Qt::Orientation orientation)
- QToolBar *addToolBar(QString)
- void addToolBar_2(Qt::ToolBarArea area, QToolBar *toolbar)
- void addToolBarBreak(Qt::ToolBarArea)
- QWidget *centralWidget(void)
- int corner(Qt::Corner corner)
- QMenu *createPopupMenu(void)
- int dockOptions(void)
- int dockWidgetArea(QDockWidget *dockwidget)
- bool documentMode(void)
- QSize iconSize(void)
- void insertToolBar(QToolBar *before, QToolBar *toolbar)
- void insertToolBarBreak(QToolBar *before)

- bool isAnimated(void)
- bool isDockNestingEnabled(void)
- QMenuBar *menuBar(void)
- QWidget *menuWidget(void)
- void removeDockWidget(QDockWidget *dockwidget)
- void removeToolBar(QToolBar *toolbar)
- void removeToolBarBreak(QToolBar *before)
- bool restoreDockWidget(QDockWidget *dockwidget)
- bool restoreState(QByteArray state, int version)
- QByteArray saveState(int version)
- void setCentralWidget(QWidget *widget)
- void setCorner(Qt::Corner corner, Qt::DockWidgetArea area)
- void setDockOptions(QMainWindow::DockOption options)
- void setDocumentMode(bool enabled)
- void setIconSize(QSize)
- void setMenuBar(QMenuBar *menuBar)
- void setMenuWidget(QWidget *menuBar)
- void setStatusBar(QStatusBar *statusbar)
- void setTabPosition(Qt::DockWidgetArea areas, QTabWidget::TabPosition tabPosition)
- void setTabShape(QTabWidget::TabShape tabShape)
- void setToolButtonStyle(Qt::ToolButtonStyle toolButtonStyle)
- void setUnifiedTitleAndToolBarOnMac(bool set)
- void splitDockWidget(QDockWidget *first, QDockWidget *second, Qt::Orientation orientation)
- QStatusBar *statusBar(void)
- int tabPosition(Qt::DockWidgetArea area)
- int tabShape(void)
- void tabifyDockWidget(QDockWidget *first, QDockWidget *second)
- int toolBarArea(QToolBar *toolbar)
- bool toolBarBreak(QToolBar *toolbar)
- int toolButtonStyle(void)
- bool unifiedTitleAndToolBarOnMac(void)

83.173 QMaterial Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qmaterial.html>

Parameters : Qt3DCore::QNode *

Parent Class : Qt3DCore::QComponent

- void addParameter(Qt3DRender::QParameter *parameter)
- Qt3DRender::QEFFECT * effect(void)
- QVector<Qt3DRender::QParameter *> parameters(void)
- void removeParameter(Qt3DRender::QParameter *parameter)
- void setEffect(Qt3DRender::QEFFECT *effect)

83.174 QMatrix4x4 Class

Parameters : qreal,qreal,qreal,qreal,qreal,qreal,qreal,qreal,qreal,qreal,qreal,qreal,qreal,qreal,qreal,qreal

- QVector4D column(int index)
- qreal * constData(void)
- qreal * data_2(void)
- qreal determinant(void)
- void fill(qreal value)
- void flipCoordinates(void)
- void frustum(qreal left, qreal right, qreal bottom, qreal top, qreal nearPlane, qreal farPlane)
- QMatrix4x4 inverted(bool * invertible)
- bool isIdentity(void)
- void lookAt(QVector3D eye, QVector3D center, QVector3D up)
- QPoint map(QPoint point)
- QPointF map_2(QPointF point)
- QVector3D map_3(QVector3D point)
- QVector4D map_4(QVector4D point)
- QRect mapRect(QRect rect)
- QRectF mapRect_2(QRectF rect)
- QVector3D mapVector(QVector3D vector)
- QMatrix3x3 normalMatrix(void)
- void optimize(void)
- void ortho(qreal left, qreal right, qreal bottom, qreal top, qreal nearPlane, qreal farPlane)
- void ortho_2(QRect rect)
- void ortho_3(QRectF rect)
- void perspective(qreal angle, qreal aspect, qreal nearPlane, qreal farPlane)

- void rotate(qreal angle, QVector3D vector)
- void rotate_2(QQuaternion quaternion)
- void rotate_3(qreal angle, qreal x, qreal y, qreal z)
- QVector4D row(int index)
- void scale(QVector3D vector)
- void scale_2(qreal x, qreal y)
- void scale_3(qreal x, qreal y, qreal z)
- void scale_4(qreal factor)
- void setColumn(int index, QVector4D value)
- void setRow(int index, QVector4D value)
- void setToIdentity(void)
- QMatrix toAffine(void)
- QTransform toTransform_2(qreal distanceToPlane)
- void translate(QVector3D vector)
- void translate_2(qreal x, qreal y)
- void translate_3(qreal x, qreal y, qreal z)
- QMatrix4x4 transposed(void)

83.175 QMdiArea Class

C++ Reference : <http://doc.qt.io/qt-5/qmdiarea.html>

Parameters : QWidget *

Parent Class : QAbstractScrollArea

- QMdiArea::WindowOrder activationOrder(void)
- QMdiSubWindow * activeSubWindow(void)
- QMdiSubWindow * addSubWindow(QWidget * widget, Qt::WindowFlags windowFlags)
- QBrush background(void)
- QMdiSubWindow * currentSubWindow(void)
- bool documentMode(void)
- void removeSubWindow(QWidget * widget)
- void setActivationOrder(QMdiArea::WindowOrder order)
- void setBackground(QBrush background)
- void setDocumentMode(bool enabled)
- void setOption(QMdiArea::AreaOption option, bool on)
- void setTabPosition(QTabWidget::TabPosition position)
- void setTabShape(QTabWidget::TabShape shape)

- void setTabsClosable(bool closable)
- void setTabsMovable(bool movable)
- void setViewMode(QMdiArea::ViewMode mode)
- QList<QMdiSubWindow *> subWindowList(QMdiArea::WindowOrder order)
- QTabWidget::TabPosition tabPosition(void)
- QTabWidget::TabShape tabShape(void)
- bool tabsClosable(void)
- bool tabsMovable(void)
- bool testOption(QMdiArea::AreaOption option)
- QMdiArea::ViewMode viewMode(void)
- void activateNextSubWindow(void)
- void activatePreviousSubWindow(void)
- void cascadeSubWindows(void)
- void closeActiveSubWindow(void)
- void closeAllSubWindows(void)
- void setActiveSubWindow(QMdiSubWindow * window)
- void tileSubWindows(void)

83.176 QMdiSubWindow Class

C++ Reference : <http://doc.qt.io/qt-5/qmdisubwindow.html>

Parameters : QWidget *

Parent Class : QWidget

- bool isShaded(void)
- int keyboardPageStep(void)
- int keyboardSingleStep(void)
- QMdiArea * mdiArea(void)
- void setKeyboardPageStep(int step)
- void setKeyboardSingleStep(int step)
- void setOption(QMdiSubWindow::SubWindowOption option, bool on)
- void setSystemMenu(QMenu * systemMenu)
- void setWidget(QWidget * widget)
- QMenu * systemMenu(void)
- bool testOption(QMdiSubWindow::SubWindowOption option)
- QWidget * widget(void)
- void showShaded(void)

- void showSystemMenu(void)

83.177 QMediaObject Class

C++ Reference : <http://doc.qt.io/qt-5/qmediaobject.html>

Parameters : void

Parent Class : QWidget

- QStringList availableMetaData(void)
- bool isMetaDataAvailable(void)
- QVariant metaData(QString key)
- int notifyInterval(void)
- void setNotifyInterval(int milliSeconds)

83.178 QMediaPlayer Class

C++ Reference : <http://doc.qt.io/qt-5/qmediaplayer.html>

Parameters : void

- int bufferStatus(void)
- QMediaContent currentMedia(void)
- QNetworkConfiguration currentNetworkConfiguration(void)
- int duration(void)
- int error(void)
- QString errorString(void)
- bool isAudioAvailable(void)
- bool isMuted(void)
- bool isSeekable(void)
- bool isVideoAvailable(void)
- QMediaContent media(void)
- int mediaStatus(void)
- QIODevice *mediaStream(void)
- qreal playbackRate(void)
- QMediaPlaylist *playlist(void)
- int position(void)
- void setVideoOutput(QVideoWidget *output)
- int volume(void)
- void pause(void)
- void play(void)

- void setMuted(bool muted)
- void setPlaylist(QMediaPlaylist *playlist)
- void setPosition(int position)
- void setVolume(int volume)
- void stop(void)

83.179 QMediaPlaylist Class

C++ Reference : <http://doc.qt.io/qt-5/qmediaplaylist.html>

Parameters : void

- int currentIndex(void)
- QMediaContent currentMedia(void)
- int error(void)
- QString errorString(void)
- bool insertMedia(int pos, QMediaContent)
- bool isReadOnly(void)
- QMediaContent media(int index)
- int mediaCount(void)
- int nextIndex(int steps)
- int playbackMode(void)
- int previousIndex(int steps)
- bool save(QUrl, const char * format)
- void next(void) # In RingQt use : void movenext(void)
- void previous(void)
- void setCurrentIndex(int playlistPosition)
- void shuffle(void)

83.180 QMenu Class

C++ Reference : <http://doc.qt.io/qt-5/qmenu.html>

Parameters : QWidget *

Parent Class : QWidget

- QAction *actionAt(QPoint)
- QRect actionGeometry(QAction *act)
- QAction *activeAction(void)
- void addAction(QAction *)
- QMenu *addMenu(QString)

- QAction *addSeparator(void)
- void clear(void)
- QAction *defaultAction(void)
- QAction *exec(const QPoint &)
- QAction *exec_2(void)
- QAction *exec_3(const QPoint &,QAction *)
- void hideTearOffMenu(void)
- QIcon icon(void)
- QAction *insertMenu(QAction *before, QMenu *menu)
- QAction *insertSeparator(QAction *before)
- bool isEmpty(void)
- bool isTearOffEnabled(void)
- bool isTearOffMenuVisible(void)
- QAction *menuAction(void)
- void popup(QPoint, QAction *atAction)
- bool separatorsCollapsible(void)
- void setActiveAction(QAction *act)
- void setDefaultAction(QAction *act)
- void setIcon(QIcon)
- void setSeparatorsCollapsible(bool collapse)
- void setTearOffEnabled(bool)
- void setTitle(QString)
- QString title(void)

83.181 QMenuBar Class

C++ Reference : <http://doc.qt.io/qt-5/qmenubar.html>

Parameters : QWidget *

Parent Class : QWidget

- QAction *actionAt(QPoint)
- QRect actionGeometry(QAction *act)
- QAction *activeAction(void)
- QAction *addAction(QString)
- QAction *addSeparator(void)
- void clear(void)
- QWidget *cornerWidget(Qt::Corner)

- QAction *insertSeparator(QAction *before)
- bool isDefaultUp(void)
- bool isNativeMenuBar(void)
- void setActiveAction(QAction *act)
- void setCornerWidget(QWidget *widget, Qt::Corner)
- void setNativeMenuBar(bool nativeMenuBar)

83.182 QMesh Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qmesh.html>

Parameters : Qt3DCore::QNode *

- QString meshName(void)
- QUrl source(void)
- Qt3DRender::QMesh::Status status(void)
- void setMeshName(QString meshName)
- void setSource(QUrl source)

83.183 QMessageBox Class

C++ Reference : <http://doc.qt.io/qt-5/qmessagebox.html>

Parameters : QWidget *parent

Parent Class : QDialog

- void addButton(QAbstractButton *button, QMessageBox::ButtonRole role)
- QAbstractButton *button(QMessageBox::StandardButton which)
- int buttonRole(QAbstractButton *button)
- QAbstractButton *clickedButton(void)
- QPushButton *defaultButton(void)
- QString detailedText(void)
- QAbstractButton *escapeButton(void)
- QPixmap iconPixmap(void)
- QString informativeText(void)
- void open(QObject *receiver, const char *member)
- void removeButton(QAbstractButton *button)
- void setDefaultButton(QPushButton *button)
- void setDetailedText(QString)
- void setEscapeButton(QAbstractButton *button)
- void setIconPixmap(QPixmap)

- void setInformativeText(QString)
- void setStandardButtons(QMessageBox::StandardButton buttons)
- void setText(QString)
- void setTextFormat(Qt::TextFormat format)
- void setWindowModality(Qt::WindowModality windowModality)
- void setWindowTitle(QString)
- int standardButton(QAbstractButton *button)
- int standardButtons(void)
- QString text(void)
- int textFormat(void)
- int exec(void)
- void about(QWidget *parent, QString,QString)
- void aboutQt(QWidget *parent, QString)
- int critical(QWidget * parent, QString , QString, int buttons, int defaultButton)
- int information(QWidget * parent, QString ,QString, int buttons,int defaultButton)
- int question(QWidget * parent,QString,QString, int buttons ,int defaultButton)
- int warning(QWidget *parent, QString,QString, int buttons,int defaultButton)

83.184 QMetalRoughMaterial Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qmetalroughmaterial.html>

Parameters : Qt3DCore::QNode *

- QVariant ambientOcclusion(void)
- QVariant baseColor(void)
- QVariant metalness(void)
- QVariant normal(void)
- QVariant roughness(void)
- float textureScale(void)
- void setAmbientOcclusion(QVariant ambientOcclusion)
- void setBaseColor(QVariant baseColor)
- void setMetalness(QVariant metalness)
- void setNormal(QVariant normal)
- void setRoughness(QVariant roughness)
- void setTextureScale(float textureScale)

83.185 QMimeData Class

C++ Reference : <http://doc.qt.io/qt-5/qmimedata.html>

Parameters : void

Parent Class : QObject

- void clear(void)
- QVariant colorData(void)
- QByteArray data(QString mimeType)
- QStringList formats(void)
- bool hasColor(void)
- bool hasFormat(QString mimeType)
- bool hasHtml(void)
- bool hasImage(void)
- bool hasText(void)
- bool hasUrls(void)
- QString html(void)
- QVariant imageData(void)
- void removeFormat(QString mimeType)
- void setColorData(QVariant color)
- void setData(QString mimeType, QByteArray data)
- void setHtml(QString html)
- void setImageData(QVariant image)
- void setText(QString text)
- void setUrls(QList<QUrl> urls)
- QString text(void)
- QList<QUrl> urls(void)

83.186 QMorphPhongMaterial Class

C++ Reference : <http://doc.qt.io/qt-5/qmorphphongmaterial.html>

Parameters : Qt3DCore::QNode *

- QColor ambient(void)
- QColor diffuse(void)
- float interpolator(void)
- float shininess(void)
- QColor specular(void)
- void setAmbient(QColor ambient)

- void setDiffuse(QColor diffuse)
- void setInterpolator(float interpolator)
- void setShininess(float shininess)
- void setSpecular(QColor specular)

83.187 QMovie Class

C++ Reference : <http://doc.qt.io/qt-5/qmovie.html>

Parameters : QObject *

Parent Class : QObject

- QColor backgroundColor(void)
- QMovie::CacheMode cacheMode(void)
- int currentFrameNumber(void)
- QImage currentImage(void)
- QPixmap currentPixmap(void)
- QIODevice * device(void)
- QString fileName(void)
- QByteArray format(void)
- int frameCount(void)
- QRect frameRect(void)
- bool isValid(void)
- bool jumpToFrame(int frameNumber)
- int nextFrameDelay(void)
- QSize scaledSize(void)
- void setBackgroundColor(QColor color)
- void setCacheMode(QMovie::CacheMode mode)
- void setDevice(QIODevice *device)
- void setFileName(QString fileName)
- void setFormat(QByteArray format)
- void setScaledSize(QSize size)
- int speed(void)
- QMovie::MovieState state(void)
- bool jumpToNextFrame(void)
- void setPaused(bool paused)
- void setSpeed(int percentSpeed)
- void start(void)

- void stop(void)
- void seterrorEvent(const char *)
- void setfinishedEvent(const char *)
- void setframeChangedEvent(const char *)
- void setresizedEvent(const char *)
- void setstartedEvent(const char *)
- void setstateChangedEvent(const char *)
- void setupdatedEvent(const char *)
- const char *geterrorEvent(void)
- const char *getfinishedEvent(void)
- const char *getframeChangedEvent(void)
- const char *getresizedEvent(void)
- const char *getstartedEvent(void)
- const char *getstateChangedEvent(void)
- const char *getupdatedEvent(void)

83.188 QMutex Class

C++ Reference : <http://doc.qt.io/qt-5/qmutex.html>

Parameters : QMutex::RecursionMode

- bool isRecursive(void)
- void lock(void)
- void unlock(void)

83.189 QMutexLocker Class

C++ Reference : <http://doc.qt.io/qt-5/qmutexlocker.html>

Parameters : QMutex *

- QMutex * mutex(void)
- void relock(void)
- void unlock(void)

83.190 QNetworkAccessManager Class

C++ Reference : <http://doc.qt.io/qt-5/qnetworkaccessmanager.html>

Parameters : QObject *

Parent Class : QObject

- void setfinishedEvent(const char *)
- const char *getfinishedEvent(void)
- QNetworkConfiguration activeConfiguration(void)
- QAbstractNetworkCache *cache(void)
- void clearAccessCache(void)
- QNetworkConfiguration configuration(void)
- void connectToHost(QString, quint16)
- QNetworkReply *deleteResource(QNetworkRequest)
- QNetworkReply *get(QNetworkRequest) # In RingQt use : QNetworkReply *getvalue(QNetworkRequest)
- QNetworkReply *head(QNetworkRequest)
- QNetworkAccessManager::NetworkAccessibility networkAccessible(void)
- QNetworkReply *post(QNetworkRequest, QByteArray)
- QNetworkProxy proxy(void)
- QNetworkProxyFactory *proxyFactory(void)
- QNetworkReply *put(QNetworkRequest, QByteArray) # In RingQt use : QNetworkReply *putvalue(QNetworkRequest, QByteArray)
- QNetworkReply *sendCustomRequest(QNetworkRequest, QByteArray, QIODevice *)
- void setCache(QAbstractNetworkCache *cache)
- void setConfiguration(QNetworkConfiguration)
- void setCookieJar(QNetworkCookieJar *cookieJar)
- void setNetworkAccessible(QNetworkAccessManager::NetworkAccessibility accessible)
- void setProxy(QNetworkProxy)
- void setProxyFactory(QNetworkProxyFactory *factory)
- QStringList supportedSchemes(void)
- void geteventparameters(void)

83.191 QNetworkProxy Class

C++ Reference : <http://doc.qt.io/qt-5/qnetworkproxy.html>

Parameters : void

- int capabilities(void)
- bool hasRawHeader(QByteArray headerName)
- QVariant header(QNetworkRequest::KnownHeaders header)
- QString hostName(void)
- bool isCachingProxy(void)
- bool isTransparentProxy(void)
- QString password(void)
- int port(void)
- QByteArray rawHeader(QByteArray headerName)
- void setCapabilities(QNetworkProxy::Capability capabilities)
- void setHeader(QNetworkRequest::KnownHeaders header, QVariant value)
- void setHostName(QString hostName)
- void setPassword(QString password)
- void setPort(int port)
- void setRawHeader(QByteArray headerName, QByteArray headerValue)
- void setType(QNetworkProxy::ProxyType type)
- void setUser(QString user)
- void swap(QNetworkProxy other)
- int type(void)
- QString user(void)
- QNetworkProxy applicationProxy(void)
- void setApplicationProxy(QNetworkProxy networkProxy)

83.192 QNetworkReply Class

C++ Reference : <http://doc.qt.io/qt-5/qnetworkreply.html>

Parameters : void

Parent Class : QIODevice

- QVariant attribute(QNetworkRequest::Attribute code)
- QNetworkReply::NetworkError error(void)
- bool hasRawHeader(QByteArray)
- QVariant header(QNetworkRequest::KnownHeaders header)
- bool isFinished(void)

- bool isRunning(void)
- QNetworkAccessManager *manager(void)
- QNetworkAccessManager::Operation operation(void)
- QByteArray rawHeader(QByteArray)
- qint64 readBufferSize(void)
- QNetworkRequest request(void)

83.193 QNetworkRequest Class

C++ Reference : <http://doc.qt.io/qt-5/qnetworkrequest.html>

Parameters : QUrl

- QVariant attribute(QNetworkRequest::Attribute, QVariant)
- bool hasRawHeader(QByteArray)
- QVariant header(QNetworkRequest::KnownHeaders)
- QObject *originatingObject(void)
- QNetworkRequest::Priority priority(void)
- QByteArray rawHeader(QByteArray)
- void setAttribute(QNetworkRequest::Attribute, QVariant)
- void setHeader(QNetworkRequest::KnownHeaders, QVariant)
- void setOriginatingObject(QObject *object)
- void setPriority(QNetworkRequest::Priority priority)
- void setRawHeader(QByteArray, QByteArray)
- void swap(QNetworkRequest)
- QUrl url(void)

83.194 QNmeaPositionInfoSource Class

C++ Reference : <http://doc.qt.io/qt-5/qnmeapositioninfosource.html>

Parameters : QNmeaPositionInfoSource::UpdateMode,QObject *

Parent Class : QGeoPositionInfoSource

- QIODevice * device(void)
- void setDevice(QIODevice * device)
- QNmeaPositionInfoSource::UpdateMode updateMode(void)

83.195 QNode Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dcore-qnode.html>

Parameters : Qt3DCore::QNode *

Parent Class : QObject

- bool blockNotifications(bool block)
- Qt3DCore::QNodeVector childNodes(void)
- void clearPropertyTracking(QString propertyName)
- void clearPropertyTrackings(void)
- Qt3DCore::QNode::PropertyTrackingMode defaultPropertyTrackingMode(void)
- Qt3DCore::QNodeId id(void)
- bool isEnabled(void)
- bool notificationsBlocked(void)
- Qt3DCore::QNode * parentNode(void)
- Qt3DCore::QNode::PropertyTrackingMode propertyTracking(QString propertyName)
- void setPropertyTracking(QString propertyName, Qt3DCore::QNode::PropertyTrackingMode trackMode)
- void setDefaultPropertyTrackingMode(Qt3DCore::QNode::PropertyTrackingMode mode)
- void setEnabled(bool isEnabled)
- void setParent(Qt3DCore::QNode *parent)

83.196 QObject Class

C++ Reference : <http://doc.qt.io/qt-5/qobject.html>

Parameters : void

- bool blockSignals(bool block)
- QObjectList children(void)
- void dumpObjectInfo(void)
- void dumpObjectTree(void)
- bool inherits(const char *className)
- void installEventFilter(QObject *filterObj)
- bool isWidgetType(void)
- void killTimer(int id)
- void moveToThread(QThread *targetThread)
- QString objectName(void)
- QObject *parent(void)
- QVariant property(const char *name)
- void removeEventFilter(QObject *obj)

- void setObjectName(QString)
- void setParent(QObject *parent)
- bool setProperty(const char *name, QVariant)
- bool setProperty_2(const char *name, int)
- bool setProperty_3(const char *name, float)
- bool setProperty_4(const char *name, double)
- bool setProperty_5(const char *name, QString)
- bool setProperty_int(const char *name, int)
- bool setProperty_float(const char *name, float)
- bool setProperty_double(const char *name, double)
- bool setProperty_string(const char *name, QString)
- bool signalsBlocked(void)
- int startTimer(int interval)
- QThread *thread(void)
- void deleteLater(void)

83.197 QObjectPicker Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qobjectpicker.html>

Parameters : Qt3DCore::QNode *

- bool containsMouse(void)
- bool isDragEnabled(void)
- bool isHoverEnabled(void)
- bool isPressed(void)
- void setDragEnabled(bool dragEnabled)
- void setHoverEnabled(bool hoverEnabled)
- void setclickedEvent(const char *)
- void setcontainsMouseChangedEvent(const char *)
- void setdragEnabledChangedEvent(const char *)
- void setenteredEvent(const char *)
- void setexitedEvent(const char *)
- void sethoverEnabledChangedEvent(const char *)
- void setmovedEvent(const char *)
- void setpressedEvent(const char *)
- void setpressedChangedEvent(const char *)
- void setreleasedEvent(const char *)

- const char *getclickedEvent(void)
- const char *getcontainsMouseChangedEvent(void)
- const char *getdragEnabledChangedEvent(void)
- const char *getenteredEvent(void)
- const char *getexitedEvent(void)
- const char *gethoverEnabledChangedEvent(void)
- const char *getmovedEvent(void)
- const char *getpressedEvent(void)
- const char *getpressedChangedEvent(void)
- const char *getreleasedEvent(void)

83.198 QOpenGLBuffer Class

C++ Reference : <http://doc.qt.io/qt-5/qopenglbuffer.html>

Parameters : void

- void allocate(void *data, int count)
- void allocate_2(int count)
- bool bind(void)
- GLuint bufferId(void)
- bool create(void)
- void destroy(void)
- bool isCreated(void)
- void * map(QOpenGLBuffer::Access access)
- void release(void)
- void setUsagePattern(QOpenGLBuffer::UsagePattern value)
- int size(void)
- QOpenGLBuffer::Type type(void)
- bool unmap(void)
- QOpenGLBuffer::UsagePattern usagePattern(void)
- void write(int offset, void *data, int count)
- void release_2(QOpenGLBuffer::Type type)

83.199 QOpenGLContext Class

C++ Reference : <http://doc.qt.io/qt-5/qopenglcontext.html>

Parameters : QObject *

Parent Class : QObject

- bool create(void)
- GLuint defaultFramebufferObject(void)
- void doneCurrent(void)
- QSet<QByteArray> extensions(void)
- QOpenGLFunctions * functions(void)
- QFunctionPointer getProcAddress(QByteArray procName)
- QFunctionPointer getProcAddress_2(char *procName)
- bool hasExtension(QByteArray extension)
- bool isOpenGLES(void)
- bool isValid(void)
- bool makeCurrent(QSurface *surface)
- QVariant nativeHandle(void)
- QScreen * screen(void)
- void setFormat(QSurfaceFormat format)
- void setNativeHandle(QVariant handle)
- void setScreen(QScreen *screen)
- void setShareContext(QOpenGLContext *shareContext)
- QOpenGLContext * shareContext(void)
- QOpenGLContextGroup * shareGroup(void)
- QSurface * surface(void)
- void swapBuffers(QSurface *surface)
- QAbstractOpenGLFunctions * versionFunctions(QOpenGLVersionProfile versionProfile))
- TYPE * versionFunctions_2(void)
- bool areSharing(QOpenGLContext *first, QOpenGLContext *second)
- QOpenGLContext * currentContext(void)
- QOpenGLContext * globalShareContext(void)
- void * openGLModuleHandle(void)
- QOpenGLContext::OpenGLModuleType openGLModuleType(void)
- bool supportsThreadedOpenGL(void)
- QOpenGLFunctions_3_2_Core *opengl32(void)

83.200 QOpenGLDebugLogger Class

C++ Reference : <http://doc.qt.io/qt-5/qopengldebuglogger.html>

Parameters : QObject *

- void disableMessages(QOpenGLDebugMessage::Sources sources, QOpenGLDebugMessage::Types types, QOpenGLDebugMessage::Severities severities)
- void disableMessages_2(QVector<GLuint> ids, QOpenGLDebugMessage::Sources sources, QOpenGLDebugMessage::Types types)
- void enableMessages(QOpenGLDebugMessage::Sources sources, QOpenGLDebugMessage::Types types, QOpenGLDebugMessage::Severities severities)
- void enableMessages_2(QVector<GLuint> ids, QOpenGLDebugMessage::Sources sources, QOpenGLDebugMessage::Types types)
- bool initialize(void)
- bool isLogging(void)
- QList<QOpenGLDebugMessage> loggedMessages(void)
- QOpenGLDebugLogger::LoggingMode loggingMode(void)
- qint64 maximumMessageLength(void)
- void popGroup(void)
- void pushGroup(QString name, GLuint id, QOpenGLDebugMessage::Source source)
- void logMessage(QOpenGLDebugMessage debugMessage)
- void startLogging(QOpenGLDebugLogger::LoggingMode loggingMode)
- void stopLogging(void)

83.201 QOpenGLFramebufferObject Class

C++ Reference : <http://doc.qt.io/qt-5/qopenglframebufferobject.html>

Parameters : int,int,GLenum

- bool bind(void)
- QOpenGLFramebufferObjectFormat format(void)
- GLuint handle(void)
- int height(void)
- bool isBound(void)
- bool isValid(void)
- bool release(void)
- void setAttachment(QOpenGLFramebufferObject::Attachment attachment)
- QSize size(void)
- QImage toImage(bool flipped)
- QImage toImage_3(bool flipped, int colorQOpenGLFramebufferObject::AttachmentIndex)

- QImage toImage_2(void)
- int width(void)
- bool bindDefault(void)
- bool hasOpenGLFramebufferObjects(void)

83.202 QOpenGLFunctions Class

C++ Reference : <http://doc.qt.io/qt-5/qopenglfunctions.html>

Parameters : void

- void glActiveTexture(GLenum texture)
- void glAttachShader(GLuint program, GLuint shader)
- void glBindAttribLocation(GLuint program, GLuint index, char *name)
- void glBindBuffer(GLenum target, GLuint buffer)
- void glBindFramebuffer(GLenum target, GLuint framebuffer)
- void glBindRenderbuffer(GLenum target, GLuint renderbuffer)
- void glBindTexture(GLenum target, GLuint texture)
- void glBlendColor(GLclampf red, GLclampf green, GLclampf blue, GLclampf alpha)
- void glBlendEquation(GLenum mode)
- void glBlendEquationSeparate(GLenum modeRGB, GLenum modeAlpha)
- void glBlendFunc(GLenum sfactor, GLenum dfactor)
- void glBlendFuncSeparate(GLenum srcRGB, GLenum dstRGB, GLenum srcAlpha, GLenum dstAlpha)
- void glBufferData(GLenum target, qopengl_GLsizeiptr size, void *data, GLenum usage)
- void glBufferSubData(GLenum target, qopengl_GLintptr offset, qopengl_GLsizeiptr size, void *data)
- GLenum glCheckFramebufferStatus(GLenum target)
- void glClear(GLbitfield mask)
- void glClearColor(GLclampf red, GLclampf green, GLclampf blue, GLclampf alpha)
- void glClearDepthf(GLclampf depth)
- void glClearStencil(GLint s)
- void glColorMask(GLboolean red, GLboolean green, GLboolean blue, GLboolean alpha)
- void glCompileShader(GLuint shader)
- void glCompressedTexImage2D(GLenum target, GLint level, GLenum internalformat, GLsizei width, GLsizei height, GLint border, GLsizei imageSize, void *data)
- void glCompressedTexSubImage2D(GLenum target, GLint level, GLint xoffset, GLint yoffset, GLsizei width, GLsizei height, GLenum format, GLsizei imageSize, void *data)
- void glCopyTexImage2D(GLenum target, GLint level, GLenum internalformat, GLint x, GLint y, GLsizei width, GLsizei height, GLint border)
- void glCopyTexSubImage2D(GLenum target, GLint level, GLint xoffset, GLint yoffset, GLint x, GLint y, GLsizei width, GLsizei height)

- GLuint glCreateProgram(void)
- GLuint glCreateShader(GLenum type)
- void glCullFace(GLenum mode)
- void glDeleteBuffers(GLsizei n, GLuint *buffers)
- void glDeleteFramebuffers(GLsizei n, GLuint *framebuffers)
- void glDeleteProgram(GLuint program)
- void glDeleteRenderbuffers(GLsizei n, GLuint *renderbuffers)
- void glDeleteShader(GLuint shader)
- void glDeleteTextures(GLsizei n, GLuint *textures)
- void glDepthFunc(GLenum func)
- void glDepthMask(GLboolean flag)
- void glDepthRangef(GLclampf zNear, GLclampf zFar)
- void glDetachShader(GLuint program, GLuint shader)
- void glDisable(GLenum cap)
- void glDisableVertexAttribArray(GLuint index)
- void glDrawArrays(GLenum mode, GLint first, GLsizei count)
- void glDrawElements(GLenum mode, GLsizei count, GLenum type, GLvoid *indices)
- void glEnable(GLenum cap)
- void glEnableVertexAttribArray(GLuint index)
- void glFinish(void)
- void glFlush(void)
- void glFramebufferRenderbuffer(GLenum target, GLenum attachment, GLenum renderbuffertarget, GLuint renderbuffer)
- void glFramebufferTexture2D(GLenum target, GLenum attachment, GLenum textarget, GLuint texture, GLint level)
- void glFrontFace(GLenum mode)
- void glGenBuffers(GLsizei n, GLuint *buffers)
- void glGenFramebuffers(GLsizei n, GLuint *framebuffers)
- void glGenRenderbuffers(GLsizei n, GLuint *renderbuffers)
- void glGenTextures(GLsizei n, GLuint *textures)
- void glGenerateMipmap(GLenum target)
- void glGetActiveAttrib(GLuint program, GLuint index, GLsizei bufsize, GLsizei *length, GLint *size, GLenum *type, char *name)
- void glGetActiveUniform(GLuint program, GLuint index, GLsizei bufsize, GLsizei *length, GLint *size, GLenum *type, char *name)
- void glGetAttachedShaders(GLuint program, GLsizei maxcount, GLsizei *count, GLuint *shaders)
- GLint glGetUniformLocation(GLuint program, char *name)

- void glGetBooleanv(GLenum pname, GLboolean *params)
- void glGetBufferParameteriv(GLenum target, GLenum pname, GLint *params)
- GLenum glGetError(void)
- void glGetFloatv(GLenum pname, GLfloat *params)
- void glGetFramebufferAttachmentParameteriv(GLenum target, GLenum attachment, GLenum pname, GLint *params)
- void glGetIntegerv(GLenum pname, GLint *params)
- void glGetProgramInfoLog(GLuint program, GLsizei bufsize, GLsizei *length, char *infolog)
- void glGetProgramiv(GLuint program, GLenum pname, GLint *params)
- void glGetRenderbufferParameteriv(GLenum target, GLenum pname, GLint *params)
- void glGetShaderInfoLog(GLuint shader, GLsizei bufsize, GLsizei *length, char *infolog)
- void glGetShaderPrecisionFormat(GLenum shadertype, GLenum precisiontype, GLint *range, GLint *precision)
- void glGetShaderSource(GLuint shader, GLsizei bufsize, GLsizei *length, char *source)
- void glGetShaderiv(GLuint shader, GLenum pname, GLint *params)
- GLubyte * glGetString(GLenum name)
- void glGetTexParameterfv(GLenum target, GLenum pname, GLfloat *params)
- void glGetTexParameteriv(GLenum target, GLenum pname, GLint *params)
- GLint glGetUniformLocation(GLuint program, char *name)
- void glGetUniformLocation(GLuint program, GLint location, GLfloat *params)
- void glGetUniformLocation(GLuint program, GLint location, GLint *params)
- void glGetVertexAttribiv(GLuint index, GLenum pname, GLint *params)
- void glHint(GLenum target, GLenum mode)
- GLboolean glIsBuffer(GLuint buffer)
- GLboolean glIsEnabled(GLenum cap)
- GLboolean glIsFramebuffer(GLuint framebuffer)
- GLboolean glIsProgram(GLuint program)
- GLboolean glIsRenderbuffer(GLuint renderbuffer)
- GLboolean glIsShader(GLuint shader)
- GLboolean glIsTexture(GLuint texture)
- void glLineWidth(GLfloat width)
- void glLinkProgram(GLuint program)
- void glPixelStorei(GLenum pname, GLint param)
- void glPolygonOffset(GLfloat factor, GLfloat units)
- void glReadPixels(GLint x, GLint y, GLsizei width, GLsizei height, GLenum format, GLenum type, GLvoid *pixels)
- void glReleaseShaderCompiler(void)

- void glRenderbufferStorage(GLenum target, GLenum internalformat, GLsizei width, GLsizei height)
- void glSampleCoverage(GLclampf value, GLboolean invert)
- void glScissor(GLint x, GLint y, GLsizei width, GLsizei height)
- void glShaderBinary(GLint n, GLuint *shaders, GLenum binaryformat, void *binary, GLint length)
- void glStencilFuncSeparate(GLenum face, GLenum func, GLint ref, GLuint mask)
- void glStencilMask(GLuint mask)
- void glStencilMaskSeparate(GLenum face, GLuint mask)
- void glStencilOp(GLenum fail, GLenum zfail, GLenum zpass)
- void glStencilOpSeparate(GLenum face, GLenum fail, GLenum zfail, GLenum zpass)
- void glTexImage2D(GLenum target, GLint level, GLint internalformat, GLsizei width, GLsizei height, GLint border, GLenum format, GLenum type, GLvoid *pixels)
- void glTexParameterf(GLenum target, GLenum pname, GLfloat param)
- void glTexParameterfv(GLenum target, GLenum pname, GLfloat *params)
- void glTexParameteri(GLenum target, GLenum pname, GLint param)
- void glTexParameteriv(GLenum target, GLenum pname, GLint *params)
- void glTexSubImage2D(GLenum target, GLint level, GLint xoffset, GLint yoffset, GLsizei width, GLsizei height, GLenum format, GLenum type, GLvoid *pixels)
- void glUniform1f(GLint location, GLfloat x)
- void glUniform1fv(GLint location, GLsizei count, GLfloat *v)
- void glUniform1i(GLint location, GLint x)
- void glUniform1iv(GLint location, GLsizei count, GLint *v)
- void glUniform2f(GLint location, GLfloat x, GLfloat y)
- void glUniform2fv(GLint location, GLsizei count, GLfloat *v)
- void glUniform2i(GLint location, GLint x, GLint y)
- void glUniform2iv(GLint location, GLsizei count, GLint *v)
- void glUniform3f(GLint location, GLfloat x, GLfloat y, GLfloat z)
- void glUniform3fv(GLint location, GLsizei count, GLfloat *v)
- void glUniform3i(GLint location, GLint x, GLint y, GLint z)
- void glUniform3iv(GLint location, GLsizei count, GLint *v)
- void glUniform4f(GLint location, GLfloat x, GLfloat y, GLfloat z, GLfloat w)
- void glUniform4fv(GLint location, GLsizei count, GLfloat *v)
- void glUniform4i(GLint location, GLint x, GLint y, GLint z, GLint w)
- void glUniform4iv(GLint location, GLsizei count, GLint *v)
- void glUniformMatrix2fv(GLint location, GLsizei count, GLboolean transpose, GLfloat *value)
- void glUniformMatrix3fv(GLint location, GLsizei count, GLboolean transpose, GLfloat *value)
- void glUniformMatrix4fv(GLint location, GLsizei count, GLboolean transpose, GLfloat *value)
- void glUseProgram(GLuint program)

- void glValidateProgram(GLuint program)
- void glVertexAttrib1f(GLuint indx, GLfloat x)
- void glVertexAttrib1fv(GLuint indx, GLfloat *values)
- void glVertexAttrib2f(GLuint indx, GLfloat x, GLfloat y)
- void glVertexAttrib2fv(GLuint indx, GLfloat *values)
- void glVertexAttrib3f(GLuint indx, GLfloat x, GLfloat y, GLfloat z)
- void glVertexAttrib3fv(GLuint indx, GLfloat *values)
- void glVertexAttrib4f(GLuint indx, GLfloat x, GLfloat y, GLfloat z, GLfloat w)
- void glVertexAttrib4fv(GLuint indx, GLfloat *values)
- void glVertexAttribPointer(GLuint indx, GLint size, GLenum type, GLboolean normalized, GLsizei stride, void *ptr)
- void glViewport(GLint x, GLint y, GLsizei width, GLsizei height)
- bool hasOpenGLFeature(QOpenGLFunctions::OpenGLFeature feature)
- void initializeOpenGLFunctions(void)
- QOpenGLFunctions::OpenGLFeatures openGLFeatures(void)

83.203 QOpenGLFunctions_3_2_Core Class

C++ Reference : http://doc.qt.io/qt-5/qopenglfunctions_3_2_core.html

Parameters : void

- void glActiveTexture(GLenum texture)
- void glAttachShader(GLuint program, GLuint shader)
- void glBeginConditionalRender(GLuint id, GLenum mode)
- void glBeginQuery(GLenum target, GLuint id)
- void glBeginTransformFeedback(GLenum primitiveMode)
- void glBindAttribLocation(GLuint program, GLuint index, GLchar *name)
- void glBindBuffer(GLenum target, GLuint buffer)
- void glBindBufferBase(GLenum target, GLuint index, GLuint buffer)
- void glBindBufferRange(GLenum target, GLuint index, GLuint buffer, GLintptr offset, GLsizeiptr size)
- void glBindFragDataLocation(GLuint program, GLuint color, GLchar *name)
- void glBindFramebuffer(GLenum target, GLuint framebuffer)
- void glBindRenderbuffer(GLenum target, GLuint renderbuffer)
- void glBindTexture(GLenum target, GLuint texture)
- void glBindVertexArray(GLuint array)
- void glBlendColor(GLfloat red, GLfloat green, GLfloat blue, GLfloat alpha)
- void glBlendEquation(GLenum mode)
- void glBlendEquationSeparate(GLenum modeRGB, GLenum modeAlpha)

- void glBlendFunc(GLenum sfactor, GLenum dfactor)
- void glBlendFuncSeparate(GLenum sfactorRGB, GLenum dfactorRGB, GLenum sfactorAlpha, GLenum dfactorAlpha)
- void glBlitFramebuffer(GLint srcX0, GLint srcY0, GLint srcX1, GLint srcY1, GLint dstX0, GLint dstY0, GLint dstX1, GLint dstY1, GLbitfield mask, GLenum filter)
- void glBufferData(GLenum target, GLsizeiptr size, GLvoid *data, GLenum usage)
- void glBufferSubData(GLenum target, GLintptr offset, GLsizeiptr size, GLvoid *data)
- GLenum glCheckFramebufferStatus(GLenum target)
- void glClampColor(GLenum target, GLenum clamp)
- void glClear(GLbitfield mask)
- void glClearBufferfi(GLenum buffer, GLint drawbuffer, GLfloat depth, GLint stencil)
- void glClearBufferfv(GLenum buffer, GLint drawbuffer, GLfloat *value)
- void glClearBufferiv(GLenum buffer, GLint drawbuffer, GLint *value)
- void glClearBufferuiv(GLenum buffer, GLint drawbuffer, GLuint *value)
- void glClearColor(GLfloat red, GLfloat green, GLfloat blue, GLfloat alpha)
- void glClearDepth(GLdouble depth)
- void glClearStencil(GLint s)
- GLenum glClientWaitSync(GLsync sync, GLbitfield flags, GLuint64 timeout)
- void glColorMask(GLboolean red, GLboolean green, GLboolean blue, GLboolean alpha)
- void glColorMaski(GLuint index, GLboolean r, GLboolean g, GLboolean b, GLboolean a)
- void glCompileShader(GLuint shader)
- void glCompressedTexImage1D(GLenum target, GLint level, GLenum internalformat, GLsizei width, GLsizei border, GLsizei imageSize, GLvoid *data)
- void glCompressedTexImage2D(GLenum target, GLint level, GLenum internalformat, GLsizei width, GLsizei height, GLsizei border, GLsizei imageSize, GLvoid *data)
- void glCompressedTexImage3D(GLenum target, GLint level, GLenum internalformat, GLsizei width, GLsizei height, GLsizei depth, GLsizei border, GLsizei imageSize, GLvoid *data)
- void glCompressedTexSubImage1D(GLenum target, GLint level, GLint xoffset, GLsizei width, GLenum format, GLsizei imageSize, GLvoid *data)
- void glCompressedTexSubImage2D(GLenum target, GLint level, GLint xoffset, GLint yoffset, GLsizei width, GLsizei height, GLenum format, GLsizei imageSize, GLvoid *data)
- void glCompressedTexSubImage3D(GLenum target, GLint level, GLint xoffset, GLint yoffset, GLint zoffset, GLsizei width, GLsizei height, GLsizei depth, GLenum format, GLsizei imageSize, GLvoid *data)
- void glCopyBufferSubData(GLenum readTarget, GLenum writeTarget, GLintptr readOffset, GLintptr writeOffset, GLsizeiptr size)
- void glCopyTexImage1D(GLenum target, GLint level, GLenum internalformat, GLint x, GLint y, GLsizei width, GLsizei border)
- void glCopyTexImage2D(GLenum target, GLint level, GLenum internalformat, GLint x, GLint y, GLsizei width, GLsizei height, GLsizei border)
- void glCopyTexSubImage1D(GLenum target, GLint level, GLint xoffset, GLint x, GLint y, GLsizei width)

- void glCopyTexSubImage2D(GLenum target, GLint level, GLint xoffset, GLint yoffset, GLint x, GLint y, GLsizei width, GLsizei height)
- void glCopyTexSubImage3D(GLenum target, GLint level, GLint xoffset, GLint yoffset, GLint zoffset, GLint x, GLint y, GLsizei width, GLsizei height)
- GLuint glCreateProgram(void)
- GLuint glCreateShader(GLenum type)
- void glCullFace(GLenum mode)
- void glDeleteBuffers(GLsizei n, GLuint *buffers)
- void glDeleteFramebuffers(GLsizei n, GLuint *framebuffers)
- void glDeleteProgram(GLuint program)
- void glDeleteQueries(GLsizei n, GLuint *ids)
- void glDeleteRenderbuffers(GLsizei n, GLuint *renderbuffers)
- void glDeleteShader(GLuint shader)
- void glDeleteSync(GLsync sync)
- void glDeleteTextures(GLsizei n, GLuint *textures)
- void glDeleteVertexArrays(GLsizei n, GLuint *arrays)
- void glDepthFunc(GLenum func)
- void glDepthMask(GLboolean flag)
- void glDepthRange(GLdouble nearVal, GLdouble farVal)
- void glDetachShader(GLuint program, GLuint shader)
- void glDisable(GLenum cap)
- void glDisableVertexAttribArray(GLuint index)
- void glDisablei(GLenum target, GLuint index)
- void glDrawArrays(GLenum mode, GLint first, GLsizei count)
- void glDrawArraysInstanced(GLenum mode, GLint first, GLsizei count, GLsizei instancecount)
- void glDrawBuffer(GLenum mode)
- void glDrawBuffers(GLsizei n, GLenum *bufs)
- void glDrawElements(GLenum mode, GLsizei count, GLenum type, GLvoid *indices)
- void glDrawElementsBaseVertex(GLenum mode, GLsizei count, GLenum type, GLvoid *indices, GLint basevertex)
- void glDrawElementsInstanced(GLenum mode, GLsizei count, GLenum type, GLvoid *indices, GLsizei instancecount)
- void glDrawElementsInstancedBaseVertex(GLenum mode, GLsizei count, GLenum type, GLvoid *indices, GLsizei instancecount, GLint basevertex)
- void glDrawRangeElements(GLenum mode, GLuint start, GLuint end, GLsizei count, GLenum type, GLvoid *indices)
- void glDrawRangeElementsBaseVertex(GLenum mode, GLuint start, GLuint end, GLsizei count, GLenum type, GLvoid *indices, GLint basevertex)

- void glEnable(GLenum cap)
- void glEnableVertexAttribArray(GLuint index)
- void glEnablei(GLenum target, GLuint index)
- void glEndConditionalRender(void)
- void glEndQuery(GLenum target)
- void glEndTransformFeedback(void)
- GLsync glFenceSync(GLenum condition, GLbitfield flags)
- void glFinish(void)
- void glFlush(void)
- void glFlushMappedBufferRange(GLenum target, GLintptr offset, GLsizeiptr length)
- void glFramebufferRenderbuffer(GLenum target, GLenum attachment, GLenum renderbuffertarget, GLuint renderbuffer)
- void glFramebufferTexture(GLenum target, GLenum attachment, GLuint texture, GLint level)
- void glFramebufferTexture1D(GLenum target, GLenum attachment, GLenum textarget, GLuint texture, GLint level)
- void glFramebufferTexture2D(GLenum target, GLenum attachment, GLenum textarget, GLuint texture, GLint level)
- void glFramebufferTexture3D(GLenum target, GLenum attachment, GLenum textarget, GLuint texture, GLint level, GLint zoffset)
- void glFramebufferTextureLayer(GLenum target, GLenum attachment, GLuint texture, GLint level, GLint layer)
- void glFrontFace(GLenum mode)
- void glGenBuffers(GLsizei n, GLuint *buffers)
- void glGenFramebuffers(GLsizei n, GLuint *framebuffers)
- void glGenQueries(GLsizei n, GLuint *ids)
- void glGenRenderbuffers(GLsizei n, GLuint *renderbuffers)
- void glGenTextures(GLsizei n, GLuint *textures)
- void glGenVertexArrays(GLsizei n, GLuint *arrays)
- void glGenerateMipmap(GLenum target)
- void glGetActiveAttrib(GLuint program, GLuint index, GLsizei bufSize, GLsizei *length, GLint *size, GLenum *type, GLchar *name)
- void glGetActiveUniform(GLuint program, GLuint index, GLsizei bufSize, GLsizei *length, GLint *size, GLenum *type, GLchar *name)
- void glGetActiveUniformBlockName(GLuint program, GLuint uniformBlockIndex, GLsizei bufSize, GLsizei *length, GLchar *uniformBlockName)
- void glGetActiveUniformBlockiv(GLuint program, GLuint uniformBlockIndex, GLenum pname, GLint *params)
- void glGetActiveUniformName(GLuint program, GLuint uniformIndex, GLsizei bufSize, GLsizei *length, GLchar *uniformName)

- void glGetActiveUniformsiv(GLuint program, GLsizei uniformCount, GLuint *uniformIndices, GLenum pname, GLint *params)
- void glGetAttachedShaders(GLuint program, GLsizei maxCount, GLsizei *count, GLuint *obj)
- GLint glGetAttribLocation(GLuint program, GLchar *name)
- void glGetBooleani_v(GLenum target, GLuint index, GLboolean *data)
- void glGetBooleanv(GLenum pname, GLboolean *params)
- void glGetBufferParameteri64v(GLenum target, GLenum pname, GLint64 *params)
- void glGetBufferParameteriv(GLenum target, GLenum pname, GLint *params)
- void glGetCompressedTexImage(GLenum target, GLint level, GLvoid *img)
- void glGetDoublev(GLenum pname, GLdouble *params)
- GLenum glGetError(void)
- void glGetFloatv(GLenum pname, GLfloat *params)
- GLint glGetFragDataLocation(GLuint program, GLchar *name)
- void glGetFramebufferAttachmentParameteriv(GLenum target, GLenum attachment, GLenum pname, GLint *params)
- void glGetInteger64i_v(GLenum target, GLuint index, GLint64 *data)
- void glGetInteger64v(GLenum pname, GLint64 *params)
- void glGetIntegeri_v(GLenum target, GLuint index, GLint *data)
- void glGetIntegerv(GLenum pname, GLint *params)
- void glGetMultisamplefv(GLenum pname, GLuint index, GLfloat *val)
- void glGetProgramiv(GLuint program, GLenum pname, GLint *params)
- void glGetQueryObjectiv(GLuint id, GLenum pname, GLint *params)
- void glGetQueryObjectuiv(GLuint id, GLenum pname, GLuint *params)
- void glGetQueryiv(GLenum target, GLenum pname, GLint *params)
- void glGetRenderbufferParameteriv(GLenum target, GLenum pname, GLint *params)
- void glGetShaderInfoLog(GLuint shader, GLsizei bufSize, GLsizei *length, GLchar *infoLog)
- void glGetShaderSource(GLuint shader, GLsizei bufSize, GLsizei *length, GLchar *source)
- void glGetShaderiv(GLuint shader, GLenum pname, GLint *params)
- GLubyte * glGetString(GLenum name)
- GLubyte * glGetStringi(GLenum name, GLuint index)
- void glGetSynciv(GLsync sync, GLenum pname, GLsizei bufSize, GLsizei *length, GLint *values)
- void glGetTexImage(GLenum target, GLint level, GLenum format, GLenum type, GLvoid *pixels)
- void glGetTexLevelParameterfv(GLenum target, GLint level, GLenum pname, GLfloat *params)
- void glGetTexLevelParameteriv(GLenum target, GLint level, GLenum pname, GLint *params)
- void glGetTexParameteriv(GLenum target, GLenum pname, GLint *params)
- void glGetTexParameterIuiv(GLenum target, GLenum pname, GLuint *params)
- void glGetTexParameterfv(GLenum target, GLenum pname, GLfloat *params)

- void glGetTexParameteriv(GLenum target, GLenum pname, GLint *params)
- void glGetTransformFeedbackVarying(GLuint program, GLuint index, GLsizei bufSize, GLsizei *length, GLsizei *size, GLenum *type, GLchar *name)
- GLuint glGetUniformLocation(GLuint program, GLchar *uniformBlockName)
- void glGetUniformfv(GLuint program, GLint location, GLfloat *params)
- void glGetUniformiv(GLuint program, GLint location, GLint *params)
- void glGetUniformuiv(GLuint program, GLint location, GLuint *params)
- void glGetVertexAttribIiv(GLuint index, GLenum pname, GLint *params)
- void glGetVertexAttribIuiv(GLuint index, GLenum pname, GLuint *params)
- void glGetVertexAttribfv(GLuint index, GLenum pname, GLfloat *params)
- void glGetVertexAttribiv(GLuint index, GLenum pname, GLint *params)
- void glHint(GLenum target, GLenum mode)
- void glIndexub(GLubyte c)
- void glIndexubv(GLubyte *c)
- GLboolean glIsBuffer(GLuint buffer)
- GLboolean glIsEnabled(GLenum cap)
- GLboolean glIsEnabledi(GLenum target, GLuint index)
- GLboolean glIsFramebuffer(GLuint framebuffer)
- GLboolean glIsProgram(GLuint program)
- GLboolean glIsQuery(GLuint id)
- GLboolean glIsRenderbuffer(GLuint renderbuffer)
- GLboolean glIsShader(GLuint shader)
- GLboolean glIsSync(GLsync sync)
- GLboolean glIsTexture(GLuint texture)
- GLboolean glIsVertexArray(GLuint array)
- void glLineWidth(GLfloat width)
- void glLinkProgram(GLuint program)
- void glLogicOp(GLenum opcode)
- GLvoid * glMapBuffer(GLenum target, GLenum access)
- GLvoid * glMapBufferRange(GLenum target, GLintptr offset, GLsizeiptr length, GLbitfield access)
- void glMultiDrawArrays(GLenum mode, GLint *first, GLsizei *count, GLsizei drawcount)
- void glPixelStorei(GLenum pname, GLint param)
- void glPointParameterf(GLenum pname, GLfloat param)
- void glPointParameterfv(GLenum pname, GLfloat *params)
- void glPointParameteri(GLenum pname, GLint param)
- void glPointParameteriv(GLenum pname, GLint *params)

- void glPointSize(GLfloat size)
- void glPolygonMode(GLenum face, GLenum mode)
- void glPolygonOffset(GLfloat factor, GLfloat units)
- void glPrimitiveRestartIndex(GLuint index)
- void glProvokingVertex(GLenum mode)
- void glReadBuffer(GLenum mode)
- void glReadPixels(GLint x, GLint y, GLsizei width, GLsizei height, GLenum format, GLenum type, GLvoid *pixels)
- void glRenderbufferStorage(GLenum target, GLenum internalformat, GLsizei width, GLsizei height)
- void glRenderbufferStorageMultisample(GLenum target, GLsizei samples, GLenum internalformat, GLsizei width, GLsizei height)
- void glSampleCoverage(GLfloat value, GLboolean invert)
- void glSampleMaski(GLuint index, GLbitfield mask)
- void glScissor(GLint x, GLint y, GLsizei width, GLsizei height)
- void glStencilFuncSeparate(GLenum face, GLenum func, GLint ref, GLuint mask)
- void glStencilMask(GLuint mask)
- void glStencilMaskSeparate(GLenum face, GLuint mask)
- void glStencilOp(GLenum fail, GLenum zfail, GLenum zpass)
- void glStencilOpSeparate(GLenum face, GLenum sfail, GLenum dpfail, GLenum dppass)
- void glTexBuffer(GLenum target, GLenum internalformat, GLuint buffer)
- void glTexImage1D(GLenum target, GLint level, GLint internalformat, GLsizei width, GLint border, GLenum format, GLenum type, GLvoid *pixels)
- void glTexImage2D(GLenum target, GLint level, GLint internalformat, GLsizei width, GLsizei height, GLint border, GLenum format, GLenum type, GLvoid *pixels)
- void glTexImage2DMultisample(GLenum target, GLsizei samples, GLint internalformat, GLsizei width, GLsizei height, GLboolean fixedsamplelocations)
- void glTexImage3D(GLenum target, GLint level, GLint internalformat, GLsizei width, GLsizei height, GLsizei depth, GLint border, GLenum format, GLenum type, GLvoid *pixels)
- void glTexImage3DMultisample(GLenum target, GLsizei samples, GLint internalformat, GLsizei width, GLsizei height, GLsizei depth, GLboolean fixedsamplelocations)
- void glTexParameterIiv(GLenum target, GLenum pname, GLint *params)
- void glTexParameterIuiv(GLenum target, GLenum pname, GLuint *params)
- void glTexParameterf(GLenum target, GLenum pname, GLfloat param)
- void glTexParameterfv(GLenum target, GLenum pname, GLfloat *params)
- void glTexParameteri(GLenum target, GLenum pname, GLint param)
- void glTexParameteriv(GLenum target, GLenum pname, GLint *params)
- void glTexSubImage1D(GLenum target, GLint level, GLint xoffset, GLsizei width, GLenum format, GLenum type, GLvoid *pixels)

- void glTexSubImage2D(GLenum target, GLint level, GLint xoffset, GLint yoffset, GLsizei width, GLsizei height, GLenum format, GLenum type, GLvoid *pixels)
- void glTexSubImage3D(GLenum target, GLint level, GLint xoffset, GLint yoffset, GLint zoffset, GLsizei width, GLsizei height, GLsizei depth, GLenum format, GLenum type, GLvoid *pixels)
- void glUniform1fv(GLint location, GLsizei count, GLfloat *value)
- void glUniform1i(GLint location, GLint v0)
- void glUniform1iv(GLint location, GLsizei count, GLint *value)
- void glUniform1ui(GLint location, GLuint v0)
- void glUniform1uiv(GLint location, GLsizei count, GLuint *value)
- void glUniform2f(GLint location, GLfloat v0, GLfloat v1)
- void glUniform2fv(GLint location, GLsizei count, GLfloat *value)
- void glUniform2i(GLint location, GLint v0, GLint v1)
- void glUniform2iv(GLint location, GLsizei count, GLint *value)
- void glUniform2ui(GLint location, GLuint v0, GLuint v1)
- void glUniform2uiv(GLint location, GLsizei count, GLuint *value)
- void glUniform3f(GLint location, GLfloat v0, GLfloat v1, GLfloat v2)
- void glUniform3fv(GLint location, GLsizei count, GLfloat *value)
- void glUniform3i(GLint location, GLint v0, GLint v1, GLint v2)
- void glUniform3iv(GLint location, GLsizei count, GLint *value)
- void glUniform3ui(GLint location, GLuint v0, GLuint v1, GLuint v2)
- void glUniform3uiv(GLint location, GLsizei count, GLuint *value)
- void glUniform4f(GLint location, GLfloat v0, GLfloat v1, GLfloat v2, GLfloat v3)
- void glUniform4fv(GLint location, GLsizei count, GLfloat *value)
- void glUniform4i(GLint location, GLint v0, GLint v1, GLint v2, GLint v3)
- void glUniform4iv(GLint location, GLsizei count, GLint *value)
- void glUniform4ui(GLint location, GLuint v0, GLuint v1, GLuint v2, GLuint v3)
- void glUniform4uiv(GLint location, GLsizei count, GLuint *value)
- void glUniformBlockBinding(GLuint program, GLuint uniformBlockIndex, GLuint uniformBlockBinding)
- void glUniformMatrix2fv(GLint location, GLsizei count, GLboolean transpose, GLfloat *value)
- void glUniformMatrix2x3fv(GLint location, GLsizei count, GLboolean transpose, GLfloat *value)
- void glUniformMatrix2x4fv(GLint location, GLsizei count, GLboolean transpose, GLfloat *value)
- void glUniformMatrix3fv(GLint location, GLsizei count, GLboolean transpose, GLfloat *value)
- void glUniformMatrix3x2fv(GLint location, GLsizei count, GLboolean transpose, GLfloat *value)
- void glUniformMatrix3x4fv(GLint location, GLsizei count, GLboolean transpose, GLfloat *value)
- void glUniformMatrix4fv(GLint location, GLsizei count, GLboolean transpose, GLfloat *value)
- void glUniformMatrix4x2fv(GLint location, GLsizei count, GLboolean transpose, GLfloat *value)
- void glUniformMatrix4x3fv(GLint location, GLsizei count, GLboolean transpose, GLfloat *value)

- GLboolean glUnmapBuffer(GLenum target)
- void glUseProgram(GLuint program)
- void glValidateProgram(GLuint program)
- void glViewport(GLint x, GLint y, GLsizei width, GLsizei height)
- void glWaitSync(GLsync sync, GLbitfield flags, GLuint64 timeout)

83.204 QOpenGLPaintDevice Class

C++ Reference : <http://doc.qt.io/qt-5/qopenglpaintdevice.html>

Parameters : void

Parent Class : QPaintDevice

- QOpenGLContext * context(void)
- qreal dotsPerMeterX(void)
- qreal dotsPerMeterY(void)
- void ensureActiveTarget(void)
- bool paintFlipped(void)
- void setDevicePixelRatio(qreal devicePixelRatio)
- void setDotsPerMeterX(qreal dpmx)
- void setDotsPerMeterY(qreal dpmy)
- void setPaintFlipped(bool flipped)
- void setSize(QSize size)
- QSize size(void)

83.205 QOpenGLShader Class

C++ Reference : <http://doc.qt.io/qt-5/qopenglshader.html>

Parameters : QOpenGLShader::ShaderType,QObject *

- bool compileSourceCode(char *source)
- bool compileSourceCode_2(QByteArray source)
- bool compileSourceCode_3(QString source)
- bool compileSourceFile(QString fileName)
- bool isCompiled(void)
- QString log(void)
- GLuint shaderId(void)
- QOpenGLShader::ShaderType shaderType(void)
- QByteArray sourceCode(void)
- bool hasOpenGLShaders(QOpenGLShader::ShaderType type, QOpenGLContext *context)

83.206 QOpenGLShaderProgram Class

C++ Reference : <http://doc.qt.io/qt-5/qopenglshaderprogram.html>

Parameters : QObject *

- bool addShaderFromSourceCode(QOpenGLShader::ShaderType type, char *source)
- bool addShaderFromSourceCode_2(QOpenGLShader::ShaderType type, QByteArray source)
- bool addShaderFromSourceCode_3(QOpenGLShader::ShaderType type, QString source)
- bool addShaderFromSourceFile(QOpenGLShader::ShaderType type, QString fileName)
- int attributeLocation(char *name)
- int attributeLocation_2(QByteArray name)
- int attributeLocation_3(QString name)
- bool bind(void)
- void bindAttributeLocation(char *name, int location)
- void bindAttributeLocation_2(QByteArray name, int location)
- void bindAttributeLocation_3(QString name, int location)
- QVector<float> defaultOuterTessellationLevels(void)
- void disableAttributeArray(int location)
- void disableAttributeArray_2(char *name)
- void enableAttributeArray(int location)
- void enableAttributeArray_2(char *name)
- bool isLinked(void)
- bool link(void)
- QString log(void)
- int maxGeometryOutputVertices(void)
- int patchVertexCount(void)
- GLuint programId(void)
- void release(void)
- void removeAllShaders(void)
- void removeShader(QOpenGLShader *shader)
- void setAttributeArray(int location, GLfloat *values, int tupleSize, int stride)
- void setAttributeArray_2(int location, QVector2D *values, int stride)
- void setAttributeArray_3(int location, QVector3D *values, int stride)
- void setAttributeArray_4(int location, QVector4D *values, int stride)
- void setAttributeArray_5(int location, GLenum type, void *values, int tupleSize, int stride)
- void setAttributeArray_6(char *name, GLfloat *values, int tupleSize, int stride)
- void setAttributeArray_7(char *name, QVector2D *values, int stride)

- void setAttributeArray_8(char *name, QVector3D *values, int stride)
- void setAttributeArray_9(char *name, QVector4D *values, int stride)
- void setAttributeArray_10(char *name, GLenum type, void *values, int tupleSize, int stride)
- void setAttributeBuffer(int location, GLenum type, int offset, int tupleSize, int stride)
- void setAttributeBuffer_2(char *name, GLenum type, int offset, int tupleSize, int stride)
- void setAttributeValue(int location, GLfloat value)
- void setAttributeValue_2(int location, GLfloat x, GLfloat y)
- void setAttributeValue_3(int location, GLfloat x, GLfloat y, GLfloat z)
- void setAttributeValue_4(int location, GLfloat x, GLfloat y, GLfloat z, GLfloat w)
- void setAttributeValue_5(int location, QVector2D value)
- void setAttributeValue_6(int location, QVector3D value)
- void setAttributeValue_7(int location, QVector4D value)
- void setAttributeValue_8(int location, QColor value)
- void setAttributeValue_9(int location, GLfloat *values, int columns, int rows)
- void setAttributeValue_10(char *name, GLfloat value)
- void setAttributeValue_11(char *name, GLfloat x, GLfloat y)
- void setAttributeValue_12(char *name, GLfloat x, GLfloat y, GLfloat z)
- void setAttributeValue_13(char *name, GLfloat x, GLfloat y, GLfloat z, GLfloat w)
- void setAttributeValue_14(char *name, QVector2D value)
- void setAttributeValue_15(char *name, QVector3D value)
- void setAttributeValue_16(char *name, QVector4D value)
- void setDefaultInnerTessellationLevels(QVector<float> levels)
- void setDefaultOuterTessellationLevels(QVector<float> levels)
- void setPatchVertexCount(int count)
- void setUniformValue(int location, GLfloat value)
- void setUniformValue_2(int location, GLint value)
- void setUniformValue_3(char *name, QColor color)
- void setUniformValue_4(char *name, QPoint point)
- void setUniformValue_5(char *name, QPointF point)
- void setUniformValue_6(char *name, QSize size)
- void setUniformValue_7(char *name, QSizeF size)
- void setUniformValue_8(char *name, QMatrix2x2 value)
- void setUniformValue_9(char *name, QMatrix2x3 value)
- void setUniformValue_10(char *name, QMatrix2x4 value)
- void setUniformValue_11(char *name, QMatrix3x2 value)
- void setUniformValue_12(char *name, QMatrix3x3 value)

- void setUniformValue_13(char *name, QMatrix3x4 value)
- void setUniformValue_14(char *name, QMatrix4x2 value)
- void setUniformValue_15(char *name, QMatrix4x3 value)
- void setUniformValue_16(char *name, QMatrix4x4 value)
- void setUniformValue_21(int location, GLuint value)
- void setUniformValue_22(int location, GLfloat x, GLfloat y)
- void setUniformValue_23(int location, GLfloat x, GLfloat y, GLfloat z)
- void setUniformValue_24(int location, GLfloat x, GLfloat y, GLfloat z, GLfloat w)
- void setUniformValue_25(int location, QVector2D value)
- void setUniformValue_26(int location, QVector3D value)
- void setUniformValue_27(int location, QVector4D value)
- void setUniformValue_28(int location, QColor color)
- void setUniformValue_29(int location, QPoint point)
- void setUniformValue_30(int location, QPointF point)
- void setUniformValue_31(int location, QSize size)
- void setUniformValue_32(int location, QSizeF size)
- void setUniformValue_33(int location, QMatrix2x2 value)
- void setUniformValue_34(int location, QMatrix2x3 value)
- void setUniformValue_35(int location, QMatrix2x4 value)
- void setUniformValue_36(int location, QMatrix3x2 value)
- void setUniformValue_37(int location, QMatrix3x3 value)
- void setUniformValue_38(int location, QMatrix3x4 value)
- void setUniformValue_39(int location, QMatrix4x2 value)
- void setUniformValue_40(int location, QMatrix4x3 value)
- void setUniformValue_41(int location, QMatrix4x4 value)
- void setUniformValue_46(char *name, GLfloat value)
- void setUniformValue_47(char *name, GLint value)
- void setUniformValue_48(char *name, GLuint value)
- void setUniformValue_49(char *name, GLfloat x, GLfloat y)
- void setUniformValue_50(char *name, GLfloat x, GLfloat y, GLfloat z)
- void setUniformValue_51(char *name, GLfloat x, GLfloat y, GLfloat z, GLfloat w)
- void setUniformValue_52(char *name, QVector2D value)
- void setUniformValue_53(char *name, QVector3D value)
- void setUniformValue_54(char *name, QVector4D value)
- void setUniformValueArray(int location, GLfloat *values, int count, int tupleSize)
- void setUniformValueArray_2(int location, GLint *values, int count)

- void setUniformValueArray_3(int location, GLuint *values, int count)
- void setUniformValueArray_4(int location, QVector2D *values, int count)
- void setUniformValueArray_5(int location, QVector3D *values, int count)
- void setUniformValueArray_6(int location, QVector4D *values, int count)
- void setUniformValueArray_7(int location, QMatrix2x2 *values, int count)
- void setUniformValueArray_8(int location, QMatrix2x3 *values, int count)
- void setUniformValueArray_9(int location, QMatrix2x4 *values, int count)
- void setUniformValueArray_10(int location, QMatrix3x2 *values, int count)
- void setUniformValueArray_11(int location, QMatrix3x3 *values, int count)
- void setUniformValueArray_12(int location, QMatrix3x4 *values, int count)
- void setUniformValueArray_13(int location, QMatrix4x2 *values, int count)
- void setUniformValueArray_14(int location, QMatrix4x3 *values, int count)
- void setUniformValueArray_15(int location, QMatrix4x4 *values, int count)
- void setUniformValueArray_16(char *name, GLfloat *values, int count, int tupleSize)
- void setUniformValueArray_17(char *name, GLint *values, int count)
- void setUniformValueArray_18(char *name, GLuint *values, int count)
- void setUniformValueArray_19(char *name, QVector2D *values, int count)
- void setUniformValueArray_20(char *name, QVector3D *values, int count)
- void setUniformValueArray_21(char *name, QVector4D *values, int count)
- void setUniformValueArray_22(char *name, QMatrix2x2 *values, int count)
- void setUniformValueArray_23(char *name, QMatrix2x3 *values, int count)
- void setUniformValueArray_24(char *name, QMatrix2x4 *values, int count)
- void setUniformValueArray_25(char *name, QMatrix3x2 *values, int count)
- void setUniformValueArray_26(char *name, QMatrix3x3 *values, int count)
- void setUniformValueArray_27(char *name, QMatrix3x4 *values, int count)
- void setUniformValueArray_28(char *name, QMatrix4x2 *values, int count)
- void setUniformValueArray_29(char *name, QMatrix4x3 *values, int count)
- void setUniformValueArray_30(char *name, QMatrix4x4 *values, int count)
- QList<QOpenGLShader *> shaders(void)
- int uniformLocation(char *name)
- int uniformLocation_2(QByteArray name)
- int uniformLocation_3(QString name)
- bool hasOpenGLShaderPrograms(QOpenGLContext *context)

83.207 QOpenGLTexture Class

C++ Reference : <http://doc.qt.io/qt-5/qopengltexture.html>

Parameters : QOpenGLTexture::Target

- void allocateStorage(void)
- void bind_2(uint unit, QOpenGLTexture::TextureUnitReset reset)
- QColor borderColor(void)
- void borderColor_2(float *border)
- void borderColor_3(int *border)
- void borderColor_4(unsigned int *border)
- QOpenGLTexture * createTextureView(QOpenGLTexture::Target target, QOpenGLTexture::TextureFormat viewFormat, int minimumMipmapLevel, int maximumMipmapLevel, int minimumLayer, int maximumLayer)
- int depth(void)
- QOpenGLTexture::DepthStencilMode depthStencilMode(void)
- void destroy(void)
- int faces(void)
- QOpenGLTexture::TextureFormat format(void)
- void generateMipMaps(void)
- void generateMipMaps_2(int baseLevel, bool resetBaseLevel)
- int height(void)
- bool isAutoMipMapGenerationEnabled(void)
- bool isBound(void)
- bool isBound_2(uint unit)
- bool isCreated(void)
- bool isTextureView(void)
- int layers(void)
- QPair<float, float> levelOfDetailRange(void)
- float levelofDetailBias(void)
- QOpenGLTexture::Filter magnificationFilter(void)
- float maximumAnisotropy(void)
- float maximumLevelOfDetail(void)
- int maximumMipLevels(void)
- float minimumLevelOfDetail(void)
- int mipBaseLevel(void)
- int mipMaxLevel(void)
- void release(void)
- void release_2(uint unit, QOpenGLTexture::TextureUnitReset reset)

- void setBorderColor(QColor color)
- void setBorderColor_4(uint r, uint g, uint b, uint a)
- void setCompressedData_4(int mipLevel, int dataSize, void *data, QOpenGLPixelTransferOptions * options)
- void setCompressedData_5(int dataSize, void *data, QOpenGLPixelTransferOptions * options)
- void setData(int mipLevel, int layer, QOpenGLTexture::CubeMapFace cubeFace, QOpenGLTexture::PixelFormat sourceFormat, QOpenGLTexture::PixelType sourceType, void *data, QOpenGLPixelTransferOptions * options)
- void setData_4(int mipLevel, QOpenGLTexture::PixelFormat sourceFormat, QOpenGLTexture::PixelType sourceType, void *data, QOpenGLPixelTransferOptions * options)
- void setData_5(QOpenGLTexture::PixelFormat sourceFormat, QOpenGLTexture::PixelType sourceType, void *data, QOpenGLPixelTransferOptions * options)
- void setData_6(QImage image, QOpenGLTexture::MipMapGeneration genMipMaps)
- void setDepthStencilMode(QOpenGLTexture::DepthStencilMode mode)
- void setLayers(int layers)
- void setLevelOfDetailRange(float min, float max)
- void setLevelofDetailBias(float bias)
- void setMagnificationFilter(QOpenGLTexture::Filter filter)
- void setMaximumAnisotropy(float anisotropy)
- void setMaximumLevelOfDetail(float value)
- void setMinMagFilters(QOpenGLTexture::Filter minificationQOpenGLTexture::Filter, QOpenGLTexture::Filter magnificationQOpenGLTexture::Filter)
- void setMinificationFilter(QOpenGLTexture::Filter filter)
- void setMinimumLevelOfDetail(float value)
- void setMipBaseLevel(int baseLevel)
- void setMipLevelRange(int baseLevel, int maxLevel)
- void setMipLevels(int levels)
- void setMipMaxLevel(int maxLevel)
- void setSwizzleMask(QOpenGLTexture::SwizzleComponent component, QOpenGLTexture::SwizzleValue value)
- void setSwizzleMask_2(QOpenGLTexture::SwizzleValue r, QOpenGLTexture::SwizzleValue g, QOpenGLTexture::SwizzleValue b, QOpenGLTexture::SwizzleValue a)
- void setWrapMode(QOpenGLTexture::WrapMode mode)
- void setWrapMode_2(QOpenGLTexture::CoordinateDirection direction, QOpenGLTexture::WrapMode mode)
- QOpenGLTexture::SwizzleValue swizzleMask(QOpenGLTexture::SwizzleComponent component)
- int width(void)
- QOpenGLTexture::WrapMode wrapMode(QOpenGLTexture::CoordinateDirection direction)
- GLuint boundTextureId(QOpenGLTexture::BindingTarget target)

83.208 QOpenGLTimerQuery Class

C++ Reference : <http://doc.qt.io/qt-5/qopengltimerquery.html>

Parameters : QObject *

- void begin(void)
- bool create(void)
- void destroy(void)
- void end(void)
- bool isCreated(void)
- bool isResultAvailable(void)
- GLuint objectId(void)
- void recordTimestamp(void)
- GLuint64 waitForResult(void)
- GLuint64 waitForTimestamp(void)

83.209 QOpenGLVersionProfile Class

C++ Reference : <http://doc.qt.io/qt-5/qopenglversionprofile.html>

Parameters : void

- bool hasProfiles(void)
- bool isLegacyVersion(void)
- bool isValid(void)
- QSurfaceFormat::OpenGLContextProfile profile(void)
- void setProfile(QSurfaceFormat::OpenGLContextProfile profile)
- void setVersion(int majorVersion, int minorVersion)
- QPair<int, int> version(void)

83.210 QOpenGLVertexArrayObject Class

C++ Reference : <http://doc.qt.io/qt-5/qopenglvertexarrayobject.html>

Parameters : QObject *

- void bind(void)
- bool create(void)
- void destroy(void)
- bool isCreated(void)
- GLuint objectId(void)
- void release(void)

83.211 QOpenGLWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qopenglwidget.html>

Parameters : QWidget *

Parent Class : QWidget

- void getEventParameters(void)
- void setInitEvent(const char *cStr)
- const char *getInitEvent(void)
- void setPaintEvent(const char *cStr)
- const char *getPaintEvent(void)
- void setResizeEvent(const char *cStr)
- const char *getResizeEvent(void)
- QOpenGLContext * context(void)
- GLuint defaultFramebufferObject(void)
- void doneCurrent(void)
- QSurfaceFormat format(void)
- QImage grabFramebuffer(void)
- bool isValid(void)
- void makeCurrent(void)
- void setFormat(QSurfaceFormat format)
- QOpenGLWidget::UpdateBehavior updateBehavior(void)

83.212 QOrbitCameraController Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qorbitcameracontroller.html>

Parameters : Qt3DCore::QNode *

Parent Class : QAbstractCameraController

- void setZoomInLimit(float zoomInLimit)
- float zoomInLimit(void)

83.213 QPageSetupDialog Class

C++ Reference : <http://doc.qt.io/qt-5/qpagesetupdialog.html>

Parameters : QPrinter *, QWidget *

Parent Class : QDialog

- void open(QObject * receiver, char * member)
- QPrinter * printer(void)

83.214 QPaintDevice Class

C++ Reference : <http://doc.qt.io/qt-5/qpaintdevice.html>

- int colorCount(void)
- int depth(void)
- int devicePixelRatio(void)
- int heightMM(void)
- int logicalDpiX(void)
- int logicalDpiY(void)
- QPaintEngine * paintEngine(void)
- bool paintingActive(void)
- int physicalDpiX(void)
- int physicalDpiY(void)
- int width(void)
- int widthMM(void)

83.215 QPainter Class

C++ Reference : <http://doc.qt.io/qt-5/qpainter.html>

Parameters : void

- QBrush background(void)
- int backgroundMode(void)
- bool begin(QPaintDevice *device)
- void beginNativePainting(void)
- QRect boundingRect(int x, int y, int w, int h, int flags, QString text)
- QBrush brush(void)
- QPoint brushOrigin(void)
- QRectF clipBoundingRect(void)
- QPainterPath clipPath(void)

- `QRegion clipRegion(void)`
- `QTransform combinedTransform(void)`
- `int compositionMode(void)`
- `QPaintDevice *device(void)`
- `QTransform deviceTransform(void)`
- `void drawArc(int x, int y, int width, int height, int startAngle, int spanAngle)`
- `void drawChord(int x, int y, int width, int height, int startAngle, int spanAngle)`
- `void drawEllipse(int x, int y, int width, int height)`
- `void drawGlyphRun(QPointF position, QGlyphRun glyphs)`
- `void drawImage(int x, int y, QImage image)`
- `void drawLine(int x1, int y1, int x2, int y2)`
- `void drawLines(QLine *lines, int lineCount)`
- `void drawPath(QPainterPath path)`
- `void drawPicture(int x, int y, QPicture picture)`
- `void drawPie(int x, int y, int width, int height, int startAngle, int spanAngle)`
- `void drawPixmap(int x, int y, QPixmap)`
- `void drawPoint(int x, int y)`
- `void drawRect(int x, int y, int width, int height)`
- `void drawRects(QRectF *rectangles, int rectCount)`
- `void drawRoundedRect(int x, int y, int w, int h, qreal xRadius, qreal yRadius, Qt::SizeMode mode)`
- `void drawStaticText(int left, int top, QStaticText staticText)`
- `void drawText(int x, int y, QString text)`
- `void drawTiledPixmap(int x, int y, int width, int height, QPixmap pixmap, int sx, int sy)`
- `bool end(void) # In RingQt use : bool endpaint(void)`
- `void endNativePainting(void)`
- `void eraseRect(int x, int y, int width, int height)`
- `void fillPath(QPainterPath path, QBrush brush)`
- `void fillRect(int x, int y, int width, int height, QBrush)`
- `QFont font(void)`
- `QFontInfo fontInfo(void)`
- `bool hasClipping(void)`
- `void initFrom(QWidget *widget)`
- `bool isActive(void)`
- `int layoutDirection(void)`
- `double opacity(void)`
- `QPaintEngine *paintEngine(void)`

- QPen pen(void)
- int renderHints(void)
- void resetTransform(void)
- void restore(void)
- void rotate(qreal angle)
- void save(void)
- void scale(double sx, double sy)
- void setBackground(QBrush brush)
- void setBackgroundMode(Qt::BGMode mode)
- void setBrush(QBrush brush)
- void setBrushOrigin(int x, int y)
- void setClipPath(QPainterPath path, Qt::ClipOperation operation)
- void setClipRect(int x, int y, int width, int height, Qt::ClipOperation operation)
- void setClipRegion(QRegion region, Qt::ClipOperation operation)
- void setClipping(bool enable)
- void setCompositionMode(QPainter::CompositionMode mode)
- void setFont(QFont font)
- void setLayoutDirection(Qt::LayoutDirection direction)
- void setOpacity(qreal opacity)
- void setPen(QPen pen)
- void setRenderHint(QPainter::RenderHint hint, bool on)
- void setTransform(QTransform transform, bool combine)
- void setViewTransformEnabled(bool enable)
- void setViewport(int x, int y, int width, int height)
- void setWindow(int x, int y, int width, int height)
- void setWorldMatrixEnabled(bool enable)
- void setWorldTransform(QTransform matrix, bool combine)
- void shear(double sh, double sv)
- void strokePath(QPainterPath path, QPen pen)
- bool testRenderHint(QPainter::RenderHint hint)
- QTransform transform(void)
- void translate(double dx, double dy)
- bool viewTransformEnabled(void)
- QRect viewport(void)
- QRect window(void)
- bool worldMatrixEnabled(void)

- `QTransform worldTransform(void)`
- `void drawPolygon(List *pPoints, Qt::FillRule fillRule)`
- `void drawConvexPolygon(List *pPoints)`
- `void drawPoints(List *pPoints)`
- `void drawPolyline(List *pPoints)`

83.216 QPainter2 Class

Parameters : `QPaintDevice *`

Parent Class : `QPainter`

83.217 QPainterPath Class

C++ Reference : <http://doc.qt.io/qt-5/qpainterpath.html>

Parameters : `void`

- `void addEllipse(qreal x, qreal y, qreal width, qreal height)`
- `void addPath(QPainterPath)`
- `void addPolygon(QPolygonF)`
- `void addRect(qreal x, qreal y, qreal width, qreal height)`
- `void addRegion(QRegion)`
- `void addRoundedRect(qreal x, qreal y, qreal w, qreal h, qreal xRadius, qreal yRadius, Qt::SizeMode mode)`
- `void addText(qreal x, qreal y, QFont, QString)`
- `qreal angleAtPercent(qreal t)`
- `void arcMoveTo(qreal x, qreal y, qreal width, qreal height, qreal angle)`
- `void arcTo(qreal x, qreal y, qreal width, qreal height, qreal startAngle, qreal sweepLength)`
- `QRectF boundingRect(void)`
- `void closeSubpath(void)`
- `void connectPath(QPainterPath)`
- `bool contains(QPointF)`
- `QRectF controlPointRect(void)`
- `void cubicTo(qreal c1X, qreal c1Y, qreal c2X, qreal c2Y, qreal endPointX, qreal endPointY)`
- `QPointF currentPosition(void)`
- `QPainterPath::Element elementAt(int index)`
- `int elementCount(void)`
- `Qt::FillRule fillRule(void)`
- `QPainterPath intersected(QPainterPath)`
- `bool intersects(QRectF)`

- bool isEmpty(void)
- qreal length(void)
- void lineTo(qreal x, qreal y)
- void moveTo(qreal x, qreal y)
- qreal percentAtLength(qreal len)
- QPointF pointAtPercent(qreal t)
- void quadTo(qreal cx, qreal cy, qreal endPointX, qreal endPointY)
- void setElementPositionAt(int index, qreal x, qreal y)
- void setFillRule(Qt::FillRule fillRule)
- QPainterPath simplified(void)
- qreal slopeAtPercent(qreal t)
- QPainterPath subtracted(QPainterPath)
- void swap(QPainterPath)
- QPolygonF toFillPolygon(QTransform)
- QPainterPath toReversed(void)
- void translate(qreal dx, qreal dy)
- QPainterPath translated(qreal dx, qreal dy)
- QPainterPath united(QPainterPath)

83.218 QPen Class

C++ Reference : <http://doc.qt.io/qt-5/qpen.html>

Parameters : void

- QBrush brush(void)
- int capStyle(void)
- QColor color(void)
- double dashOffset(void)
- bool isCosmetic(void)
- bool isSolid(void)
- int joinStyle(void)
- double miterLimit(void)
- void setBrush(QBrush)
- void setCapStyle(Qt::PenCapStyle style)
- void setColor(QColor)
- void setCosmetic(bool cosmetic)
- void setDashOffset(double offset)

- void setJoinStyle(Qt::PenJoinStyle style)
- void setMiterLimit(double limit)
- void setStyle(Qt::PenStyle style)
- void setWidth(int width)
- void setWidthF(double width)
- int style(void)
- void swap(QPen)
- int width(void)
- double widthF(void)

83.219 QPerVertexColorMaterial Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qpervertexcolormaterial.html>

Parameters : Qt3DCore::QNode *

83.220 QPercentBarSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qpercentbarseries.html>

Parameters : QObject *

Parent Class : QAbstractBarSeries

- QAbstractSeries::SeriesType type(void)

83.221 QPhongMaterial Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qphongmaterial.html>

Parameters : Qt3DCore::QNode *

- QColor ambient(void)
- QColor diffuse(void)
- float shininess(void)
- QColor specular(void)
- void setAmbient(QColor ambient)
- void setDiffuse(QColor diffuse)
- void setShininess(float shininess)
- void setSpecular(QColor specular)

83.222 QPicture Class

C++ Reference : <http://doc.qt.io/qt-5/qpicture.html>

Parameters : void

- QRect boundingRect(void)
- const char *data(void)
- boolisNull(void)
- bool load(QString, const char *format) # In RingQt use : bool loadfile(QString, const char *format)
- bool play(QPainter *painter)
- bool save(QString , const char *format)
- void setBoundingRect(QRect)
- int size(void)
- void swap(QPicture)

83.223 QPieLegendMarker Class

C++ Reference : <http://doc.qt.io/qt-5/qpielegendmarker.html>

Parent Class : QLegendMarker

- QPieSlice * slice(void)

83.224 QPieSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qpieseries.html>

Parameters : QObject *

Parent Class : QAbstractSeries

- bool append_2(QList<QPieSlice *> slices)
- QPieSlice * append_3(QString label, qreal value)
- void clear(void)
- int count(void)
- qreal holeSize(void)
- qreal horizontalPosition(void)
- bool insert(int index, QPieSlice *slice)
- bool isEmpty(void)
- qreal pieEndAngle(void)
- qreal pieSize(void)
- qreal pieStartAngle(void)
- bool remove(QPieSlice *slice)

- void setHoleSize(qreal holeSize)
- void setHorizontalPosition(qreal relativePosition)
- void setLabelsPosition(QPieSlice::LabelPosition position)
- void setLabelsVisible(bool visible)
- void setPieEndAngle(qreal angle)
- void setPieSize(qreal relativeSize)
- void setPieStartAngle(qreal startAngle)
- void setVerticalPosition(qreal relativePosition)
- QList<QPieSlice *> slices(void)
- qreal sum(void)
- bool take(QPieSlice *slice)
- qreal verticalPosition(void)
- void setaddedEvent(const char *)
- void setclickedEvent(const char *)
- void setcountChangedEvent(const char *)
- void setdoubleClickedEvent(const char *)
- void sethoveredEvent(const char *)
- void setpressedEvent(const char *)
- void setreleasedEvent(const char *)
- void setremovedEvent(const char *)
- void setsumChangedEvent(const char *)
- const char *getaddedEvent(void)
- const char *getclickedEvent(void)
- const char *getcountChangedEvent(void)
- const char *getdoubleClickedEvent(void)
- const char *gethoveredEvent(void)
- const char *getpressedEvent(void)
- const char *getreleasedEvent(void)
- const char *getremovedEvent(void)
- const char *getsumChangedEvent(void)

83.225 QPieSlice Class

C++ Reference : <http://doc.qt.io/qt-5/qpieslice.html>

Parameters : QObject *

Parent Class : QObject

- QColor borderColor(void)
- int borderWidth(void)
- QBrush brush(void)
- QColor color(void)
- qreal explodeDistanceFactor(void)
- bool isExploded(void)
- bool isLabelVisible(void)
- QString label(void)
- qreal labelArmLengthFactor(void)
- QBrush labelBrush(void)
- QColor labelColor(void)
- QFont labelFont(void)
- QPieSlice::LabelPosition labelPosition(void)
- QPen pen(void)
- qreal percentage(void)
- QPieSeries * series(void)
- void setBorderColor(QColor color)
- void setBorderWidth(int width)
- void setBrush(QBrush brush)
- void setColor(QColor color)
- void setExplodeDistanceFactor(qreal factor)
- void setExploded(bool exploded)
- void setLabel(QString label)
- void setLabelArmLengthFactor(qreal factor)
- void setLabelBrush(QBrush brush)
- void setLabelColor(QColor color)
- void setLabelFont(QFont font)
- void setLabelPosition(QPieSlice::LabelPosition position)
- void setLabelVisible(bool visible)
- void setPen(QPen pen)
- void setValue(qreal value)

- qreal startAngle(void)
- qreal value(void)
- void setangleSpanChangedEvent(const char *)
- void setborderColorChangedEvent(const char *)
- void setborderWidthChangedEvent(const char *)
- void setbrushChangedEvent(const char *)
- void setclickedEvent(const char *)
- void setcolorChangedEvent(const char *)
- void setdoubleClickedEvent(const char *)
- void sethoveredEvent(const char *)
- void setlabelBrushChangedEvent(const char *)
- void setlabelChangedEvent(const char *)
- void setlabelColorChangedEvent(const char *)
- void setlabelFontChangedEvent(const char *)
- void setlabelVisibleChangedEvent(const char *)
- void setpenChangedEvent(const char *)
- void setpercentageChangedEvent(const char *)
- void setpressedEvent(const char *)
- void setreleasedEvent(const char *)
- void setstartAngleChangedEvent(const char *)
- void setvalueChangedEvent(const char *)
- const char *getangleSpanChangedEvent(void)
- const char *getborderColorChangedEvent(void)
- const char *getborderWidthChangedEvent(void)
- const char *getbrushChangedEvent(void)
- const char *getclickedEvent(void)
- const char *getcolorChangedEvent(void)
- const char *getdoubleClickedEvent(void)
- const char *gethoveredEvent(void)
- const char *getlabelBrushChangedEvent(void)
- const char *getlabelChangedEvent(void)
- const char *getlabelColorChangedEvent(void)
- const char *getlabelFontChangedEvent(void)
- const char *getlabelVisibleChangedEvent(void)
- const char *getpenChangedEvent(void)
- const char *getpercentageChangedEvent(void)

- const char *getpressedEvent(void)
- const char *getreleasedEvent(void)
- const char *getstartAngleChangedEvent(void)
- const char *getvalueChangedEvent(void)

83.226 QPixmap Class

C++ Reference : <http://doc.qt.io/qt-5/qpixmap.html>

Parameters : const char *

- QPixmap copy(int x, int y, int width, int height)
- QPixmap scaled(int width, int height, Qt::AspectRatioMode aspectRatioMode, Qt::TransformationMode transformMode)
- int width(void)
- int height(void)
- QBitmap createMaskFromColor(QColor , Qt::MaskMode)
- QBitmap mask(void)
- void setMask(QBitmap)
- void fill(QColor)
- QPixmap fromImage(QImage,Qt::ImageConversionFlags)
- bool load(QString, const char *, Qt::ImageConversionFlags)
- qint64 cacheKey(void)
- bool convertFromImage(QImage image, Qt::ImageConversionFlags flags)
- QPixmap copy_2(QRect rectangle)
- QBitmap createHeuristicMask(bool clipTight)
- int depth(void)
- void detach(void)
- qreal devicePixelRatio(void)
- bool hasAlpha(void)
- bool hasAlphaChannel(void)
- boolisNull(void)
- bool isQBitmap(void)
- bool loadFromData(uchar *data, uint len, char *format, Qt::ImageConversionFlags flags)
- bool loadFromData_2(QByteArray data, char *format, Qt::ImageConversionFlags flags)
- QRect rect(void)
- bool save(QString fileName, char *format, int quality)
- bool save_2(QIODevice *device, char *format, int quality)

- QPixmap scaled_2(QSize size, Qt::AspectRatioMode aspectRatioMode, Qt::TransformationMode transformMode)
- QPixmap scaledToHeight(int height, Qt::TransformationMode mode)
- QPixmap scaledToWidth(int width, Qt::TransformationMode mode)
- void scroll(int dx, int dy, int x, int y, int width, int height, QRegion *exposed)
- void scroll_2(int dx, int dy, QRect rect, QRegion *exposed)
- void setDevicePixelRatio(qreal scaleFactor)
- QSize size(void)
- void swap(QPixmap other)
- QImage toImage(void)
- QPixmap transformed(QTransform transform, Qt::TransformationMode mode)
- QPixmap transformed_2(QMatrix matrix, Qt::TransformationMode mode)
- int defaultDepth(void)
- QPixmap fromImage_2(QImage image, Qt::ImageConversionFlags flags)
- QPixmap fromImageReader(QImageReader *imageReader, Qt::ImageConversionFlags flags)
- QTransform trueMatrix(QTransform matrix, int width, int height)
- QMatrix trueMatrix_2(QMatrix m, int w, int h)

83.227 QPixmap2 Class

Parameters : int width, int height

Parent Class : QPixmap

83.228 QPlainTextEdit Class

C++ Reference : <http://doc.qt.io/qt-5/qplaintextedit.html>

Parameters : QWidget *

Parent Class : QAbstractScrollArea

- QString anchorAt(QPoint pos)
- bool backgroundVisible(void)
- int blockCount(void)
- bool canPaste(void)
- bool centerOnScroll(void)
- QMenu * createStandardContextMenu(void)
- QTextCharFormat currentCharFormat(void)
- QTextCursor cursorForPosition(QPoint pos)
- QRect cursorRect(QTextCursor cursor)

- `QRect cursorRect_2(void)`
- `int cursorWidth(void)`
- `QTextDocument * document(void)`
- `QString documentTitle(void)`
- `void ensureCursorVisible(void)`
- `QList<QTextEdit::ExtraSelection> extraSelections(void)`
- `bool find(QString exp, QTextDocument::FindFlags options)`
- `bool isReadOnly(void)`
- `bool isUndoRedoEnabled(void)`
- `QPlainTextEdit::LineWrapMode lineWrapMode(void)`
- `int maximumBlockCount(void)`
- `void mergeCurrentCharFormat(QTextCharFormat modifier)`
- `void moveCursor(QTextCursor::MoveOperation operation, QTextCursor::MoveMode mode)`
- `bool overwriteMode(void)`
- `void print(QPagedPaintDevice *printer)`
- `void setBackgroundVisible(bool visible)`
- `void setCenterOnScroll(bool enabled)`
- `void setCurrentCharFormat(QTextCharFormat format)`
- `void setCursorWidth(int width)`
- `void setDocument(QTextDocument *document)`
- `void setDocumentTitle(QString title)`
- `void setExtraSelections(QList<QTextEdit::ExtraSelection> selections)`
- `void setLineWrapMode(QPlainTextEdit::LineWrapMode mode)`
- `void setMaximumBlockCount(int maximum)`
- `void setOverwriteMode(bool overwrite)`
- `void setReadOnly(bool ro)`
- `void setTabChangesFocus(bool b)`
- `void setTabStopWidth(int width)`
- `void setTextCursor(QTextCursor cursor)`
- `void setTextInteractionFlags(Qt::TextInteractionFlags flags)`
- `void setUndoRedoEnabled(bool enable)`
- `void setWordWrapMode(QTextOption::WrapMode policy)`
- `bool tabChangesFocus(void)`
- `int tabStopWidth(void)`
- `QTextCursor textCursor(void)`
- `Qt::TextInteractionFlags textInteractionFlags(void)`

- `QString toPlainText(void)`
- `QTextOption::WrapMode wordWrapMode(void)`
- `void appendHtml(QString html)`
- `void appendPlainText(QString text)`
- `void centerCursor(void)`
- `void clear(void)`
- `void copy(void)`
- `void cut(void)`
- `void insertPlainText(QString text)`
- `void paste(void)`
- `void redo(void)`
- `void selectAll(void)`
- `void setPlainText(QString text)`
- `void undo(void)`
- `void zoomIn(int range)`
- `void zoomOut(int range)`
- `void setblockCountChangedEvent(const char *cStr)`
- `void setcopyAvailableEvent(const char *cStr)`
- `void setcursorPositionChangedEvent(const char *cStr)`
- `void setmodificationChangedEvent(const char *cStr)`
- `void setredoAvailableEvent(const char *cStr)`
- `void setselectionChangedEvent(const char *cStr)`
- `void settextChangedEvent(const char *cStr)`
- `void setundoAvailableEvent(const char *cStr)`
- `void setupdateRequestEvent(const char *cStr)`
- `const char *getblockCountChangedEvent(void)`
- `const char *getcopyAvailableEvent(void)`
- `const char *getcursorPositionChangedEvent(void)`
- `const char *getmodificationChangedEvent(void)`
- `const char *getredoAvailableEvent(void)`
- `const char *getselectionChangedEvent(void)`
- `const char *gettextChangedEvent(void)`
- `const char *getundoAvailableEvent(void)`
- `const char *getupdateRequestEvent(void)`
- `void cyanline(void)`
- `void setactivelinecolor(QColor)`

83.229 QPlaneMesh Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qplanemesh.html>

Parameters : Qt3DCore::QNode *

- float height(void)
- QSize meshResolution(void)
- bool mirrored(void)
- float width(void)
- void setHeight(float height)
- void setMeshResolution(QSize resolution)
- void setMirrored(bool mirrored)
- void setWidth(float width)

83.230 QPoint Class

C++ Reference : <http://doc.qt.io/qt-5/qpoint.html>

Parameters : void

- boolisNull(void)
- int manhattanLength(void)
- int rx(void)
- int ry(void)
- void setX(int x)
- void setY(int y)
- int x(void)
- int y(void)

83.231 QPointF Class

C++ Reference : <http://doc.qt.io/qt-5/qpointf.html>

Parameters : void

- boolisNull(void)
- qreal manhattanLength(void)
- qreal rx(void)
- qreal ry(void)
- void setX(qreal x)
- void setY(qreal y)
- QPoint toPoint(void)

- qreal x(void)
- qreal y(void)

83.232 QPointLight Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qpointlight.html>

Parameters : Qt3DCore::QNode *

- float constantAttenuation(void)
- float linearAttenuation(void)
- float quadraticAttenuation(void)
- void setConstantAttenuation(float value)
- void setLinearAttenuation(float value)
- void setQuadraticAttenuation(float value)
- void setColor(QColor)
- void setIntensity(float intensity)

83.233 QPolarChart Class

C++ Reference : <http://doc.qt.io/qt-5/qpolarchart.html>

Parameters : QGraphicsItem *,Qt::WindowFlags

Parent Class : QChart

- QList<QAbstractAxis *> axes(QPolarChart::PolarOrientations polarOrientation, QAbstractSeries *series)

83.234 QPrintDialog Class

C++ Reference : <http://doc.qt.io/qt-5/qprintdialog.html>

Parameters : QPrinter *,QWidget *

Parent Class : QAbstractPrintDialog

- void open(QObject * receiver, char * member)
- QAbstractPrintDialog::PrintDialogOptions options(void)
- QPrinter * printer(void)
- void setOption(QAbstractPrintDialog::PrintDialogOption option, bool on)
- void setOptions(QAbstractPrintDialog::PrintDialogOptions options)
- bool testOption(QAbstractPrintDialog::PrintDialogOption option)
- void setAcceptedEvent(const char *)
- const char *getAcceptedEvent(void)

83.235 QPrintPreviewDialog Class

C++ Reference : <http://doc.qt.io/qt-5/qprintpreviewdialog.html>

Parameters : QPrinter *

Parent Class : QDialog

- void open(QObject * receiver, char * member)
- QPrinter * printer(void)
- void setpaintRequestedEvent(const char *)
- const char *getpaintRequestedEvent(void)

83.236 QPrintPreviewWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qprintpreviewwidget.html>

Parameters : QPrinter *

Parent Class : QWidget

- int currentPage(void)
- QPrinter::Orientation orientation(void)
- int pageCount(void)
- QPrintPreviewWidget::ViewMode viewMode(void)
- qreal zoomFactor(void)
- QPrintPreviewWidget::ZoomMode zoomMode(void)
- void fitInView(void)
- void fitToWidth(void)
- void print(void)
- void setAllPagesViewMode(void)
- void setCurrentPage(int page)
- void setFacingPagesViewMode(void)
- void setLandscapeOrientation(void)
- void setOrientation(QPrinter::Orientation orientation)
- void setPortraitOrientation(void)
- void setSinglePageViewMode(void)
- void setViewMode(QPrintPreviewWidget::ViewMode mode)
- void setZoomFactor(qreal factor)
- void setZoomMode(QPrintPreviewWidget::ZoomMode zoomMode)
- void updatePreview(void)
- void zoomIn(qreal factor)
- void zoomOut(qreal factor)

- void setpaintRequestedEvent(const char *)
- void setpreviewChangedEvent(const char *)
- const char *getpaintRequestedEvent(void)
- const char *getpreviewChangedEvent(void)

83.237 QPrinter Class

C++ Reference : <http://doc.qt.io/qt-5/qprinter.html>

Parameters : QPrinter::PrinterMode

- bool abort(void)
- bool collateCopies(void)
- int colorMode(void)
- int copyCount(void)
- QString creator(void)
- QString docName(void)
- int duplex(void)
- bool fontEmbeddingEnabled(void)
- int fromPage(void)
- bool fullPage(void)
- bool isValid(void)
- QString outputFileName(void)
- int outputFormat(void)
- QRectF pageRect(QPrinter::Unit unit)
- QRectF paperRect(QPrinter::Unit unit)
- int paperSource(void)
- QPrintEngine *printEngine(void)
- QString printProgram(void)
- int printRange(void)
- QString printerName(void)
- QString printerSelectionOption(void)
- int printerState(void)
- int resolution(void)
- void setCollateCopies(bool collate)
- void setColorMode(QPrinter::ColorMode newColorMode)
- void setCopyCount(int count)
- void setCreator(QString)

- void setDocName(QString)
- void setDuplex(QPrinter::DuplexMode duplex)
- void setFontEmbeddingEnabled(bool enable)
- void setFromTo(int from, int to)
- void setFullPage(bool fp)
- void setOutputFileName(QString)
- void setOutputFormat(QPrinter::OutputFormat format)
- void setPrintProgram(QString)
- void setPrintRange(QPrinter::PrintRange)
- void setPrinterName(QString)
- void setPrinterSelectionOption(QString)
- void setResolution(int dpi)
- bool supportsMultipleCopies(void)
- int toPage(void)
- bool newPage(void)
- QPaintEngine *paintEngine(void)
- void setPageSizeMM(QSizeF)

83.238 QPrinterInfo Class

C++ Reference : <http://doc.qt.io/qt-5/qprinterinfo.html>

Parameters : void

- QString description(void)
- bool isDefault(void)
- bool isNull(void)
- QString location(void)
- QString makeAndModel(void)
- QString printerName(void)
- QPrinterInfo printerInfo(QString printerName)

83.239 QProcess Class

C++ Reference : <http://doc.qt.io/qt-5/qprocess.html>

Parameters : QObject *

Parent Class : QIODevice

- QStringList arguments(void)
- void closeReadChannel(QProcess::ProcessChannel channel)
- void closeWriteChannel(void)
- QProcess::ProcessError error(void)
- int exitCode(void)
- QProcess::ExitStatus exitStatus(void)
- QProcess::InputChannelMode inputChannelMode(void)
- QProcess::ProcessChannelMode processChannelMode(void)
- QProcessEnvironment processEnvironment(void)
- QString program(void)
- QByteArray readAllStandardError(void)
- QByteArray readAllStandardOutput(void)
- QProcess::ProcessChannel readChannel(void)
- void setArguments(QStringList arguments)
- void setInputChannelMode(QProcess::InputChannelMode mode)
- void setProcessChannelMode(QProcess::ProcessChannelMode mode)
- void setProcessEnvironment(QProcessEnvironment environment)
- void setProgram(QString program)
- void setReadChannel(QProcess::ProcessChannel channel)
- void setStandardErrorFile(QString fileName, QIODevice::OpenMode mode)
- void setStandardInputFile(QString fileName)
- void setStandardOutputFile(QString fileName, QIODevice::OpenMode mode)
- void setStandardOutputProcess(QProcess *destination)
- void setWorkingDirectory(QString dir)
- void start(QString program, QStringList arguments, QIODevice::OpenMode mode)
- void start_2(QString command, QIODevice::OpenMode mode)
- void start_3(QIODevice::OpenMode mode)
- QProcess::ProcessState state(void)
- bool waitForFinished(int msecs)
- bool waitForStarted(int msecs)
- QString workingDirectory(void)

- void kill(void)
- void terminate(void)
- void setreadyReadStandardErrorEvent(const char *)
- void setreadyReadStandardOutputEvent(const char *)
- const char *getreadyReadStandardErrorEvent(void)
- const char *getreadyReadStandardOutputEvent(void)

83.240 QProgressBar Class

C++ Reference : <http://doc.qt.io/qt-5/qprogressbar.html>

Parameters : QWidget *parent

Parent Class : QWidget

- int alignment(void)
- QString format(void)
- bool invertedAppearance(void)
- bool isTextVisible(void)
- int maximum(void)
- int minimum(void)
- int orientation(void)
- void resetFormat(void)
- void setAlignment(Qt::AlignmentFlag alignment)
- void setFormat(QString)
- void setInvertedAppearance(bool invert)
- void setTextDirection(QProgressBar::Direction textDirection)
- void setTextVisible(bool visible)
- QString text(void)
- int textDirection(void)
- int value(void)
- void reset(void)
- void setMaximum(int maximum)
- void setMinimum(int minimum)
- void setOrientation(Qt::Orientation)
- void setRange(int minimum, int maximum)
- void setValue(int value)
- void setvalueChangedEvent(const char *)
- const char *getvalueChangedEvent(void)

83.241 QPushButton Class

C++ Reference : <http://doc.qt.io/qt-5/qpushbutton.html>

Parameters : QWidget *

Parent Class : QAbstractButton

- void setText(const char *)
- void setClickEvent(const char *)
- void setIcon(QIcon)
- void setIconSize(QSize)
- const char *getClickEvent(void)

83.242 QQmlEngine Class

C++ Reference : <http://doc.qt.io/qt-5/qqmlengine.html>

Parameters : QObject *

- void addImageProvider(QString providerId, QQmlImageProviderBase *provider)
- void addImportPath(QString path)
- void addPluginPath(QString path)
- QUrl baseUrl(void)
- void clearComponentCache(void)
- QQmlImageProviderBase *imageProvider(QString providerId)
- QStringList importPathList(void)
- bool importPlugin(QString filePath, QString uri, QList<QQmlError> *errors)
- QQmlIncubationController *incubationController(void)
- QNetworkAccessManager *networkAccessManager(void)
- QQmlNetworkAccessManagerFactory *networkAccessManagerFactory(void)
- QString offlineStorageDatabaseFilePath(QString databaseName)
- QString offlineStoragePath(void)
- bool outputWarningsToStandardError(void)
- QStringList pluginPathList(void)
- void removeImageProvider(QString providerId)
- QQmlContext *rootContext(void)
- void setBaseUrl(QUrl url)
- void setImportPathList(QStringList paths)
- void setIncubationController(QQmlIncubationController *controller)
- void setNetworkAccessManagerFactory(QQmlNetworkAccessManagerFactory *factory)
- void setOfflineStoragePath(QString dir)

- void setOutputWarningsToStandardError(bool enabled)
- void setPluginPathList(QStringList paths)
- void trimComponentCache(void)
- void retranslate(void)
- QQmlContext * contextForObject(QObject *object)
- QQmlEngine::ObjectOwnership objectOwnership(QObject *object)
- void setContextForObject(QObject *object, QQmlContext *context)
- void setObjectOwnership(QObject *object, QQmlEngine::ObjectOwnership ownership)

83.243 QQmlError Class

C++ Reference : <http://doc.qt.io/qt-5/qqmlerror.html>

Parameters : void

- int column(void)
- QString description(void)
- bool isValid(void)
- int line(void)
- QObject * object(void)
- void setColumn(int column)
- void setDescription(QString description)
- void setLine(int line)
- void setObject(QObject *object)
- void setUrl(QUrl url)
- QString toString(void)
- QUrl url(void)

83.244 QQuaternion Class

C++ Reference : <http://doc.qt.io/qt-5/qquaternion.html>

Parameters : float,float,float,float

- boolisNull(void)
- float length(void)
- float lengthSquared(void)
- void normalize(void)
- QQuaternion normalized(void)
- QVector3D rotatedVector(QVector3D vector)
- float scalar(void)

- void setScalar(float scalar)
- void setVector(QVector3D vector)
- void setVector_2(float x, float y, float z)
- void setX(float x)
- void setY(float y)
- void setZ(float z)
- QVector3D vector(void)
- float x(void)
- float y(void)
- float z(void)
- QQuaternion fromAxisAndAngle_2(float x, float y, float z, float angle)
- QQuaternion nlerp(QQuaternion q1, QQuaternion q2, float t)
- QQuaternion slerp(QQuaternion q1, QQuaternion q2, float t)

83.245 QQuickView Class

C++ Reference : <http://doc.qt.io/qt-5/qquickview.html>

Parameters : void

Parent Class : QWindow

- QQmlEngine *engine(void)
- QList<QQmlError> errors(void)
- QSize initialSize(void)
- QQuickWidget::ResizeMode resizeMode(void)
- QQmlContext *rootContext(void)
- QQuickItem *rootObject(void)
- void setFormat(QSurfaceFormat format)
- void setResizeMode(QQuickView::ResizeMode)
- QUrl source(void)
- QQuickWidget::Status status(void)
- void setSource(QUrl url)

83.246 QQuickWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qquickwidget.html>

Parameters : QWidget *

Parent Class : QWidget

- QQmlEngine *engine(void)
- QList<QQmlError> errors(void)
- QSurfaceFormat format(void)
- QImage grabFramebuffer(void)
- QSize initialSize(void)
- QQuickWindow *quickWindow(void)
- QQuickWidget::ResizeMode resizeMode(void)
- QQmlContext *rootContext(void)
- QQuickItem *rootObject(void)
- void setClearColor(QColor color)
- void setFormat(QSurfaceFormat format)
- void setResizeMode(QQuickWidget::ResizeMode)
- QUrl source(void)
- QQuickWidget::Status status(void)
- void setSource(QUrl url)
- void setSceneGraphErrorEvent(const char *)
- void setStatusChangedEvent(const char *)
- const char *getSceneGraphErrorEvent(void)
- const char *getStatusChangedEvent(void)

83.247 QRadioButton Class

C++ Reference : <http://doc.qt.io/qt-5/qradiobutton.html>

Parameters : QWidget *parent

Parent Class : QAbstractButton

- QSize minimumSizeHint(void)
- QSize sizeHint(void)
- void setClickedEvent(const char *)
- void setPressedEvent(const char *)
- void setReleasedEvent(const char *)
- void setToggledEvent(const char *)
- const char *getClickedEvent(void)

- const char *getpressedEvent(void)
- const char *getreleasedEvent(void)
- const char *gettoggledEvent(void)

83.248 QRect Class

C++ Reference : <http://doc.qt.io/qt-5/qrect.html>

Parameters : void

- void adjust(int dx1, int dy1, int dx2, int dy2)
- QRect adjusted(int dx1, int dy1, int dx2, int dy2)
- int bottom(void)
- QPoint bottomLeft(void)
- QPoint bottomRight(void)
- QPoint center(void)
- bool contains(int x, int y, bool proper)
- void getCoords(int *x1, int *y1, int *x2, int *y2)
- void getRect(int *x, int *y, int *width, int *height)
- int height(void)
- QRect intersected(QRect)
- bool intersects(QRect)
- bool isEmpty(void)
- boolisNull(void)
- bool isValid(void)
- int left(void)
- void moveBottom(int y)
- void moveBottomLeft(QPoint)
- void moveBottomRight(QPoint)
- void moveCenter(QPoint)
- void moveLeft(int x)
- void moveRight(int x)
- void moveTo(int x, int y)
- void moveTop(int y)
- void moveTopLeft(QPoint)
- void moveTopRight(QPoint)
- QRect normalized(void)
- int right(void)

- void setBottom(int y)
- void setBottomLeft(QPoint)
- void setBottomRight(QPoint)
- void setCoords(int x1, int y1, int x2, int y2)
- void setHeight(int height)
- void setLeft(int x)
- void setRect(int x, int y, int width, int height)
- void setRight(int x)
- void setSize(QSize)
- void setTop(int y)
- void setTopLeft(QPoint)
- void setTopRight(QPoint)
- void setWidth(int width)
- void setX(int x)
- void setY(int y)
- QSize size(void)
- int top(void)
- QPoint topLeft(void)
- QPoint topRight(void)
- void translate(int dx, int dy)
- QRect translated(int dx, int dy)
- QRect united(QRect)
- int width(void)
- int x(void)
- int y(void)

83.249 QRegion Class

C++ Reference : <http://doc.qt.io/qt-5/qregion.html>

Parameters : void

- QRect boundingRect(void)
- bool contains(QPoint p)
- bool contains_2(QRect r)
- QRegion intersected(QRegion r)
- QRegion intersected_2(QRect rect)
- bool intersects(QRegion region)

- bool intersects_2(QRect rect)
- bool isEmpty(void)
- boolisNull(void)
- int rectCount(void)
- QVector<QRect> rects(void)
- void setRects(QRect *rects, int number)
- QRegion subtracted(QRegion r)
- void swap(QRegion other)
- void translate(int dx, int dy)
- void translate_2(QPoint point)
- QRegion translated(int dx, int dy)
- QRegion translated_2(QPoint p)
- QRegion united(QRegion r)
- QRegion united_2(QRect rect)
- QRegion xored(QRegion r)

83.250 QRegularExpression Class

C++ Reference : <http://doc.qt.io/qt-5/qregularexpression.html>

Parameters : void

- int captureCount(void)
- QString errorString(void)
- QRegularExpressionMatchIterator globalMatch(QString subject, int offset, QRegularExpression::MatchType matchType, QRegularExpression::MatchOptions matchOptions)
- bool isValid(void)
- QRegularExpressionMatch match(QString subject, int offset, QRegularExpression::MatchType matchType, QRegularExpression::MatchOptions matchOptions)
- QStringList namedCaptureGroups(void)
- QString pattern(void)
- int patternErrorOffset(void)
- QRegularExpression::PatternOptions patternOptions(void)
- void setPattern(QString pattern)
- void setPatternOptions(QRegularExpression::PatternOptions options)
- void swap(QRegularExpression other)

83.251 QRegularExpressionMatch Class

C++ Reference : <http://doc.qt.io/qt-5/qregularexpressionmatch.html>

Parameters : void

- QString captured(int nth)
- QString captured_2(const QString name)
- int capturedEnd(int nth)
- int capturedEnd_2(const QString name)
- int capturedLength(int nth)
- int capturedLength_2(const QString name)
- QStringRef capturedRef(int nth)
- QStringRef capturedRef_2(const QString name)
- int capturedStart(int nth)
- int capturedStart_2(const QString name)
- QStringList capturedTexts(void)
- bool hasMatch(void)
- bool hasPartialMatch(void)
- bool isValid(void)
- int lastCapturedIndex(void)
- QRegularExpression::MatchOptions matchOptions(void)
- QRegularExpression::MatchType matchType(void)
- QRegularExpression regularExpression(void)
- void swap(QRegularExpressionMatch other)

83.252 QRegularExpressionMatchIterator Class

C++ Reference : <http://doc.qt.io/qt-5/qregularexpressionmatchiterator.html>

Parameters : void

- bool hasNext(void)
- bool isValid(void)
- QRegularExpression::MatchOptions matchOptions(void)
- QRegularExpression::MatchType matchType(void)
- QRegularExpressionMatch next(void) # In RingQt use : QRegularExpressionMatch nextitem(void)
- QRegularExpressionMatch peekNext(void)
- QRegularExpression regularExpression(void)
- void swap(QRegularExpressionMatchIterator other)

83.253 QRenderAspect Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qrenderspect.html>

Parameters : QObject *

83.254 QRenderPass Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qrenderpass.html>

Parameters : Qt3DCore::QNode *

- void addFilterKey(Qt3DRender::QFilterKey *filterKey)
- void addParameter(Qt3DRender::QParameter *parameter)
- void addRenderState(Qt3DRender::QRenderState *state)
- QVector<Qt3DRender::QFilterKey *> filterKeys(void)
- QVector<Qt3DRender::QParameter *> parameters(void)
- void removeFilterKey(Qt3DRender::QFilterKey *filterKey)
- void removeParameter(Qt3DRender::QParameter *parameter)
- void removeRenderState(Qt3DRender::QRenderState *state)
- QVector<Qt3DRender::QRenderState *> renderStates(void)
- Qt3DRender::QShaderProgram * shaderProgram(void)
- void setShaderProgram(Qt3DRender::QShaderProgram *shaderProgram)

83.255 QScatterSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qscatterseries.html>

Parameters : QObject *

Parent Class : QXYSeries

- QBrush brush(void)
- QScatterSeries::MarkerShape markerShape(void)
- qreal markerSize(void)
- void setBorderColor(QColor color)
- void setMarkerShape(QScatterSeries::MarkerShape shape)
- void setMarkerSize(qreal size)
- void setborderColorChangedEvent(const char *)
- void setcolorChangedEvent(const char *)
- void setmarkerShapeChangedEvent(const char *)
- void setmarkerSizeChangedEvent(const char *)
- const char *getborderColorChangedEvent(void)

- const char *getcolorChangedEvent(void)
- const char *getmarkerShapeChangedEvent(void)
- const char *getmarkerSizeChangedEvent(void)

83.256 QSceneLoader Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qsceneloader.html>

Parameters : Qt3DCore::QNode *

Parent Class : QComponent

- Qt3DCore::QComponent * component(QString entityName, Qt3DRender::QSceneLoader::ComponentType componentType)
- Qt3DCore::QEntity * entity(QString entityName)
- QStringList entityNames(void)
- QUrl source(void)
- Qt3DRender::QSceneLoader::Status status(void)
- void setSource(QUrl arg)

83.257 QScreen Class

C++ Reference : <http://doc.qt.io/qt-5/qscreen.html>

- int angleBetween(Qt::ScreenOrientation a, Qt::ScreenOrientation b)
- QRect availableGeometry(void)
- QSize availableSize(void)
- QRect availableVirtualGeometry(void)
- QSize availableVirtualSize(void)
- int depth(void)
- qreal devicePixelRatio(void)
- QRect geometry(void)
- QPixmap grabWindow(int window, int x, int y, int width, int height)
- QPixmap grabWindow_2(int window)
- QPlatformScreen * handle(void)
- bool isLandscape(Qt::ScreenOrientation o)
- bool isPortrait(Qt::ScreenOrientation o)
- qreal logicalDotsPerInch(void)
- qreal logicalDotsPerInchX(void)
- qreal logicalDotsPerInchY(void)
- QRect mapBetween(Qt::ScreenOrientation a, Qt::ScreenOrientation b, QRect rect)

- QString name(void)
- Qt::ScreenOrientation nativeOrientation(void)
- Qt::ScreenOrientation orientation(void)
- Qt::ScreenOrientations orientationUpdateMask(void)
- qreal physicalDotsPerInch(void)
- qreal physicalDotsPerInchX(void)
- qreal physicalDotsPerInchY(void)
- QSizeF physicalSize(void)
- Qt::ScreenOrientation primaryOrientation(void)
- qreal refreshRate(void)
- void setOrientationUpdateMask(Qt::ScreenOrientations mask)
- QSize size(void)
- QTransform transformBetween(Qt::ScreenOrientation a, Qt::ScreenOrientation b, QRect target)

83.258 QScrollArea Class

C++ Reference : <http://doc.qt.io/qt-5/qscrollarea.html>

Parameters : QWidget *parent

Parent Class : QAbstractScrollArea

- Qt::Alignment alignment(void)
- void ensureVisible(int x, int y, int xmargin , int ymargin)
- void ensureWidgetVisible(QWidget *childWidget, int xmargin , int ymargin)
- void setAlignment(Qt::Alignment)
- void setWidget(QWidget *widget)
- void setWidgetResizable(bool resizable)
- QWidget *takeWidget(void)
- QWidget *widget(void)
- bool widgetResizable(void)

83.259 QScrollBar Class

C++ Reference : <http://doc.qt.io/qt-5/qscrollbar.html>

Parameters : QWidget *parent

Parent Class : QAbstractSlider

83.260 QSerialPort Class

C++ Reference : <http://doc.qt.io/qt-5/qserialport.html>

Parameters : QObject *

Parent Class : QIODevice

- qint32 baudRate(QSerialPort::Directions directions)
- bool clear(QSerialPort::Directions directions)
- void clearError(void)
- QSerialPort::DataBits dataBits(void)
- QSerialPort::SerialPortError error(void)
- QSerialPort::FlowControl flowControl(void)
- bool flush(void)
- void *handle(void)
- bool isDataTerminalReady(void)
- bool isRequestToSend(void)
- QSerialPort::Parity parity(void)
- QSerialPort::PinoutSignals pinoutSignals(void)
- QString portName(void)
- qint64 readBufferSize(void)
- bool setBaudRate(qint32 baudRate, QSerialPort::Directions directions)
- bool setBreakEnabled(bool set)
- bool setDataBits(QSerialPort::DataBits dataBits)
- bool setDataTerminalReady(bool set)
- bool setFlowControl(QSerialPort::FlowControl flowControl)
- bool setParity(QSerialPort::Parity parity)
- void setPort(QSerialPortInfo serialPortInfo)
- void setPortName(QString name)
- void setReadBufferSize(qint64 size)
- bool setRequestToSend(bool set)
- bool setStopBits(QSerialPort::StopBits stopBits)
- QSerialPort::StopBits stopBits(void)
- void setbaudRateChangedEvent(const char *)
- void setbreakEnabledChangedEvent(const char *)
- void setdataBitsChangedEvent(const char *)
- void setdataTerminalReadyChangedEvent(const char *)
- void seterrorEvent(const char *)

- void setflowControlChangedEvent(const char *)
- void setparityChangedEvent(const char *)
- void setrequestToSendChangedEvent(const char *)
- void setstopBitsChangedEvent(const char *)
- const char *getbaudRateChangedEvent(void)
- const char *getbreakEnabledChangedEvent(void)
- const char *getdataBitsChangedEvent(void)
- const char *getdataTerminalReadyChangedEvent(void)
- const char *geterrorEvent(void)
- const char *getflowControlChangedEvent(void)
- const char *getparityChangedEvent(void)
- const char *getrequestToSendChangedEvent(void)
- const char *getstopBitsChangedEvent(void)

83.261 QSerialPortInfo Class

C++ Reference : <http://doc.qt.io/qt-5/qserialportinfo.html>

Parameters : void

- QString description(void)
- bool hasProductIdentifier(void)
- bool hasVendorIdentifier(void)
- bool isBusy(void)
- boolisNull(void)
- QString manufacturer(void)
- QString portName(void)
- quint16 productIdentifier(void)
- void swap(QSerialPortInfo other)
- QString systemLocation(void)
- quint16 vendorIdentifier(void)

83.262 QSize Class

C++ Reference : <http://doc.qt.io/qt-5/qsize.html>

Parameters : int width, int height

83.263 QSkyboxEntity Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qskyboxentity.html>

Parameters : Qt3DCore::QNode *

Parent Class : QEntity

- QString baseName(void)
- QString extension(void)
- bool isGammaCorrectEnabled(void)
- void setBaseName(QString baseName)
- void setExtension(QString extension)
- void setGammaCorrectEnabled(bool enabled)

83.264 QSlider Class

C++ Reference : <http://doc.qt.io/qt-5/qslider.html>

Parameters : QWidget *parent

Parent Class : QAbstractSlider

- void setTickInterval(int ti)
- void setTickPosition(QSlider::TickPosition position)
- int tickInterval(void)
- int tickPosition(void)
- QSize minimumSizeHint(void)
- QSize sizeHint(void)
- void setactionTriggeredEvent(const char *)
- void setrangeChangedEvent(const char *)
- void setsliderMovedEvent(const char *)
- void setsliderPressedEvent(const char *)
- void setsliderReleasedEvent(const char *)
- void setvalueChangedEvent(const char *)
- const char *getactionTriggeredEvent(void)
- const char *getrangeChangedEvent(void)
- const char *getsliderMovedEvent(void)

- const char *getsliderPressedEvent(void)
- const char *getsliderReleasedEvent(void)
- const char *getvalueChangedEvent(void)

83.265 QSphereMesh Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qspheremesh.html>

Parameters : Qt3DCore::QNode *

- bool generateTangents(void)
- float radius(void)
- int rings(void)
- int slices(void)
- void setGenerateTangents(bool gen)
- void setRadius(float radius)
- void setRings(int rings)
- void setSlices(int slices)

83.266 QSpinBox Class

C++ Reference : <http://doc.qt.io/qt-5/qspinbox.html>

Parameters : QWidget *parent

Parent Class : QWidget

- QString cleanText(void)
- int displayIntegerBase(void)
- int maximum(void)
- int minimum(void)
- QString prefix(void)
- void setDisplayIntegerBase(int base)
- void setMaximum(int max)
- void setMinimum(int min)
- void setPrefix(QString)
- void setRange(int minimum, int maximum)
- void setSingleStep(int val)
- void setSuffix(QString)
- int singleStep(void)
- QString suffix(void)
- int value(void)

- void setValue(int val)
- void setvalueChangedEvent(const char *)
- const char *getvalueChangedEvent(void)

83.267 QSplashScreen Class

C++ Reference : <http://doc.qt.io/qt-5/qsplashscreen.html>

Parameters : QPixmap

Parent Class : QWidget

- void finish(QWidget *mainWin)
- QPixmap pixmap(void)
- void repaint(void)
- void setPixmap(QPixmap pixmap)
- void clearMessage(void)
- void showMessage(QString message, int alignment ,QColor color)

83.268 QSplineSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qsplineseries.html>

Parameters : QObject *

Parent Class : QLineSeries

- QAbstractSeries::SeriesType type(void)

83.269 QSplitter Class

C++ Reference : <http://doc.qt.io/qt-5/qsplitter.html>

Parameters : QWidget *parent

Parent Class : QFrame

- void addWidget(QWidget *widget)
- bool childrenCollapsible(void)
- int count(void)
- void getRange(int index, int *min, int *max)
- QSplitterHandle * handle(int index)
- int handleWidth(void)
- int indexOf(QWidget *widget)
- void insertWidget(int index, QWidget *widget)
- bool isCollapsible(int index)

- bool opaqueResize(void)
- Qt::Orientation orientation(void)
- void refresh(void)
- bool restoreState(QByteArray state)
- QByteArray saveState(void)
- void setChildrenCollapsible(bool)
- void setCollapsible(int index, bool collapse)
- void setHandleWidth(int)
- void setOpaqueResize(bool opaque)
- void setOrientation(Qt::Orientation)
- void setSizes(QList<int> list)
- void setStretchFactor(int index, int stretch)
- QList<int> sizes(void)
- QWidget * widget(int index)

83.270 QSqlDatabase Class

C++ Reference : <http://doc.qt.io/qt-5/qsqldatabase.html>

Parameters : void

- void close(void)
- bool commit(void)
- QString connectOptions(void)
- QString connectionName(void)
- QString databaseName(void)
- QSqlDriver *driver(void)
- QString driverName(void)
- QSqlQuery exec(QString)
- QString hostName(void)
- bool isOpen(void)
- bool isOpenError(void)
- bool isValid(void)
- QSqlError lastError(void)
- QSql::NumericalPrecisionPolicy numericalPrecisionPolicy(void)
- bool open(void)
- QString password(void)
- int port(void)

- QSqlIndex primaryIndex(QString)
- QSqlRecord record(QString)
- bool rollback(void)
- void setConnectOptions(QString)
- void setDatabaseName(QString)
- void setHostName(QString)
- void setNumericalPrecisionPolicy(QSql::NumericalPrecisionPolicy precisionPolicy)
- void setPassword(QString)
- void setPort(int port)
- void setUserName(QString)
- QStringList tables(QSql::TableType type)
- bool transaction(void)
- QString userName(void)
- QSqlDatabase addDatabase(QString)
- QSqlDatabase cloneDatabase(QSqlDatabase, QString)
- QStringList connectionNames(void)
- bool contains(QString)
- QSqlDatabase database(QString , bool)
- QStringList drivers(void)
- bool isDriverAvailable(QString)
- void registerSqlDriver(QString, QSqlDriverCreatorBase *)
- void removeDatabase(QString)

83.271 QSqlDriver Class

C++ Reference : <http://doc.qt.io/qt-5/qsqldriver.html>

Parameters : void

- QSqlError lastError(void)
- QSql::NumericalPrecisionPolicy numericalPrecisionPolicy(void)
- void setNumericalPrecisionPolicy(QSql::NumericalPrecisionPolicy)

83.272 QSqlDriverCreatorBase Class

C++ Reference : <http://doc.qt.io/qt-5/qsqldrivercreatorbase.html>

Parameters : void

83.273 QSqlError Class

C++ Reference : <http://doc.qt.io/qt-5/qsqlerror.html>

Parameters : QString, QString, QSqlError::ErrorType

- QString databaseText(void)
- QString driverText(void)
- bool isValid(void)
- int number(void)
- void setDatabaseText(QString)
- void setDriverText(QString)
- void setNumber(int number)
- void setType(QSqlError::ErrorType type)
- QString text(void)
- QSqlError::ErrorType type(void)

83.274 QSqlField Class

C++ Reference : <http://doc.qt.io/qt-5/qsqlfield.html>

Parameters : QString,QVariant::Type

- void clear(void)
- QVariant defaultValue(void)
- bool isAutoValue(void)
- bool isGenerated(void)
- boolisNull(void)
- bool isReadOnly(void)
- bool isValid(void)
- int length(void)
- QString name(void)
- int precision(void)
- RequiredStatus requiredStatus(void)
- void setAutoValue(bool autoVal)
- void setDefaultValue(QVariant)

- void setGenerated(bool gen)
- void setLength(int fieldLength)
- void setName(QString)
- void setPrecision(int precision)
- void setReadOnly(bool readOnly)
- void setRequired(bool required)
- void setRequiredStatus(QSqlField::RequiredStatus required)
- void setType(QVariant::Type type)
- void setValue(QVariant)
- QVariant::Type type(void)
- QVariant value(void)

83.275 QSqlIndex Class

C++ Reference : <http://doc.qt.io/qt-5/qsqlindex.html>

Parameters : QString, QString

Parent Class : QSqlRecord

- void append(QSqlField, bool)
- QString cursorName(void)
- bool isDescending(int i)
- QString name(void)
- void setCursorName(QString)
- void setDescending(int i, bool desc)
- void setName(QString)

83.276 QSqlQuery Class

C++ Reference : <http://doc.qt.io/qt-5/qsqlquery.html>

Parameters : void

- void addBindValue(QVariant, QSql::ParamType paramType)
- int at(void)
- void bindValue(QString, QVariant, QSql::ParamType paramType)
- QVariant boundValue(QString)
- void clear(void)
- QSqlDriver * driver(void)
- bool exec(QString)
- bool exec_2(void)

- bool execBatch(QSqlQuery::BatchExecutionMode mode)
- QString executedQuery(void)
- void finish(void)
- bool first(void)
- bool isActive(void)
- bool isForwardOnly(void)
- boolisNull(int field)
- bool isSelect(void)
- bool isValid(void)
- bool last(void)
- QSqlError lastError(void)
- QVariant lastInsertId(void)
- QString lastQuery(void)
- bool next(void) # In RingQt use : bool movenext(void)
- bool nextResult(void)
- int numRowsAffected(void)
- QSql::NumericalPrecisionPolicy numericalPrecisionPolicy(void)
- bool prepare(QString)
- bool previous(void)
- QSqlRecord record(void)
- QSqlResult *result(void)
- bool seek(int index, bool relative)
- void setForwardOnly(bool forward)
- void setNumericalPrecisionPolicy(QSql::NumericalPrecisionPolicy precisionPolicy)
- int size(void)
- QVariant value(int index)

83.277 QSqlRecord Class

C++ Reference : <http://doc.qt.io/qt-5/qsqlrecord.html>

Parameters : void

- void append(QSqlField)
- void clear(void)
- void clearValues(void)
- bool contains(QString)
- int count(void)

- QSqlField field(int index)
- QString fieldName(int index)
- int indexOf(QString)
- void insert(int pos, QSqlField)
- bool isEmpty(void)
- bool isGenerated(QString)
- boolisNull(QString)
- void remove(int pos)
- void replace(int pos, QSqlField)
- void setGenerated(QString, bool generated)
- void setNull(int index)
- void setValue(int index, QVariant)
- QVariant value(int index)

83.278 QStackedBarSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qstackedbarseries.html>

Parameters : QObject *

Parent Class : QAbstractBarSeries

- QAbstractSeries::SeriesType type(void)

83.279 QStackedWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qstackedwidget.html>

Parameters : QWidget *

Parent Class : QFrame

- int addWidget(QWidget *widget)
- int count(void)
- int currentIndex(void)
- QWidget * currentWidget(void)
- int indexOf(QWidget *widget)
- int insertWidget(int index, QWidget *widget)
- void removeWidget(QWidget *widget)
- QWidget * widget(int index)
- void setCurrentIndex(int index)
- void setCurrentWidget(QWidget *widget)
- void setcurrentChangedEvent(const char *)

- void setwidgetRemovedEvent(const char *)
- const char *getcurrentChangedEvent(void)
- const char *getwidgetRemovedEvent(void)

83.280 QStandardPaths Class

C++ Reference : <http://doc.qt.io/qt-5/qstandardpaths.html>

Parameters : void

- QString displayName(QStandardPaths::StandardLocation type)
- QString findExecutable(QString executableName, QStringList paths))
- QString locate(QStandardPaths::StandardLocation type, QString fileName, QStandardPaths::LocateOptions options)
- QStringList locateAll(QStandardPaths::StandardLocation type, QString fileName, QStandardPaths::LocateOptions options)
- void setTestModeEnabled(bool testMode)
- QStringList standardLocations(QStandardPaths::StandardLocation type)
- QString writableLocation(QStandardPaths::StandardLocation type)

83.281 QStatusBar Class

C++ Reference : <http://doc.qt.io/qt-5/qstatusbar.html>

Parameters : QWidget *

Parent Class : QWidget

- void addPermanentWidget(QWidget * widget, int stretch)
- void addWidget(QWidget * widget, int stretch)
- QString currentMessage(void)
- int insertPermanentWidget(int index, QWidget * widget, int stretch)
- int insertWidget(int index, QWidget * widget, int stretch)
- bool isSizeGripEnabled(void)
- void removeWidget(QWidget *widget)
- void setSizeGripEnabled(bool)
- void clearMessage(void)
- void showMessage(QString , int timeout)

83.282 QString2 Class

Parameters : void

- `QString append(QString str)`
- `QByteArray toUtf8(void)`
- `QByteArray toLatin1(void)`
- `QByteArray toLocal8Bit(void)`
- `QStringList split(QString sep, QString::SplitBehavior behavior , Qt::CaseSensitivity cs)`
- `QStringList split_2(QChar sep, QString::SplitBehavior behavior , Qt::CaseSensitivity cs)`
- `QStringList split_3(QRegExp rx, QString::SplitBehavior behavior)`
- `QStringList split_4(QRegularExpression re, QString::SplitBehavior behavior)`
- `QChar * unicode(void)`
- `QString number(ulong n, int base)`
- `int count(void)`
- `QString left(int n)`
- `QString mid(int position, int n)`
- `QString right(int n)`
- `int compare(QString other, Qt::CaseSensitivity cs)`
- `bool contains(QString str, Qt::CaseSensitivity cs)`
- `int indexOf(QString str,int from,Qt::CaseSensitivity cs)`
- `QString insert(int position, QString str)`
- `bool isRightToLeft(void)`
- `QString repeated(int times)`
- `QString replace(int position, int n, QString after)`
- `bool startsWith(QString s, Qt::CaseSensitivity cs)`
- `bool endsWith(QString s, Qt::CaseSensitivity cs)`
- `QString toHtmlEscaped(void)`
- `void clear(void)`
- `boolisNull(void)`
- `void resize(int size)`
- `QString fill(QChar ch, int size)`

83.283 QStringList Class

C++ Reference : <http://doc.qt.io/qt-5/qstringlist.html>

Parameters : void

- QString join(QString)
- void sort(void)
- int removeDuplicates(void)
- QStringList filter(QString, Qt::CaseSensitivity)
- QStringList replaceInStrings(QString,QString, Qt::CaseSensitivity)
- void append(QString)
- QString at(int)
- QString back(void)
- void clear(void)
- bool contains(QString)
- int count(void)
- bool empty(void)
- bool endsWith(QString)
- QString first(void)
- QString front(void)
- int indexOf(QString, int)
- void insert(int, QString)
- bool isEmpty(void)
- QString last(void)
- int lastIndexOf(QString,int)
- int length(void)
- void move(int,int)
- void pop_back(void)
- void pop_front(void)
- void prepend(QString)
- void push_back(QString)
- void push_front(QString)
- int removeAll(QString)
- void removeAt(int)
- void removeFirst(void)
- void removeLast(void)
- bool removeOne(QString)

- void replace(int,QString)
- void reserve(int)
- int size(void)
- bool startsWith(QString)
- void swap(int,int)
- QString takeAt(int)
- QString takeFirst(void)
- QString takeLast(void)
- QString value(int)

83.284 QStringRef Class

C++ Reference : <http://doc.qt.io/qt-5/qstringref.html>

Parameters : void

- QStringRef appendTo(QString * string)
- QChar at(int position)
- void clear(void)
- int compare_3(QLatin1String other, Qt::CaseSensitivity cs)
- QChar * constData(void)
- bool contains(QString str, Qt::CaseSensitivity cs)
- bool contains_2(QChar ch, Qt::CaseSensitivity cs)
- bool contains_3(QStringRef str, Qt::CaseSensitivity cs)
- bool contains_4(QLatin1String str, Qt::CaseSensitivity cs)
- int count(void)
- int count_2(QString str, Qt::CaseSensitivity cs)
- int count_3(QChar ch, Qt::CaseSensitivity cs)
- int count_4(QStringRef str, Qt::CaseSensitivity cs)
- QChar * data(void)
- bool endsWith(QString str, Qt::CaseSensitivity cs)
- bool endsWith_2(QChar ch, Qt::CaseSensitivity cs)
- bool endsWith_3(QLatin1String str, Qt::CaseSensitivity cs)
- bool endsWith_4(QStringRef str, Qt::CaseSensitivity cs)
- int indexOf(QString str, int from, Qt::CaseSensitivity cs)
- int indexOf_2(QLatin1String str, int from, Qt::CaseSensitivity cs)
- int indexOf_3(QChar ch, int from, Qt::CaseSensitivity cs)
- int indexOf_4(QStringRef str, int from, Qt::CaseSensitivity cs)

- bool isEmpty(void)
- boolisNull(void)
- int lastIndexOf(QString str, int from, Qt::CaseSensitivity cs)
- int lastIndexOf_2(QChar ch, int from, Qt::CaseSensitivity cs)
- int lastIndexOf_3(QLatin1String str, int from, Qt::CaseSensitivity cs)
- int lastIndexOf_4(QStringRef str, int from, Qt::CaseSensitivity cs)
- int length(void)
- int localeAwareCompare(QString other)
- int localeAwareCompare_2(QStringRef other)
- int position(void)
- int size(void)
- bool startsWith(QString str, Qt::CaseSensitivity cs)
- bool startsWith_2(QLatin1String str, Qt::CaseSensitivity cs)
- bool startsWith_3(QStringRef str, Qt::CaseSensitivity cs)
- bool startsWith_4(QChar ch, Qt::CaseSensitivity cs)
- QString * string(void)
- QByteArray toLatin1(void)
- QByteArray toLocal8Bit(void)
- QString toString(void)
- QVector<uint> toUcs4(void)
- QByteArray toUtf8(void)
- QChar * unicode(void)
- int compare_4(QStringRef s1, QString s2, Qt::CaseSensitivity cs)
- int compare_5(QStringRef s1, QStringRef s2, Qt::CaseSensitivity cs)
- int compare_6(QStringRef s1, QLatin1String s2, Qt::CaseSensitivity cs)
- int localeAwareCompare_3(QStringRef s1, QString s2)
- int localeAwareCompare_4(QStringRef s1, QStringRef s2)

83.285 QSurfaceFormat Class

C++ Reference : <http://doc.qt.io/qt-5/qsurfaceformat.html>

Parameters : void

- int alphaBufferSize(void)
- int blueBufferSize(void)
- int greenBufferSize(void)
- bool hasAlpha(void)

- int majorVersion(void)
- int minorVersion(void)
- QSurfaceFormat::FormatOptions options(void)
- QSurfaceFormat::OpenGLContextProfile profile(void)
- int redBufferSize(void)
- QSurfaceFormat::RenderableType renderableType(void)
- int samples(void)
- void setAlphaBufferSize(int size)
- void setBlueBufferSize(int size)
- void setGreenBufferSize(int size)
- void setMajorVersion(int major)
- void setMinorVersion(int minor)
- void setOption(QSurfaceFormat::FormatOption option, bool on)
- void setOptions(QSurfaceFormat::FormatOptions options)
- void setProfile(QSurfaceFormat::OpenGLContextProfile profile)
- void setRedBufferSize(int size)
- void setRenderableType(QSurfaceFormat::RenderableType type)
- void setSamples(int numSamples)
- void setStencilBufferSize(int size)
- void setStereo(bool enable)
- void setSwapBehavior(QSurfaceFormat::SwapBehavior behavior)
- void setSwapInterval(int interval)
- void setVersion(int major, int minor)
- int stencilBufferSize(void)
- bool stereo(void)
- QSurfaceFormat::SwapBehavior swapBehavior(void)
- int swapInterval(void)
- bool testOption(QSurfaceFormat::FormatOption option)
- QSurfaceFormat defaultFormat(void)
- void setDefaultFormat(QSurfaceFormat format)

83.286 QSystemTrayIcon Class

C++ Reference : <http://doc.qt.io/qt-5/qsystemtrayicon.html>

Parameters : void

- QMenu *contextMenu(void)
- QRect geometry(void)
- QIcon icon(void)
- bool isVisible(void)
- void setContextMenu(QMenu *menu)
- void setIcon(QIcon)
- void setToolTip(QString)
- QString toolTip(void)
- void hide(void)
- void setVisible(bool visible)
- void show(void)
- void showMessage(QString, QString, QSystemTrayIcon::MessageIcon, int millisecondsTimeoutHint)
- bool isSystemTrayAvailable(void)
- bool supportsMessages(void)

83.287 QTabBar Class

C++ Reference : <http://doc.qt.io/qt-5/qtabbar.html>

Parameters : QWidget *

Parent Class : QWidget

- int addTab(QString text)
- int addTab_2(QIcon icon, QString text)
- int count(void)
- int currentIndex(void)
- bool documentMode(void)
- bool drawBase(void)
- Qt::TextElideMode elideMode(void)
- bool expanding(void)
- QSize iconSize(void)
- int insertTab(int index, QString text)
- int insertTab_2(int index, QIcon icon, QString text)
- bool isMovable(void)
- bool isTabEnabled(int index)

- void moveTab(int from, int to)
- void removeTab(int index)
- QTabBar::SelectionBehavior selectionBehaviorOnRemove(void)
- void setDocumentMode(bool set)
- void setDrawBase(bool drawTheBase)
- void setElideMode(Qt::TextElideMode)
- void setExpanding(bool enabled)
- void setIconSize(QSize size)
- void setMovable(bool movable)
- void setSelectionBehaviorOnRemove(QTabBar::SelectionBehavior behavior)
- void setShape(QTabBar::Shape shape)
- void setTabButton(int index, QTabBar::ButtonPosition position, QWidget * widget)
- void setTabData(int index, QVariant data)
- void setTabEnabled(int index, bool enabled)
- void setTabIcon(int index, QIcon icon)
- void setTabText(int index, QString text)
- void setTabTextColor(int index, QColor color)
- void setTabToolTip(int index, QString tip)
- void setTabWhatsThis(int index, QString text)
- void setTabsClosable(bool closable)
- void setUsesScrollButtons(bool useButtons)
- QTabBar::Shape shape(void)
- int tabAt(QPoint position)
- QWidget * tabButton(int index, QTabBar::ButtonPosition position)
- QVariant tabData(int index)
- QIcon tabIcon(int index)
- QRect tabRect(int index)
- QString tabText(int index)
- QColor tabTextColor(int index)
- QString tabToolTip(int index)
- QString tabWhatsThis(int index)
- bool tabsClosable(void)
- bool usesScrollButtons(void)
- void setCurrentIndex(int index)
- void setcurrentChangedEvent(const char *)
- void settabCloseRequestedEvent(const char *)

- void settabMovedEvent(const char *)
- const char *getcurrentChangedEvent(void)
- const char *gettabCloseRequestedEvent(void)
- const char *gettabMovedEvent(void)

83.288 QTabWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qtabwidget.html>

Parameters : QWidget *parent

Parent Class : QWidget

- int addTab(QWidget *page, QString)
- void clear(void)
- QWidget *cornerWidget(Qt::Corner corner)
- int count(void)
- int currentIndex(void)
- QWidget *currentWidget(void)
- bool documentMode(void)
- int elideMode(void)
- QSize iconSize(void)
- int indexOf(QWidget *w)
- int insertTab(int index, QWidget *page,QString)
- bool isMovable(void)
- bool isTabEnabled(int index)
- void removeTab(int index)
- void setCornerWidget(QWidget *widget, Qt::Corner corner)
- void setDocumentMode(bool set)
- void setElideMode(Qt::TextElideMode)
- void setIconSize(QSize)
- void setMovable(bool movable)
- void setTabEnabled(int index, bool enable)
- void setTabIcon(int index, QIcon)
- void setTabText(int index,QString)
- void setTabToolTip(int index, QString)
- void setTabWhatsThis(int index, QString)
- void setTabsClosable(bool closeable)
- void setUsesScrollButtons(bool useButtons)

- QIcon tabIcon(int index)
- QString tabText(int index)
- QString tabToolTip(int index)
- QString tabWhatsThis(int index)
- bool tabsClosable(void)
- bool usesScrollButtons(void)
- QWidget *widget(int index)
- int heightForWidth(int width)
- QSize minimumSizeHint(void)
- QSize sizeHint(void)
- void setCurrentIndex(int index)
- void setCurrentWidget(QWidget *widget)
- void setcurrentChangedEvent(const char *)
- void settabCloseRequestedEvent(const char *)
- const char *getcurrentChangedEvent(void)
- const char *gettabCloseRequestedEvent(void)
- void geteventparameters(void)

83.289 QTableView Class

C++ Reference : <http://doc.qt.io/qt-5/qtableview.html>

Parameters : QWidget *parent

Parent Class : QAbstractItemView

- void clearSpans(void)
- int columnAt(int x)
- int columnSpan(int row, int column)
- int columnViewportPosition(int column)
- int columnWidth(int column)
- Qt::PenStyle gridStyle(void)
- QHeaderView *horizontalHeader(void)
- bool isColumnHidden(int column)
- bool isCornerButtonEnabled(void)
- bool isRowHidden(int row)
- bool isSortingEnabled(void)
- int rowAt(int y)
- int rowHeight(int row)

- int rowSpan(int row, int column)
- int rowViewportPosition(int row)
- void setColumnHidden(int column, bool hide)
- void setColumnWidth(int column, int width)
- void setCornerButtonEnabled(bool enable)
- void setGridStyle(Qt::PenStyle style)
- void setHorizontalHeader(QHeaderView *header)
- void setRowHeight(int row, int height)
- void setRowHidden(int row, bool hide)
- void setSortingEnabled(bool enable)
- void setSpan(int row, int column, int rowSpanCount, int columnSpanCount)
- void setVerticalHeader(QHeaderView *header)
- void setWordWrap(bool on)
- bool showGrid(void)
- void sortByColumn(int column, Qt::SortOrder order)
- QHeaderView *verticalHeader(void)
- bool wordWrap(void)
- void hideColumn(int column)
- void hideRow(int row)
- void resizeColumnToContents(int column)
- void resizeColumnsToContents(void)
- void resizeRowToContents(int row)
- void resizeRowsToContents(void)
- void selectColumn(int column)
- void selectRow(int row)
- void setShowGrid(bool show)
- void showColumn(int column)
- void showRow(int row)

83.290 QTableWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qtablewidget.html>

Parameters : QWidget *parent

Parent Class : QTableView

- QWidget *cellWidget(int row, int column)
- void closePersistentEditor(QTableWidgetItem *item)

- int column(QTableWidgetItem *item)
- int columnCount(void)
- int currentColumn(void)
- QTableWidgetItem * currentItem(void)
- int currentRow(void)
- void editItem(QTableWidgetItem *item)
- QTableWidgetItem * horizontalHeaderItem(int column)
- QTableWidgetItem * item(int row, int column)
- QTableWidgetItem * itemAt(int ax, int ay)
- QTableWidgetItem * itemPrototype(void)
- void openPersistentEditor(QTableWidgetItem *item)
- void removeCellWidget(int row, int column)
- int row(const QTableWidgetItem *item)
- int rowCount(void)
- QList<QTableWidgetItem *> selectedItems(void)
- QList<QTableWidgetSelectionRange> selectedRanges(void)
- void setCellWidget(int row, int column, QWidget *widget)
- void setColumnCount(int columns)
- void setCurrentCell(int row, int column)
- void setCurrentItem(QTableWidgetItem * item)
- void setHorizontalHeaderItem(int column, QTableWidgetItem *item)
- void setHorizontalHeaderLabels(QStringList)
- void setItem(int row, int column, QTableWidgetItem *item)
- void setItemPrototype(QTableWidgetItem *item)
- void setRowCount(int rows)
- void setVerticalHeaderItem(int row, QTableWidgetItem *item)
- void sortItems(int column, Qt::SortOrder order)
- QTableWidgetItem * takeHorizontalHeaderItem(int column)
- QTableWidgetItem * takeItem(int row, int column)
- QTableWidgetItem * takeVerticalHeaderItem(int row)
- QTableWidgetItem * verticalHeaderItem(int row)
- int visualColumn(int logicalColumn)
- QRect visualItemRect(QTableWidgetItem *)
- int visualRow(int logicalRow)
- void clear(void)
- void clearContents(void)

- void insertColumn(int column)
- void insertRow(int row)
- void removeColumn(int column)
- void removeRow(int row)
- void scrollToItem(QTableWidgetItem *item, QAbstractItemView::ScrollHint hint)
- void setcellActivatedEvent(const char *)
- void setcellChangedEvent(const char *)
- void setcellClickedEvent(const char *)
- void setcellDoubleClickedEvent(const char *)
- void setcellEnteredEvent(const char *)
- void setcellPressedEvent(const char *)
- void setcurrentCellChangedEvent(const char *)
- void setcurrentItemChangedEvent(const char *)
- void setitemActivatedEvent(const char *)
- void setitemChangedEvent(const char *)
- void setitemClickedEvent(const char *)
- void setitemDoubleClickedEvent(const char *)
- void setitemEnteredEvent(const char *)
- void setitemPressedEvent(const char *)
- void setitemSelectionChangedEvent(const char *)
- const char *getcellActivatedEvent(void)
- const char *getcellChangedEvent(void)
- const char *getcellClickedEvent(void)
- const char *getcellDoubleClickedEvent(void)
- const char *getcellEnteredEvent(void)
- const char *getcellPressedEvent(void)
- const char *getcurrentCellChangedEvent(void)
- const char *getcurrentItemChangedEvent(void)
- const char *getitemActivatedEvent(void)
- const char *getitemChangedEvent(void)
- const char *getitemClickedEvent(void)
- const char *getitemDoubleClickedEvent(void)
- const char *getitemEnteredEvent(void)
- const char *getitemPressedEvent(void)
- const char *getitemSelectionChangedEvent(void)

83.291 QTableWidgetItem Class

C++ Reference : <http://doc.qt.io/qt-5/qtablewidgetitem.html>

Parameters : QString

- QBrush background(void)
- int checkState(void)
- QTableWidgetItem *clone(void)
- int column(void)
- QVariant data(int role)
- int flags(void)
- QFont font(void)
- QBrush foreground(void)
- QIcon icon(void)
- bool isSelected(void)
- void read(QDataStream)
- int row(void)
- void setBackground(QBrush)
- void setCheckState(Qt::CheckState state)
- void setData(int role, QVariant)
- void setFlags(Qt::ItemFlag flags)
- void setFont(QFont)
- void setForeground(QBrush)
- void setIcon(QIcon)
- void setSelected(bool select)
- void setSizeHint(QSize)
- void setStatusTip(QString)
- void setText(QString)
- void setTextColor(int alignment)
- void setToolTip(QString)
- void setWhatsThis(QString)
- QSize sizeHint(void)
- QString statusTip(void)
- QTableWidget *tableWidget(void)
- QString text(void)
- int textAlignment(void)
- QString toolTip(void)

- int type(void)
- QString whatsThis(void)
- void write(QDataStream)

83.292 QTcpServer Class

C++ Reference : <http://doc.qt.io/qt-5/qtcpserver.html>

Parameters : QWidget *

- void close(void)
- QString errorString(void)
- bool hasPendingConnections(void)
- bool isListening(void)
- bool listen(QHostAddress, int port)
- int maxPendingConnections(void)
- QTcpSocket *nextPendingConnection(void)
- void pauseAccepting(void)
- QNetworkProxy proxy(void)
- void resumeAccepting(void)
- QHostAddress serverAddress(void)
- int serverError(void)
- int serverPort(void)
- void setMaxPendingConnections(int numConnections)
- void setProxy(QNetworkProxy)
- bool setSocketDescriptor(qintptr socketDescriptor)
- int *socketDescriptor(void)
- bool waitForNewConnection(int msec, bool *timedOut)
- void setacceptErrorEvent(const char *)
- void setnewConnectionEvent(const char *)
- const char *getacceptErrorEvent(void)
- const char *getnewConnectionEvent(void)

83.293 QTcpSocket Class

C++ Reference : <http://doc.qt.io/qt-5/qtcpsocket.html>

Parameters : QObject *

Parent Class : QAbstractSocket

- void setconnectedEvent(const char *)
- void setdisconnectedEvent(const char *)
- void seterrorEvent(const char *)
- void sethostFoundEvent(const char *)
- void setproxyAuthenticationRequiredEvent(const char *)
- void setstateChangedEvent(const char *)
- void setaboutToCloseEvent(const char *)
- void setbytesWrittenEvent(const char *)
- void setreadChannelFinishedEvent(const char *)
- void setreadyReadEvent(const char *)
- const char *getconnectedEvent(void)
- const char *getdisconnectedEvent(void)
- const char *geterrorEvent(void)
- const char *gethostFoundEvent(void)
- const char *getproxyAuthenticationRequiredEvent(void)
- const char *getstateChangedEvent(void)
- const char *getaboutToCloseEvent(void)
- const char *getbytesWrittenEvent(void)
- const char *getreadChannelFinishedEvent(void)
- const char *getreadyReadEvent(void)

83.294 QTechnique Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qtechnique.html>

Parameters : Qt3DCore::QNode *

- void addFilterKey(Qt3DRender::QFilterKey *filterKey)
- void addParameter(Qt3DRender::QParameter *parameter)
- void addRenderPass(Qt3DRender::QRenderPass *pass)
- QVector<Qt3DRender::QFilterKey *> filterKeys(void)
- Qt3DRender::QGraphicsApiFilter * graphicsApiFilter(void)
- QVector<Qt3DRender::QParameter *> parameters(void)
- void removeFilterKey(Qt3DRender::QFilterKey *filterKey)

- void removeParameter(Qt3DRender::QParameter *parameter)
- void removeRenderPass(Qt3DRender::QRenderPass *pass)
- QVector<Qt3DRender::QRenderPass *> renderPasses(void)

83.295 QTest Class

C++ Reference : <http://doc.qt.io/qt-5/qtest.html>

- void qsleep(int)

83.296 QText2DEntity Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qtext2dentity.html>

Parameters : Qt3DCore::QNode *

Parent Class : QEntity

- QColor color(void)
- QFont font(void)
- float height(void)
- void setColor(QColor color)
- void setFont(QFont font)
- void setHeight(float height)
- void setText(QString text)
- void setWidth(float width)
- QString text(void)
- float width(void)

83.297 QTextBlock Class

C++ Reference : <http://doc.qt.io/qt-5/qtextblock.html>

Parameters : void

- int blockFormatIndex(void)
- int blockNumber(void)
- QTextCharFormat charFormat(void)
- int charFormatIndex(void)
- void clearLayout(void)
- bool contains(int position)
- QTextDocument *document(void)
- bool isValid(void)

- bool isVisible(void)
- QTextLayout * layout(void)
- int length(void)
- int lineCount(void)
- QTextBlock next(void) # In RingQt use : QTextBlock nextblock(void)
- int position(void)
- QTextBlock previous(void)
- int revision(void)
- void setLineCount(int count)
- void setRevision(int rev)
- void setUserData(QTextBlockUserData * data)
- void setUserState(int state)
- void setVisible(bool visible)
- QString text(void)
- int textDirection(void)
- QTextList * textList(void)
- QTextBlockUserData * userData(void)
- int userState(void)

83.298 QTextBrowser Class

C++ Reference : <http://doc.qt.io/qt-5/qtextbrowser.html>

Parameters : QWidget *

Parent Class : QTextEdit

- int backwardHistoryCount(void)
- void clearHistory(void)
- int forwardHistoryCount(void)
- QString historyTitle(int i)
- QUrl historyUrl(int i)
- bool isBackwardAvailable(void)
- bool isForwardAvailable(void)
- bool openExternalLinks(void)
- bool openLinks(void)
- QStringList searchPaths(void)
- void setOpenExternalLinks(bool open)
- void setOpenLinks(bool open)

- void setSearchPaths(QStringList paths)
- QUrl source(void)
- void setanchorClickedEvent(const char *)
- void setbackwardAvailableEvent(const char *)
- void setforwardAvailableEvent(const char *)
- void sethighlightedEvent(const char *)
- void sethistoryChangedEvent(const char *)
- void setsourceChangedEvent(const char *)
- const char *getanchorClickedEvent(void)
- const char *getbackwardAvailableEvent(void)
- const char *getforwardAvailableEvent(void)
- const char *gethighlightedEvent(void)
- const char *gethistoryChangedEvent(void)
- const char *getsourceChangedEvent(void)

83.299 QTextCharFormat Class

C++ Reference : <http://doc.qt.io/qt-5/qtextcharformat.html>

Parameters : void

- QString anchorHref(void)
- QStringList anchorNames(void)
- QFont font(void)
- QFont::Capitalization fontCapitalization(void)
- QString fontFamily(void)
- bool fontFixedPitch(void)
- QFont::HintingPreference fontHintingPreference(void)
- bool fontItalic(void)
- bool fontKerning(void)
- qreal fontLetterSpacing(void)
- QFont::SpacingType fontLetterSpacingType(void)
- bool fontOverline(void)
- qreal fontPointSize(void)
- int fontStretch(void)
- bool fontStrikeOut(void)
- QFont::StyleHint fontStyleHint(void)
- QFont::StyleStrategy fontStyleStrategy(void)

- bool fontUnderline(void)
- int fontWeight(void)
- qreal fontWordSpacing(void)
- bool isAnchor(void)
- bool isValid(void)
- void setAnchor(bool anchor)
- void setAnchorHref(QString value)
- void setAnchorNames(QStringList names)
- void setFontCapitalization(QFont::Capitalization capitalization)
- void setFontFamily(QString family)
- void setFontFixedPitch(bool fixedPitch)
- void setFontHintingPreference(QFont::HintingPreference hintingPreference)
- void setFontItalic(bool italic)
- void setFontKerning(bool enable)
- void setFontLetterSpacing(qreal spacing)
- void setFontLetterSpacingType(QFont::SpacingType letterSpacingType)
- void setFontOverline(bool overline)
- void setFontPointSize(qreal size)
- void setFontStretch(int factor)
- void setFontStrikeOut(bool strikeOut)
- void setFontStyleHint(QFont::StyleHint hint, QFont::StyleStrategy strategy)
- void setFontStyleStrategy(QFont::StyleStrategy strategy)
- void setFontUnderline(bool underline)
- void setFontWeight(int weight)
- void setFontWordSpacing(qreal spacing)
- void setTextOutline(QPen pen)
- void setToolTip(QString text)
- void setUnderlineColor(QColor color)
- void setUnderlineStyle(QTextCharFormat::UnderlineStyle style)
- void setVerticalAlignment(QTextCharFormat::VerticalAlignment alignment)
- QPen textOutline(void)
- QString toolTip(void)
- QColor underlineColor(void)
- QTextCharFormat::UnderlineStyle underlineStyle(void)
- QTextCharFormat::VerticalAlignment verticalAlignment(void)

83.300 QTextCodec Class

C++ Reference : <http://doc.qt.io/qt-5/qtextcodec.html>

- `QTextCodec *codecForName(const char *name)`
- `void setCodecForLocale(QTextCodec *c)`

83.301 QTextCursor Class

C++ Reference : <http://doc.qt.io/qt-5/qtextcursor.html>

Parameters : void

- `int anchor(void)`
- `bool atBlockEnd(void)`
- `bool atBlockStart(void)`
- `bool atEnd(void)`
- `bool atStart(void)`
- `void beginEditBlock(void)`
- `QTextBlock block(void)`
- `QTextCharFormat blockCharFormat(void)`
- `QTextBlockFormat blockFormat(void)`
- `int blockNumber(void)`
- `QTextCharFormat charFormat(void)`
- `void clearSelection(void)`
- `int columnNumber(void)`
- `QTextList *createList(QTextListFormat)`
- `QTextFrame *currentFrame(void)`
- `QTextList *currentList(void)`
- `QTextTable *currentTable(void)`
- `void deleteChar(void)`
- `void deletePreviousChar(void)`
- `QTextDocument *document(void)`
- `void endEditBlock(void)`
- `bool hasComplexSelection(void)`
- `bool hasSelection(void)`
- `void insertBlock(void)`
- `void insertFragment(QTextDocumentFragment)`
- `QTextFrame *insertFrame(QTextFrameFormat)`
- `void insertHtml(QString)`

- void insertImage(QTextImageFormat)
- QTextList *insertList(QTextListFormat)
- QTextTable * insertTable(int rows, int columns, QTextTableFormat)
- void insertText(QString)
- void insertText_2(QString, QTextCharFormat)
- bool isCopyOf(QTextCursor)
- boolisNull(void)
- void joinPreviousEditBlock(void)
- bool keepPositionOnInsert(void)
- void mergeBlockCharFormat(QTextCharFormat)
- void mergeBlockFormat(QTextBlockFormat)
- void mergeCharFormat(QTextCharFormat)
- bool movePosition(QTextCursor::MoveOperation operation, QTextCursor::MoveMode mode, int n)
- int position(void)
- int positionInBlock(void)
- void removeSelectedText(void)
- void select(QTextCursor::SelectionType selection)
- void selectedTableCells(int *firstRow, int *numRows, int *firstColumn, int *numColumns)
- QString selectedText(void)
- QTextDocumentFragment selection(void)
- int selectionEnd(void)
- int selectionStart(void)
- void setBlockCharFormat(QTextCharFormat)
- void setBlockFormat(QTextBlockFormat)
- void setCharFormat(QTextCharFormat)
- void setKeepPositionOnInsert(bool b)
- void setPosition(int pos, QTextCursor::MoveMode m)
- void setVerticalMovementX(int x)
- void setVisualNavigation(bool b)
- int verticalMovementX(void)
- bool visualNavigation(void)

83.302 QTextDocument Class

C++ Reference : <http://doc.qt.io/qt-5/qtextdocument.html>

Parameters : void

Parent Class : QObject

- void addResource(int type,QUrl name, QVariant resource)
- void adjustSize(void)
- QVector<QTextFormat> allFormats(void)
- int availableRedoSteps(void)
- int availableUndoSteps(void)
- QTextBlock begin(void)
- int blockCount(void)
- QChar characterAt(int pos)
- int characterCount(void)
- void clearUndoRedoStacks(QTextDocument::Stacks stacksToClear)
- QTextDocument *clone(QObject *parent)
- int defaultCursorMoveStyle(void)
- QFont defaultFont(void)
- QString defaultStyleSheet(void)
- QTextOption defaultTextOption(void)
- QAbstractTextDocumentLayout *documentLayout(void)
- double documentMargin(void)
- void drawContents(QPainter *p, QRectF rect)
- QTextBlock end(void) # In RingQt use : QTextBlock enddoc(void)
- QTextCursor find(QString subString, QTextCursor cursor, QTextDocument::FindFlag options)
- QTextBlock findBlock(int pos)
- QTextBlock findBlockByLineNumber(int lineNumber)
- QTextBlock findBlockByNumber(int blockNumber)
- QTextBlock firstBlock(void)
- double idealWidth(void)
- double indentWidth(void)
- bool isEmpty(void)
- bool isModified(void)
- bool isredoAvailable(void)
- bool isundoAvailable(void)
- bool isUndoRedoEnabled(void)

- QTextBlock lastBlock(void)
- int lineCount(void)
- void markContentsDirty(int position, int length)
- int maximumBlockCount(void)
- QString metaInformation(QTextDocument::MetaInformation info)
- QTextObject *object(int objectIndex)
- QTextObject *objectForFormat(QTextFormat f)
- int pageCount(void)
- QSizeF pageSize(void)
- void print(QPrinter *printer)
- void redo(QTextCursor *cursor)
- QVariant resource(int type, QUrl name)
- int revision(void)
- QTextFrame *rootFrame(void)
- void setDefaultCursorMoveStyle(Qt::CursorMoveStyle style)
- void setDefaultFont(QFont font)
- void setDefaultStyleSheet(QString sheet)
- void setDefaultTextOption(QTextOption option)
- void setDocumentLayout(QAbstractTextDocumentLayout * layout)
- void setDocumentMargin(double margin)
- void setHtml(QString html)
- void setIndentWidth(double width)
- void setMaximumBlockCount(int maximum)
- void setMetaInformation(QTextDocument::MetaInformation info, QString string)
- void setPageSize(QSizeF size)
- void setPlainText(QString text)
- void setTextWidth(double width)
- void setUndoRedoEnabled(bool enable)
- void setUseDesignMetrics(bool b)
- QSizeF size(void)
- qreal textWidth(void)
- QString toHtml(QByteArray encoding)
- QString toPlainText(void)
- void undo(QTextCursor *cursor)
- bool useDesignMetrics(void)
- void setModified(bool m)

83.303 QTextEdit Class

C++ Reference : <http://doc.qt.io/qt-5/qtextedit.html>

Parameters : QWidget *

Parent Class : QAbstractScrollArea

- bool acceptRichText(void)
- int alignment(void)
- QString anchorAt(QPoint)
- bool canPaste(void)
- QTextCharFormat currentCharFormat(void)
- QFont currentFont(void)
- QTextCursor cursorForPosition(QPoint)
- QRect cursorRect(void)
- int cursorWidth(void)
- QTextDocument *document(void)
- QString documentTitle(void)
- void ensureCursorVisible(void)
- bool find(QString, QTextDocument::FindFlag)
- QString fontFamily(void)
- bool fontItalic(void)
- double fontPointSize(void)
- bool fontUnderline(void)
- int fontWeight(void)
- bool isReadOnly(void)
- bool isUndoRedoEnabled(void)
- int lineWrapColumnOrWidth(void)
- QVariant loadResource(int, QUrl)
- void mergeCurrentCharFormat(QTextCharFormat)
- void moveCursor(QTextCursor::MoveOperation operation, QTextCursor::MoveMode mode)
- bool overwriteMode(void)
- void print(QPrinter * printer)
- void setAcceptRichText(bool accept)
- void setCurrentCharFormat(QTextCharFormat)
- void setCursorWidth(int width)
- void setDocument(QTextDocument *document)
- void setDocumentTitle(QString)

- void setLineWrapColumnOrWidth(int w)
- void setLineWrapMode(QTextEdit::LineWrapMode)
- void setOverwriteMode(bool overwrite)
- void setReadOnly(bool)
- void setTabChangesFocus(bool)
- void setTabStopWidth(int width)
- void setTextCursor(QTextCursor)
- void setTextInteractionFlags(Qt::TextInteractionFlag flags)
- void setUndoRedoEnabled(bool enable)
- void setWordWrapMode(QTextOption::WrapMode policy)
- bool tabChangesFocus(void)
- int tabStopWidth(void)
- QColor textBackgroundColor(void)
- QColor textColor(void)
- QTextCursor textCursor(void)
- int textInteractionFlags(void)
- QString toHtml(void)
- QString toPlainText(void)
- int wordWrapMode(void)
- void append(QString)
- void clear(void)
- void copy(void)
- void cut(void)
- void insertHtml(QString)
- void insertPlainText(QString)
- void paste(void)
- void redo(void)
- void scrollToAnchor(QString)
- void selectAll(void)
- void setAlignment(Qt::AlignmentFlag a)
- void setCurrentFont(QFont)
- void setFontFamily(QString)
- void setFontItalic(bool italic)
- void setFontPointSize(double s)
- void setFontUnderline(bool underline)
- void setFontWeight(int weight)

- void setHtml(QString)
- void setPlainText(QString)
- void setText(QString)
- void setTextBackgroundColor(QColor)
- void setTextColor(QColor)
- void undo(void)
- void zoomIn(int range)
- void zoomOut(int range)
- void setcopyAvailableEvent(const char *)
- void setcurrentCharFormatChangedEvent(const char *)
- void setcursorPositionChangedEvent(const char *)
- void setredoAvailableEvent(const char *)
- void setselectionChangedEvent(const char *)
- void settextChangedEvent(const char *)
- void setundoAvailableEvent(const char *)
- const char *getcopyAvailableEvent(void)
- const char *getcurrentCharFormatChangedEvent(void)
- const char *getcursorPositionChangedEvent(void)
- const char *getredoAvailableEvent(void)
- const char *getselectionChangedEvent(void)
- const char *gettextChangedEvent(void)
- const char *getundoAvailableEvent(void)
- void cyanline(void)
- void setactivelinecolor(QColor)

83.304 QTextStream Class

C++ Reference : <http://doc.qt.io/qt-5/qtextstream.html>

Parameters : void

- bool atEnd(void)
- bool autoDetectUnicode(void)
- QTextCodec * codec(void)
- QIODevice * device(void)
- QTextStream::FieldAlignment fieldAlignment(void)
- int fieldWidth(void)
- void flush(void)

- bool generateByteOrderMark(void)
- int integerBase(void)
- QLocale locale(void)
- QTextStream::NumberFlags numberFlags(void)
- QChar padChar(void)
- qint64 pos(void)
- QString read(qint64 maxlen)
- QString readAll(void)
- QString readLine(qint64 maxlen)
- QTextStream::RealNumberNotation realNumberNotation(void)
- int realNumberPrecision(void)
- void reset(void)
- void resetStatus(void)
- bool seek(qint64 pos)
- void setAutoDetectUnicode(bool enabled)
- void setCodec(QTextCodec * codec)
- void setCodec_2(char * codecName)
- void setDevice(QIODevice * device)
- void setFieldAlignment(QTextStream::FieldAlignment mode)
- void setFieldWidth(int width)
- void setGenerateByteOrderMark(bool generate)
- void setIntegerBase(int base)
- void setLocale(QLocale locale)
- void setNumberFlags(QTextStream::NumberFlags flags)
- void setPadChar(QChar ch)
- void setRealNumberNotation(QTextStream::RealNumberNotation notation)
- void setRealNumberPrecision(int precision)
- void setStatus(QTextStream::Status status)
- void setString(QString * string, QIODevice::OpenMode openMode)
- void skipWhiteSpace(void)
- QTextStream::Status status(void)
- QString * string(void)

83.305 QTextStream2 Class

Parameters : QIODevice * device

Parent Class : QTextStream

83.306 QTextStream3 Class

Parameters : FILE * fileHandle, QIODevice::OpenMode

Parent Class : QTextStream

83.307 QTextStream4 Class

Parameters : QString *, QIODevice::OpenMode

Parent Class : QTextStream

83.308 QTextStream5 Class

Parameters : QByteArray *, QIODevice::OpenMode

Parent Class : QTextStream

83.309 QTextToSpeech Class

C++ Reference : <http://doc.qt.io/qt-5/qtexttospeech.html>

Parameters : QObject *

Parent Class : QObject

- QVector<QLocale> availableLocales(void)
- QVector<QVoice> availableVoices(void)
- QLocale locale(void)
- double pitch(void)
- double rate(void)
- QTextToSpeech::State state(void)
- QVoice voice(void)
- double volume(void)
- void pause(void)
- void resume(void)
- void say(QString text)
- void setLocale(QLocale locale)

- void setPitch(double pitch)
- void setRate(double rate)
- void setVoice(QVoice voice)
- void setVolume(double volume)
- void stop(void)
- QStringList availableEngines(void)
- void setlocaleChangedEvent(const char *)
- void setpitchChangedEvent(const char *)
- void setrateChangedEvent(const char *)
- void setstateChangedEvent(const char *)
- void setvoiceChangedEvent(const char *)
- void setvolumeChangedEvent(const char *)
- const char *getlocaleChangedEvent(void)
- const char *getpitchChangedEvent(void)
- const char *getrateChangedEvent(void)
- const char *getstateChangedEvent(void)
- const char *getvoiceChangedEvent(void)
- const char *getvolumeChangedEvent(void)

83.310 QTextureLoader Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qtextureloader.html>

Parameters : Qt3DCore::QNode *

- bool isMirrored(void)
- QUrl source(void)
- void setMirrored(bool mirrored)
- void setSource(QUrl source)

83.311 QTextureMaterial Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qtexturematerial.html>

Parameters : Qt3DCore::QNode *

- bool isAlphaBlendingEnabled(void)
- Qt3DRender::QAbstractTexture *texture(void)
- QVector2D textureOffset(void)
- QMatrix3x3 textureTransform(void)
- void setAlphaBlendingEnabled(bool enabled)

- void setTexture(Qt3DRender::QAbstractTexture *texture)
- void setTextureOffset(QVector2D textureOffset)
- void setTextureTransform(QMatrix3x3 matrix)

83.312 QThread Class

C++ Reference : <http://doc.qt.io/qt-5/qthread.html>

Parameters : QObject *

Parent Class : QObject

- QAbstractEventDispatcher *eventDispatcher(void)
- void exit(int returnCode) # In RingQt use : void exitfromthread(int returnCode)
- bool isFinished(void)
- bool isInterruptionRequested(void)
- bool isRunning(void)
- QThread::Priority priority(void)
- void requestInterruption(void)
- void setEventDispatcher(QAbstractEventDispatcher *eventDispatcher)
- void setPriority(QThread::Priority priority)
- void setStackSize(uint stackSize)
- uint stackSize(void)
- bool wait(unsigned long time)
- void quit(void)
- void start(QThread::Priority priority)
- void terminate(void)
- QThread *currentThread(void)
- Qt::HANDLE currentThreadId(void)
- int idealThreadCount(void)
- void msleep(unsigned long msecs)
- void sleep(unsigned long secs)
- void usleep(unsigned long usecs)
- void yieldCurrentThread(void)
- void setStartedEvent(const char *)
- void setFinishedEvent(const char *)
- const char *getStartedEvent(void)
- const char *getFinishedEvent(void)

83.313 QThreadPool Class

C++ Reference : <http://doc.qt.io/qt-5/qthreadpool.html>

Parameters : void

Parent Class : QObject

- int activeThreadCount(void)
- void clear(void)
- int expiryTimeout(void)
- int maxThreadCount(void)
- void releaseThread(void)
- void reserveThread(void)
- void setExpiryTimeout(int expiryTimeout)
- void setMaxThreadCount(int maxThreadCount)
- void start(QRunnable * runnable, int priority)
- bool tryStart(QRunnable * runnable)
- bool waitForDone(int msecs)
- QThreadPool *globalInstance(void)

83.314 QTime Class

C++ Reference : <http://doc.qt.io/qt-5/qtime.html>

Parameters : void

- QTime addMSecs(int ms)
- QTime addSecs(int s)
- int elapsed(void)
- int hour(void)
- boolisNull(void)
- boolisValid(void)
- int minute(void)
- int msec(void)
- int msecsSinceStartOfDay(void)
- int msecsTo(QTime)
- int restart(void)
- int second(void)
- int secsTo(QTime)
- boolsetHMS(int h, int m, int s, int ms)
- voidstart(void)

- `QString toString(QString)`
- `QTime currentTime(void)`
- `QTime fromMSecsSinceStartOfDay(int msecs)`
- `QTime fromString(QString,QString)`

83.315 QTimer Class

C++ Reference : <http://doc.qt.io/qt-5/qtimer.html>

Parameters : `QObject *parent`

- `int interval(void)`
- `bool isActive(void)`
- `bool isSingleShot(void)`
- `void setInterval(int msec)`
- `void setSingleShot(bool singleShot)`
- `int timerId(void)`
- `void start(void)`
- `void stop(void)`
- `void setTimeoutEvent(const char *)`
- `const char *getTimeoutEvent(void)`

83.316 QToolBar Class

C++ Reference : <http://doc.qt.io/qt-5/qtoolbar.html>

Parameters : `QWidget *`

Parent Class : `QWidget`

- `QAction *actionAt(int x, int y)`
- `QAction *addAction(QString)`
- `QAction *addSeparator(void)`
- `QAction *addWidget(QWidget *widget)`
- `int allowedAreas(void)`
- `void clear(void)`
- `QSize iconSize(void)`
- `QAction *insertSeparator(QAction *before)`
- `QAction *insertWidget(QAction *before, QWidget *widget)`
- `bool isAreaAllowed(Qt::ToolBarArea area)`
- `bool isFloatable(void)`
- `bool isFloating(void)`

- bool isMovable(void)
- int orientation(void)
- void setAllowedAreas(Qt::ToolBarArea areas)
- void setFloatable(bool floatable)
- void setMovable(bool movable)
- void setOrientation(Qt::Orientation orientation)
- QAction *toggleViewAction(void)
- int toolButtonStyle(void)
- QWidget *widgetForAction(QAction *action)
- void setIconSize(QSize)
- void setToolButtonStyle(Qt::ToolButtonStyle toolButtonStyle)

83.317 QToolButton Class

C++ Reference : <http://doc.qt.io/qt-5/qtoolbutton.html>

Parameters : QWidget *

Parent Class : QAbstractButton

- Qt::ArrowType arrowType(void)
- bool autoRaise(void)
- QAction * defaultAction(void)
- QMenu * menu(void)
- QToolButton::ToolButtonPopupMode popupMode(void)
- void setArrowType(Qt::ArrowType type)
- void setAutoRaise(bool enable)
- void setMenu(QMenu * menu)
- void setPopupMode(QToolButton::ToolButtonPopupMode mode)
- Qt::ToolButtonStyle toolButtonStyle(void)
- void setDefaultAction(QAction * action)
- void setToolButtonStyle(Qt::ToolButtonStyle style)
- void showMenu(void)
- void settriggeredEvent(const char *)
- const char *gettriggeredEvent(void)
- void setClickEvent(const char *)
- const char *getClickEvent(void)

83.318 QTorusMesh Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qtorusmesh.html>

Parameters : Qt3DCore::QNode *

- float minorRadius(void)
- float radius(void)
- int rings(void)
- int slices(void)
- void setMinorRadius(float minorRadius)
- void setRadius(float radius)
- void setRings(int rings)
- void setSlices(int slices)

83.319 QTransform Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dcore-qtransform.html>

Parameters : Qt3DCore::QNode *

- QMatrix4x4 matrix(void)
- QQuaternion rotation(void)
- float rotationX(void)
- float rotationY(void)
- float rotationZ(void)
- float scale(void)
- QVector3D scale3D(void)
- QVector3D translation(void)
- void setMatrix(QMatrix4x4 matrix)
- void setRotation(QQuaternion rotation)
- void setRotationX(float rotationX)
- void setRotationY(float rotationY)
- void setRotationZ(float rotationZ)
- void setScale(float scale)
- void setScale3D(QVector3D scale)
- void setTranslation(QVector3D translation)
- QQuaternion fromAxes(QVector3D xAxis, QVector3D yAxis, QVector3D zAxis)
- QQuaternion fromAxesAndAngles(QVector3D axis1, float angle1, QVector3D axis2, float angle2)
- QQuaternion fromAxesAndAngles_2(QVector3D axis1, float angle1, QVector3D axis2, float angle2, QVector3D axis3, float angle3)

- QQuaternion fromAxisAndAngle(QVector3D axis, float angle)
- QQuaternion fromAxisAndAngle_2(float x, float y, float z, float angle)
- QQuaternion fromEulerAngles(QVector3D eulerAngles)
- QQuaternion fromEulerAngles_2(float pitch, float yaw, float roll)
- QMatrix4x4 rotateAround(QVector3D point, float angle, QVector3D axis)
- QMatrix4x4 rotateFromAxes(QVector3D xAxis, QVector3D yAxis, QVector3D zAxis)

83.320 QTreeView Class

C++ Reference : <http://doc.qt.io/qt-5/qtreeview.html>

Parameters : QWidget *

Parent Class : QAbstractItemView

- bool allColumnsShowFocus(void)
- int autoExpandDelay(void)
- int columnAt(int x)
- int columnViewportPosition(int column)
- int columnWidth(int column)
- bool expandsOnDoubleClick(void)
- QHeaderView *header(void)
- int indentation(void)
- QModelIndex indexAbove(QModelIndex)
- QModelIndex indexBelow(QModelIndex)
- bool isAnimated(void)
- bool isColumnHidden(int column)
- bool isExpanded(QModelIndex)
- bool isFirstColumnSpanned(int row, QModelIndex)
- bool isHeaderHidden(void)
- bool isRowHidden(int row, QModelIndex)
- bool isSortingEnabled(void)
- bool itemsExpandable(void)
- bool rootIsDecorated(void)
- void setAllColumnsShowFocus(bool enable)
- void setAnimated(bool enable)
- void setAutoExpandDelay(int delay)
- void setColumnHidden(int column, bool hide)
- void setColumnWidth(int column, int width)

- void setExpanded(QModelIndex, bool expanded)
- void setExpandsOnDoubleClick(bool enable)
- void setFirstColumnSpanned(int row, QModelIndex, bool span)
- void setHeader(QHeaderView * header)
- void setHeaderHidden(bool hide)
- void setIndentation(int i)
- void setItemsExpandable(bool enable)
- void setRootIsDecorated(bool show)
- void setRowHidden(int row,QModelIndex, bool hide)
- void setSortingEnabled(bool enable)
- void setUniformRowHeights(bool uniform)
- void setWordWrap(bool on)
- void sortByColumn(int column,Qt::SortOrder order)
- bool uniformRowHeights(void)
- bool wordWrap(void)
- void dataChanged(QModelIndex,QModelIndex)
- QModelIndex indexAt(QPoint)
- void keyboardSearch(QString)
- void reset(void)
- void scrollTo(QModelIndex, QAbstractItemView::ScrollHint)
- void selectAll(void)
- void setModel(QAbstractItemModel *model)
- void setRootIndex(QModelIndex)
- void setSelectionModel(QItemSelectionModel *selectionModel)
- QRect visualRect(QModelIndex)
- void collapse(QModelIndex)
- void collapseAll(void)
- void expand(QModelIndex)
- void expandAll(void)
- void expandToDepth(int depth)
- void hideColumn(int column)
- void resizeColumnToContents(int column)
- void showColumn(int column)
- void setcollapsedEvent(const char *)
- void setexpandedEvent(const char *)
- void setactivatedEvent(const char *)

- void setclickedEvent(const char *)
- void setdoubleClickedEvent(const char *)
- void setenteredEvent(const char *)
- void setpressedEvent(const char *)
- void setviewportEnteredEvent(const char *)
- const char *getcollapsedEvent(void)
- const char *getexpandedEvent(void)
- const char *getactivatedEvent(void)
- const char *getclickedEvent(void)
- const char *getdoubleClickedEvent(void)
- const char *getenteredEvent(void)
- const char *getpressedEvent(void)
- const char *getviewportEnteredEvent(void)

83.321 QTreeWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qtreewidget.html>

Parameters : QWidget *

Parent Class : QTreeView

- void addTopLevelItem(QTreeWidgetItem *item)
- void closePersistentEditor(QTreeWidgetItem *item, int column)
- int columnCount(void)
- int currentColumn(void)
- QTreeWidgetItem *currentItem(void)
- void editItem(QTreeWidgetItem *item, int column)
- QTreeWidgetItem *headerItem(void)
- int indexOfTopLevelItem(QTreeWidgetItem *item)
- void insertTopLevelItem(int index, QTreeWidgetItem *item)
- QTreeWidgetItem *invisibleRootItem(void)
- bool isFirstItemColumnSpanned(QTreeWidgetItem *item)
- QTreeWidgetItem *itemAbove(QTreeWidgetItem *item)
- QTreeWidgetItem *itemAt(int x, int y)
- QTreeWidgetItem *itemBelow(QTreeWidgetItem *item)
- QWidget *itemWidget(QTreeWidgetItem *item, int column)
- void openPersistentEditor(QTreeWidgetItem *item, int column)
- void removeItemWidget(QTreeWidgetItem *item, int column)

- void setColumnCount(int columns)
- void setCurrentItem(QTreeWidgetItem * item, QItemSelectionModel::SelectionFlag column)
- void setFirstItemColumnSpanned(QTreeWidgetItem *item, bool span)
- void setHeaderItem(QTreeWidgetItem *item)
- void setHeaderLabel(QString)
- void setHeaderLabels(QStringList)
- void setItemWidget(QTreeWidgetItem *item, int column, QWidget * widget)
- int sortColumn(void)
- void sortItems(int column, Qt::SortOrder order)
- QTreeWidgetItem *takeTopLevelItem(int index)
- QTreeWidgetItem *topLevelItem(int index)
- int topLevelItemCount(void)
- QRect visualItemRect(QTreeWidgetItem *item)
- void setSelectionModel(QItemSelectionModel *selectionModel)
- void clear(void)
- void collapseItem(QTreeWidgetItem *item)
- void expandItem(QTreeWidgetItem *item)
- void scrollToItem(QTreeWidgetItem *item, QAbstractItemView::ScrollHint hint)
- void setcollapsedEvent(const char *)
- void setexpandedEvent(const char *)
- void setactivatedEvent(const char *)
- void setclickedEvent(const char *)
- void setdoubleClickedEvent(const char *)
- void setenteredEvent(const char *)
- void setpressedEvent(const char *)
- void setviewportEnteredEvent(const char *)
- void setcurrentItemChangedEvent(const char *)
- void setitemActivatedEvent(const char *)
- void setitemChangedEvent(const char *)
- void setitemClickedEvent(const char *)
- void setitemCollapsedEvent(const char *)
- void setitemDoubleClickedEvent(const char *)
- void setitemEnteredEvent(const char *)
- void setitemExpandedEvent(const char *)
- void setitemPressedEvent(const char *)
- void setitemSelectionChangedEvent(const char *)

- const char *getcollapsedEvent(void)
- const char *getexpandedEvent(void)
- const char *getactivatedEvent(void)
- const char *getclickedEvent(void)
- const char *getdoubleClickedEvent(void)
- const char *getenteredEvent(void)
- const char *getpressedEvent(void)
- const char *getviewportEnteredEvent(void)
- const char *getcurrentItemChangedEvent(void)
- const char *getitemActivatedEvent(void)
- const char *getitemChangedEvent(void)
- const char *getitemClickedEvent(void)
- const char *getitemCollapsedEvent(void)
- const char *getitemDoubleClickedEvent(void)
- const char *getitemEnteredEvent(void)
- const char *getitemExpandedEvent(void)
- const char *getitemPressedEvent(void)
- const char *getitemSelectionChangedEvent(void)

83.322 QTreeWidgetItem Class

C++ Reference : <http://doc.qt.io/qt-5/qtreewidgetitem.html>

Parameters : void

- void addChild(QTreeWidgetItem *child)
- QBrush background(int column)
- int checkState(int column)
- QTreeWidgetItem *child(int index)
- int childCount(void)
- int childIndicatorPolicy(void)
- QTreeWidgetItem *clone(void)
- int columnCount(void)
- QVariant data(int column, int role)
- int flags(void)
- QFont font(int column)
- QBrush foreground(int column)
- QIcon icon(int column)

- int indexOfChild(QTreeWidgetItem *child)
- void insertChild(int index, QTreeWidgetItem *child)
- bool isEnabled(void)
- bool isExpanded(void)
- bool isFirstColumnSpanned(void)
- bool isHidden(void)
- bool isSelected(void)
- QTreeWidgetItem *parent(void)
- void read(QDataStream)
- void removeChild(QTreeWidgetItem *child)
- void setBackground(int column,QBrush)
- void setCheckState(int column, Qt::CheckState state)
- void setChildIndicatorPolicy(QTreeWidgetItem::ChildIndicatorPolicy policy)
- void setData(int column, int role,QVariant)
- void setDisabled(bool disabled)
- void setExpanded(bool expand)
- void setFirstColumnSpanned(bool span)
- void setFlags(Qt::ItemFlag flags)
- void setFont(int column, QFont)
- void setForeground(int column, QBrush)
- void setHidden(bool hide)
- void setIcon(int column, QIcon)
- void setSelected(bool select)
- void setSizeHint(int column, QSize)
- void setStatusTip(int column, QString)
- void setText(int column, QString)
- void setTextAlignment(int column, int alignment)
- void setToolTip(int column, QString)
- void setWhatsThis(int column, QString)
- QSize sizeHint(int column)
- void sortChildren(int column, Qt::SortOrder order)
- QString statusTip(int column)
- QTreeWidgetItem *takeChild(int index)
- QString text(int column)
- int textAlign(int column)
- QString toolTip(int column)

- QTreeWidget *treeWidget(void)
- int type(void)
- QString whatsThis(int column)
- void write(QDataStream)

83.323 QUrl Class

C++ Reference : <http://doc.qt.io/qt-5/qurl.html>

Parameters : QString

- void clear(void)
- QString errorString(void)
- QString fileName(QUrl::ComponentFormattingOption options)
- QString fragment(QUrl::ComponentFormattingOption options)
- bool hasFragment(void)
- bool hasQuery(void)
- QString host(QUrl::ComponentFormattingOption options)
- bool isEmpty(void)
- bool isLocalFile(void)
- bool isParentOf(QUrl)
- bool isRelative(void)
- bool isValid(void)
- QString path(QUrl::ComponentFormattingOption options)
- int port(int defaultPort)
- QString query(QUrl::ComponentFormattingOption options)
- QUrl resolved(QUrl)
- QString scheme(void)
- void setAuthority(QString, QUrl::ParsingMode mode)
- void setFragment(QString, QUrl::ParsingMode mode)
- void setHost(QString, QUrl::ParsingMode mode)
- void setPassword(QString, QUrl::ParsingMode mode)
- void setPath(QString, QUrl::ParsingMode mode)
- void setPort(int port)
- void setQuery(QString, QUrl::ParsingMode mode)
- void setScheme(QString)
- void setUrl(QString, QUrl::ParsingMode parsingMode)
- void setUserInfo(QString, QUrl::ParsingMode mode)

- void setUserName(QString, QUrl::ParsingMode mode)
- void swap(QUrl)
- QString topLevelDomain(QUrl::ComponentFormattingOption options)
- QString userInfo(QUrl::ComponentFormattingOption options)
- QString userName(QUrl::ComponentFormattingOption options)
- QUrl fromLocalFile(QString)

83.324 QUuid Class

C++ Reference : <http://doc.qt.io/qt-5/quuid.html>

Parameters : void

- QString toString(void)

83.325 QVBarModelMapper Class

C++ Reference : <http://doc.qt.io/qt-5/qvbarmodelmapper.html>

Parameters : QObject *

Parent Class : QObject

- int firstRow(void)
- int lastBarSetColumn(void)
- QAbstractItemModel * model(void)
- int rowCount(void)
- QAbstractBarSeries * series(void)
- void setFirstBarSetColumn(int firstBarSetColumn)
- void setFirstRow(int firstRow)
- void setLastBarSetColumn(int lastBarSetColumn)
- void setModel(QAbstractItemModel *model)
- void setRowCount(int rowCount)
- void setSeries(QAbstractBarSeries *series)
- void setfirstBarSetColumnChangedEvent(const char *)
- void setfirstRowChangedEvent(const char *)
- void setlastBarSetColumnChangedEvent(const char *)
- void setmodelReplacedEvent(const char *)
- void setrowCountChangedEvent(const char *)
- void setseriesReplacedEvent(const char *)
- const char *getfirstBarSetColumnChangedEvent(void)
- const char *getfirstRowChangedEvent(void)

- const char *getLastBarSetColumnChangedEvent(void)
- const char *getModelReplacedEvent(void)
- const char *GetRowCountChangedEvent(void)
- const char *GetSeriesReplacedEvent(void)

83.326 QBoxLayout Class

C++ Reference : <http://doc.qt.io/qt-5/qvboxlayout.html>

Parameters : void

Parent Class : QHBoxLayout

- void addWidget(QWidget *)
- void addLayout(QLayout *)

83.327 QVBoxPlotModelMapper Class

C++ Reference : <http://doc.qt.io/qt-5/qvboxplotmodelmapper.html>

Parameters : QObject *

Parent Class : QObject

- int firstRow(void)
- int lastBoxSetColumn(void)
- QAbstractItemModel * model(void)
- int rowCount(void)
- QBoxPlotSeries * series(void)
- void setFirstBoxSetColumn(int firstBoxSetColumn)
- void setFirstRow(int firstRow)
- void setLastBoxSetColumn(int lastBoxSetColumn)
- void setModel(QAbstractItemModel *model)
- void setRowCount(int rowCount)
- void setSeries(QBoxPlotSeries *series)
- void setfirstBoxSetColumnChangedEvent(const char *)
- void setfirstRowChangedEvent(const char *)
- void setlastBoxSetColumnChangedEvent(const char *)
- void setmodelReplacedEvent(const char *)
- void setrowCountChangedEvent(const char *)
- void setsseriesReplacedEvent(const char *)
- const char *getfirstBoxSetColumnChangedEvent(void)
- const char *getfirstRowChangedEvent(void)

- const char *getLastBoxSetColumnChangedEvent(void)
- const char *getModelReplacedEvent(void)
- const char *GetRowCountChangedEvent(void)
- const char *GetSeriesReplacedEvent(void)

83.328 QVCandlestickModelMapper Class

C++ Reference : <http://doc.qt.io/qt-5/qvcandlestickmodelmapper.html>

Parameters : QObject *

Parent Class : QCandlestickModelMapper

- int closeRow(void)
- int firstSetColumn(void)
- int highRow(void)
- int lastSetColumn(void)
- int lowRow(void)
- int openRow(void)
- void setCloseRow(int closeRow)
- void setFirstSetColumn(int firstSetColumn)
- void setHighRow(int highRow)
- void setLastSetColumn(int lastSetColumn)
- void setLowRow(int lowRow)
- void setOpenRow(int openRow)
- void setTimestampRow(int timestampRow)
- int timestampRow(void)
- void setcloseRowChangedEvent(const char *)
- void setfirstSetColumnChangedEvent(const char *)
- void sethighRowChangedEvent(const char *)
- void setlastSetColumnChangedEvent(const char *)
- void setlowRowChangedEvent(const char *)
- void setopenRowChangedEvent(const char *)
- void settimestampRowChangedEvent(const char *)
- const char *getcloseRowChangedEvent(void)
- const char *getfirstSetColumnChangedEvent(void)
- const char *gethighRowChangedEvent(void)
- const char *getLastSetColumnChangedEvent(void)
- const char *getlowRowChangedEvent(void)

- const char *getopenRowChangedEvent(void)
- const char *gettimestampRowChangedEvent(void)

83.329 QVPieModelMapper Class

C++ Reference : <http://doc.qt.io/qt-5/qvpiemodelmapper.html>

Parameters : QObject *

Parent Class : QPieModelMapper

- int firstRow(void)
- int labelsColumn(void)
- QAbstractItemModel * model(void)
- int rowCount(void)
- QPieSeries * series(void)
- void setFirstRow(int firstRow)
- void setLabelsColumn(int labelsColumn)
- void setModel(QAbstractItemModel *model)
- void setRowCount(int rowCount)
- void setSeries(QPieSeries *series)
- void setValuesColumn(int valuesColumn)
- int valuesColumn(void)
- void setfirstRowChangedEvent(const char *)
- void setlabelsColumnChangedEvent(const char *)
- void setmodelReplacedEvent(const char *)
- void setrowCountChangedEvent(const char *)
- void setsseriesReplacedEvent(const char *)
- void setvaluesColumnChangedEvent(const char *)
- const char *getfirstRowChangedEvent(void)
- const char *getlabelsColumnChangedEvent(void)
- const char *getmodelReplacedEvent(void)
- const char *getrowCountChangedEvent(void)
- const char *getseriesReplacedEvent(void)
- const char *getvaluesColumnChangedEvent(void)

83.330 QVXYModelMapper Class

C++ Reference : <http://doc.qt.io/qt-5/qvxymodelmapper.html>

Parameters : QObject *

Parent Class : QXYModelMapper

- int firstRow(void)
- QAbstractItemModel * model(void)
- int rowCount(void)
- QXYSeries * series(void)
- void setFirstRow(int firstRow)
- void setModel(QAbstractItemModel *model)
- void setRowCount(int rowCount)
- void setSeries(QXYSeries *series)
- void setXColumn(int xColumn)
- void setYColumn(int yColumn)
- int xColumn(void)
- int yColumn(void)
- void setfirstRowChangedEvent(const char *)
- void setmodelReplacedEvent(const char *)
- void setrowCountChangedEvent(const char *)
- void setsseriesReplacedEvent(const char *)
- void setxColumnChangedEvent(const char *)
- void setyColumnChangedEvent(const char *)
- const char *getfirstRowChangedEvent(void)
- const char *getmodelReplacedEvent(void)
- const char *getrowCountChangedEvent(void)
- const char *getseriesReplacedEvent(void)
- const char *getxColumnChangedEvent(void)
- const char *getyColumnChangedEvent(void)

83.331 QValueAxis Class

C++ Reference : <http://doc.qt.io/qt-5/qvalueaxis.html>

Parameters : QObject *

Parent Class : QAbstractAxis

- QString labelFormat(void)
- qreal max(void)
- qreal min(void)
- int minorTickCount(void)
- void setLabelFormat(QString format)
- void setMax(qreal max)
- void setMin(qreal min)
- void setMinorTickCount(int count)
- void setRange(qreal min, qreal max)
- void setTickAnchor(qreal anchor)
- void setTickCount(int count)
- void setTickInterval(qreal interval)
- void setTickType(QValueAxis::TickType type)
- qreal tickAnchor(void)
- int tickCount(void)
- qreal tickInterval(void)
- QValueAxis::TickType tickType(void)
- void setlabelFormatChangedEvent(const char *)
- void setmaxChangedEvent(const char *)
- void setminChangedEvent(const char *)
- void setminorTickCountChangedEvent(const char *)
- void setrangeChangedEvent(const char *)
- void settickAnchorChangedEvent(const char *)
- void settickCountChangedEvent(const char *)
- void settickIntervalChangedEvent(const char *)
- void settickTypeChangedEvent(const char *)
- const char *getlabelFormatChangedEvent(void)
- const char *getmaxChangedEvent(void)
- const char *getminChangedEvent(void)
- const char *getminorTickCountChangedEvent(void)
- const char *getrangeChangedEvent(void)

- const char *gettickAnchorChangedEvent(void)
- const char *gettickCountChangedEvent(void)
- const char *gettickIntervalChangedEvent(void)
- const char *gettickTypeChangedEvent(void)

83.332 QVariant Class

C++ Reference : <http://doc.qt.io/qt-5/qvariant.html>

Parameters : void

- bool canConvert(int targetTypeId)
- void clear(void)
- bool convert(int targetTypeId)
- boolisNull(void)
- bool isValid(void)
- void swap(QVariant)
- QBitArray toBitArray(void)
- bool toBool(void)
- QByteArray toByteArray(void)
- QChar toChar(void)
- QDate toDate(void)
- QDateTime toDateTime(void)
- double toDouble(bool *ok)
- QEasingCurve toEasingCurve(void)
- float toFloat(bool *ok)
- int toInt(bool *ok)
- QJsonArray toJsonArray(void)
- QJsonDocument toJsonDocument(void)
- QJsonObject toJsonObject(void)
- QJsonValue toJsonValue(void)
- QLine toLine(void)
- QLineF toLineF(void)
- QLocale toLocale(void)
- qlonglong toLongLong(bool *ok)
- QModelIndex toModelIndex(void)
- QPointF toPointF(void)
- qreal toReal(bool *ok)

- QRect toRect(void)
- QRectF toRectF(void)
- QRegExp toRegExp(void)
- QRegularExpression toRegularExpression(void)
- QSize toSize(void)
- QSizeF toSizeF(void)
- QStringList toStringList(void)
- QTime toTime(void)
- uint toUInt(bool *ok)
- qulonglong toULongLong(bool *ok)
- QUrl toUrl(void)
- QUuid toUuid(void)
- QVariant::Type type(void)
- const char *typeName(void)
- int userType(void)
- QString toString(void)

83.333 QVariant2 Class

Parent Class : QVariant

Parameters : int

83.334 QVariant3 Class

Parent Class : QVariant

Parameters : float

83.335 QVariant4 Class

Parent Class : QVariant

Parameters : double

83.336 QVariant5 Class

Parent Class : QVariant

Parameters : QString

83.337 QVariantDouble Class

C++ Reference : <http://doc.qt.io/qt-5/qvariantdouble.html>

Parent Class : QVariant

Parameters : double

83.338 QVariantFloat Class

C++ Reference : <http://doc.qt.io/qt-5/qvariantfloat.html>

Parent Class : QVariant

Parameters : float

83.339 QVariantInt Class

C++ Reference : <http://doc.qt.io/qt-5/qvariantint.html>

Parent Class : QVariant

Parameters : int

83.340 QVariantString Class

C++ Reference : <http://doc.qt.io/qt-5/qvariantstring.html>

Parent Class : QVariant

Parameters : QString

83.341 QVector2D Class

C++ Reference : <http://doc.qt.io/qt-5/qvector2d.html>

Parameters : float,float

- float distanceToLine(QVector2D point, QVector2D direction)
- float distanceToPoint(QVector2D point)
- boolisNull(void)
- float length(void)

- float lengthSquared(void)
- void normalize(void)
- QVector2D normalized(void)
- void setX(float x)
- void setY(float y)
- QPoint toPoint(void)
- QPointF toPointF(void)
- QVector3D toVector3D(void)
- QVector4D toVector4D(void)
- float x(void)
- float y(void)
- float dotProduct(QVector2D v1, QVector2D v2)

83.342 QVector3D Class

C++ Reference : <http://doc.qt.io/qt-5/qvector3d.html>

Parameters : float,float,float

- float distanceToLine(QVector3D point, QVector3D direction)
- float distanceToPlane(QVector3D plane, QVector3D normal)
- float distanceToPlane_2(QVector3D plane1, QVector3D plane2, QVector3D plane3)
- float distanceToPoint(QVector3D point)
- boolisNull(void)
- float length(void)
- float lengthSquared(void)
- void normalize(void)
- QVector3D normalized(void)
- void setY(float y)
- void setZ(float z)
- QPoint toPoint(void)
- QPointF toPointF(void)
- QVector2D toVector2D(void)
- QVector4D toVector4D(void)
- float y(void)
- float z(void)
- QVector3D crossProduct(QVector3D v1, QVector3D v2)
- float dotProduct(QVector3D v1, QVector3D v2)

- QVector3D normal(QVector3D v1, QVector3D v2)
- QVector3D normal_2(QVector3D v1, QVector3D v2, QVector3D v3)

83.343 QVector4D Class

C++ Reference : <http://doc.qt.io/qt-5/qvector4d.html>

Parameters : float,float,float,float

- boolisNull(void)
- floatlength(void)
- floatlengthSquared(void)
- voidnormalize(void)
- QVector4Dnormalized(void)
- voidsetW(float w)
- voidsetX(float x)
- voidsetY(float y)
- voidsetZ(float z)
- QPointtoPoint(void)
- QPointFtoPointF(void)
- QVector2DtoVector2D(void)
- QVector2DtoVector2DAffine(void)
- QVector3DtoVector3D(void)
- QVector3DtoVector3DAffine(void)
- floatw(void)
- floatx(void)
- floaty(void)
- floatz(void)
- floatdotProduct(QVector4D v1, QVector4D v2)

83.344 QVectorQVoice Class

C++ Reference : <http://doc.qt.io/qt-5/qvectorqvoice.html>

Parameters : void

- intcount(void)
- QVoicevalue(int i)

83.345 QVideoWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qvideowidget.html>

Parameters : QWidget *parent

Parent Class : QWidget

- int aspectRatioMode(void)
- int brightness(void)
- int contrast(void)
- int hue(void)
- bool isFullScreen(void)
- int saturation(void)
- void setAspectRatioMode(Qt::AspectRatioMode mode)
- void setBrightness(int brightness)
- void setContrast(int contrast)
- void setFullScreen(bool fullScreen)
- void setHue(int hue)
- void setSaturation(int saturation)
- void setbrightnessChangedEvent(const char *)
- void setcontrastChangedEvent(const char *)
- void setfullScreenChangedEvent(const char *)
- void sethueChangedEvent(const char *)
- void setsaturationChangedEvent(const char *)
- const char *getbrightnessChangedEvent(void)
- const char *getcontrastChangedEvent(void)
- const char *getfullScreenChangedEvent(void)
- const char *gethueChangedEvent(void)
- const char *getsaturationChangedEvent(void)

83.346 QVideoWidgetControl Class

C++ Reference : <http://doc.qt.io/qt-5/qvideowidgetcontrol.html>

Parent Class : QMediaControl

83.347 QViewport Class

C++ Reference : <http://doc.qt.io/qt-5/qt3drender-qviewport.html>

Parameters : Qt3DCore::QNode *

- float gamma(void)
- QRectF normalizedRect(void)
- void setGamma(float gamma)
- void setNormalizedRect(QRectF normalizedRect)

83.348 QVoice Class

C++ Reference : <http://doc.qt.io/qt-5/qvoice.html>

Parameters : void

- QVoice::Age age(void)
- QVoice::Gender gender(void)
- QString name(void)
- QString ageName(QVoice::Age age)
- QString genderName(QVoice::Gender gender)

83.349 QWebEngineView Class

C++ Reference : <http://doc.qt.io/qt-5/qwebengineview.html>

Parameters : QWidget *parent

Parent Class : QWidget

- bool hasSelection(void)
- QWebEngineHistory *history(void)
- void load(QUrl) # In RingQt use : void loadpage(QUrl)
- QWebEnginePage *page(void)
- QAction *pageAction(QWebEnginePage::WebAction action)
- QString selectedText(void)
- void setContent(QByteArray,QString,QUrl)
- void setHtml(QString,QUrl)
- void setPage(QWebEnginePage *page)
- void setUrl(QUrl)
- void setZoomFactor(qreal factor)
- QWebSettings *settings(void)
- QString title(void)

- void triggerPageAction(QWebEnginePage::WebAction action, bool checked)
- QUrl url(void)
- qreal zoomFactor(void)
- void back(void)
- void forward(void)
- void reload(void)
- void stop(void)
- void setloadFinishedEvent(const char *)
- void setloadProgressEvent(const char *)
- void setloadStartedEvent(const char *)
- void setselectionChangedEvent(const char *)
- void settitleChangedEvent(const char *)
- void seturlChangedEvent(const char *)
- const char *getloadFinishedEvent(void)
- const char *getloadProgressEvent(void)
- const char *getloadStartedEvent(void)
- const char *getselectionChangedEvent(void)
- const char *getttitleChangedEvent(void)
- const char *geturlChangedEvent(void)

83.350 QWebView Class

C++ Reference : <http://doc.qt.io/qt-5/qwebview.html>

Parameters : QWidget *parent

Parent Class : QWebEngineView

83.351 QWebView Class

C++ Reference : <http://doc.qt.io/qt-5/qwebview.html>

Parameters : QWidget *parent

Parent Class : QWidget

- QWebHistory *history(void)
- QAction *pageAction(QWebPage::WebAction action)
- void setContent(QByteArray,QString,QUrl)
- void setHtml(QString,QUrl)
- void setPage(QWebPage *page)
- void setZoomFactor(qreal factor)

- QWebSettings *settings(void)
- void triggerPageAction(QWebPage::WebAction action, bool checked)
- QUrl url(void)
- qreal zoomFactor(void)
- void back(void)
- void forward(void)
- void print(QPrinter *printer)
- void reload(void)
- void stop(void)
- void setloadProgressEvent(const char *)
- void setloadStartedEvent(const char *)
- void setselectionChangedEvent(const char *)
- void seturlChangedEvent(const char *)
- const char *getloadFinishedEvent(void)
- const char *getloadProgressEvent(void)
- const char *getloadStartedEvent(void)
- const char *getselectionChangedEvent(void)
- const char *getttitleChangedEvent(void)
- const char *geturlChangedEvent(void)

83.352 QWidget Class

C++ Reference : <http://doc.qt.io/qt-5/qwidget.html>

Parameters : void

Parent Class : QObject

- bool acceptDrops(void)
- QString accessibleDescription(void)
- QString accessibleName(void)
- void activateWindow(void)
- void addAction(QAction *action)
- void adjustSize(void)
- bool autoFillBackground(void)
- int backgroundRole(void)
- QSize baseSize(void)
- QWidget *childAt(int x, int y)
- QRect childrenRect(void)

- `QRegion childrenRegion(void)`
- `void clearFocus(void)`
- `void clearMask(void)`
- `QMargins contentsMargins(void)`
- `QRect contentsRect(void)`
- `int contextMenuPolicy(void)`
- `QCursor cursor(void)`
- `int effectiveWinId(void)`
- `void ensurePolished(void)`
- `int focusPolicy(void)`
- `QWidget *focusProxy(void)`
- `QWidget *focusWidget(void)`
- `QFont font(void)`
- `QFontInfo fontInfo(void)`
- `int foregroundRole(void)`
- `QRect frameGeometry(void)`
- `QSize frameSize(void)`
- `QRect geometry(void)`
- `void getContentsMargins(int *left, int *top, int *right, int *bottom)`
- `QPixmap grab(QRect)`
- `void grabGesture(Qt::GestureType gesture, Qt::GestureFlag flags)`
- `void grabKeyboard(void)`
- `void grabMouse(void)`
- `int grabShortcut(QKeySequence , Qt::ShortcutContext context)`
- `QGraphicsEffect *graphicsEffect(void)`
- `QGraphicsProxyWidget *graphicsProxyWidget(void)`
- `bool hasFocus(void)`
- `bool hasMouseTracking(void)`
- `int height(void)`
- `int heightForWidth(int w)`
- `int inputMethodHints(void)`
- `QVariant inputMethodQuery(Qt::InputMethodQuery query)`
- `void insertAction(QAction *before, QAction *action)`
- `bool isActiveWindow(void)`
- `bool isAncestorOf(QWidget *child)`
- `bool isEnabled(void)`

- bool isEnabledTo(QWidget *ancestor)
- bool isFullScreen(void)
- bool isHidden(void)
- bool isMaximized(void)
- bool isMinimized(void)
- bool isModal(void)
- bool isVisible(void)
- bool isVisibleTo(QWidget *ancestor)
- bool isWindow(void)
- bool isWindowModified(void)
- QLayout *layout(void)
- int layoutDirection(void)
- QLocale locale(void)
- QPoint mapFrom(QWidget *parent, QPoint)
- QPoint mapFromGlobal(QPoint)
- QPoint mapFromParent(QPoint)
- QPoint mapTo(QWidget *parent, QPoint)
- QPoint mapToGlobal(QPoint pos)
- QPoint mapToParent(QPoint pos)
- QRegion mask(void)
- int maximumHeight(void)
- QSize maximumSize(void)
- int maximumWidth(void)
- int minimumHeight(void)
- QSize minimumSize(void)
- int minimumWidth(void)
- void move(int x, int y)
- QWidget *nativeParentWidget(void)
- QWidget *nextInFocusChain(void)
- QRect normalGeometry(void)
- void overrideWindowFlags(Qt::WindowType flags)
- QPalette palette(void)
- QWidget *parentWidget(void)
- QPoint pos(void)
- QWidget *previousInFocusChain(void)
- QRect rect(void)

- void releaseKeyboard(void)
- void releaseMouse(void)
- void releaseShortcut(int id)
- void removeAction(QAction *action)
- void render(QPaintDevice *target, QPoint,QRegion, QWidget::RenderFlag)
- void repaint(void)
- void resize(int w, int h)
- bool restoreGeometry(QByteArray)
- QByteArray saveGeometry(void)
- void scroll(int dx, int dy)
- void setAcceptDrops(bool on)
- void setAccessibleDescription(QString)
- void setAccessibleName(QString)
- void setAttribute(Qt::WidgetAttribute attribute, bool on)
- void setAutoFillBackground(bool enabled)
- void setBackgroundRole(QPalette::ColorRole role)
- void setBaseSize(int basew, int baseh)
- void setContentsMargins(int left, int top, int right, int bottom)
- void setContextMenuPolicy(Qt::ContextMenuPolicy policy)
- void setCursor(QCursor)
- void setFixedHeight(int h)
- void setFixedSize(int w, int h)
- void setFixedWidth(int w)
- void setFocus(Qt::FocusReason reason)
- void setFocusPolicy(Qt::FocusPolicy policy)
- void setFocusProxy(QWidget *w)
- void setFont(QFont)
- void setForegroundRole(QPalette::ColorRole role)
- void setGeometry(int x, int y, int w, int h)
- void setGraphicsEffect(QGraphicsEffect *effect)
- void setInputMethodHints(Qt::InputMethodHint hints)
- void setLayout(QLayout *layout)
- void setLayoutDirection(Qt::LayoutDirection direction)
- void setLocale(QLocale)
- void setMask(QBitmap)
- void setMaximumHeight(int maxh)

- void setMaximumSize(int maxw, int maxh)
- void setMaximumWidth(int maxw)
- void setMinimumHeight(int minh)
- void setMinimumSize(int minw, int minh)
- void setMinimumWidth(int minw)
- void setMouseTracking(bool enable)
- void setPalette(QPalette)
- void setParent(QWidget *parent)
- void setShortcutAutoRepeat(int id, bool enable)
- void setShortcutEnabled(int id, bool enable)
- void setSizeIncrement(int w, int h)
- void setSizePolicy(QSizePolicy::Policy horizontal, QSizePolicy::Policy vertical)
- void setStatusTip(QString)
- void setStyle(QStyle *style)
- void setToolTip(QString)
- void setUpdatesEnabled(bool enable)
- void setWhatsThis(QString)
- void setWindowFilePath(QString)
- void setWindowFlags(Qt::WindowType type)
- void setWindowIcon(QIcon)
- void setWindowIconText(QString)
- void setWindowModality(Qt::WindowModality windowModality)
- void setWindowOpacity(double level)
- void setWindowRole(QString)
- void setState(Qt::WindowState windowState)
- QSize size(void)
- QSize sizeIncrement(void)
- QSizePolicy sizePolicy(void)
- void stackUnder(QWidget *w)
- QString statusTip(void)
- QStyle *style(void)
- QString styleSheet(void)
- bool testAttribute(Qt::WidgetAttribute attribute)
- QString toolTip(void)
- bool underMouse(void)
- void ungrabGesture(Qt::GestureType gesture)

- void unsetCursor(void)
- void unsetLayoutDirection(void)
- void unsetLocale(void)
- void update(int x, int y, int w, int h)
- void updateGeometry(void)
- bool updatesEnabled(void)
- QRegion visibleRegion(void)
- QString whatsThis(void)
- int width(void)
- int winId(void)
- QWidget *window(void)
- QString windowFilePath(void)
- int windowFlags(void)
- QWindow *windowHandle(void)
- QIcon windowIcon(void)
- QString windowIconText(void)
- int windowModality(void)
- double windowOpacity(void)
- QString windowRole(void)
- int windowState(void)
- QString windowTitle(void)
- int windowType(void)
- int x(void)
- int y(void)
- bool close(void)
- void hide(void)
- void lower(void)
- void raise(void)
- void setDisabled(bool disable)
- void setEnabled(bool)
- void setHidden(bool hidden)
- void setStyleSheet(QString)
- void setWindowModified(bool)
- void setWindowTitle(QString)
- void show(void)
- void showFullScreen(void)

- void showMaximized(void)
- void showMinimized(void)
- void showNormal(void)
- QWidget *find(int id)
- QWidget *keyboardGrabber(void)
- QWidget *mouseGrabber(void)
- void setTabOrder(QWidget *first, QWidget *second)
- QWidget *createWindowContainer(QWindow *window, QWidget *parent, Qt::WindowFlags flags)

83.353 QWindow Class

C++ Reference : <http://doc.qt.io/qt-5/qwindow.html>

Parameters : QScreen *

Parent Class : QObject

- QSize baseSize(void)
- Qt::ScreenOrientation contentOrientation(void)
- void create(void)
- QCursor cursor(void)
- void destroy(void)
- qreal devicePixelRatio(void)
- QString filePath(void)
- Qt::WindowFlags flags(void)
- QObject * focusObject(void)
- QRect frameGeometry(void)
- QMargins frameMargins(void)
- QPoint framePosition(void)
- QRect geometry(void)
- int height(void)
- QIcon icon(void)
- bool isActive(void)
- bool isAncestorOf(QWindow *child, QWindow::AncestorMode mode)
- bool isExposed(void)
- bool isModal(void)
- bool isTopLevel(void)
- bool isVisible(void)
- QPoint mapFromGlobal(QPoint pos)

- QPoint mapToGlobal(QPoint pos)
- QRegion mask(void)
- int maximumHeight(void)
- QSize maximumSize(void)
- int maximumWidth(void)
- int minimumHeight(void)
- QSize minimumSize(void)
- int minimumWidth(void)
- Qt::WindowModality modality(void)
- qreal opacity(void)
- QPoint position(void)
- void reportContentOrientationChange(Qt::ScreenOrientation orientation)
- QSurfaceFormat requestedFormat(void)
- void resize(QSize newSize)
- void resize_2(int w, int h)
- QScreen * screen(void)
- void setBaseSize(QSize size)
- void setCursor(QCursor cursor)
- void setFilePath(QString filePath)
- void setFlags(Qt::WindowFlags flags)
- void setFormat(QSurfaceFormat format)
- void setFramePosition(QPoint point)
- void setGeometry(int posx, int posy, int w, int h)
- void setGeometry_2(QRect rect)
- void setIcon(QIcon icon)
- bool setKeyboardGrabEnabled(bool grab)
- void setMask(QRegion region)
- void setMaximumSize(QSize size)
- void setMinimumSize(QSize size)
- void setModality(Qt::WindowModality modality)
- bool setMouseGrabEnabled(bool grab)
- void setOpacity(qreal level)
- void setParent(QWindow *parent)
- void setPosition(QPoint pt)
- void setPosition_2(int posx, int posy)
- void setScreen(QScreen *newScreen)

- void setSizeIncrement(QSize size)
- void setTransientParent(QWindow *parent)
- void setVisibility(QWindow::Visibility v)
- void setWindowState(Qt::WindowState state)
- QSize sizeIncrement(void)
- QString title(void)
- QWindow * transientParent(void)
- Qt::WindowType type(void)
- void unsetCursor(void)
- QWindow::Visibility visibility(void)
- int width(void)
- WId winId(void)
- Qt::WindowState windowState(void)
- int x(void)
- int y(void)
- void alert(int msec)
- bool close(void)
- void hide(void)
- void lower(void)
- void raise(void)
- void requestActivate(void)
- void setHeight(int arg)
- void setMaximumHeight(int h)
- void setMaximumWidth(int w)
- void setMinimumHeight(int h)
- void setMinimumWidth(int w)
- void setTitle(QString)
- void setVisible(bool visible)
- void setWidth(int arg)
- void setX(int arg)
- void setY(int arg)
- void show(void)
- void showFullScreen(void)
- void showMaximized(void)
- void showMinimized(void)
- void showNormal(void)

- QWindow * fromWinId(WId id)
- void setactiveChangedEvent(const char *)
- void setcontentOrientationChangedEvent(const char *)
- void setfocusObjectChangedEvent(const char *)
- void setheightChangedEvent(const char *)
- void setmaximumHeightChangedEvent(const char *)
- void setmaximumWidthChangedEvent(const char *)
- void setminimumHeightChangedEvent(const char *)
- void setminimumWidthChangedEvent(const char *)
- void setmodalityChangedEvent(const char *)
- void setopacityChangedEvent(const char *)
- void setscreenChangedEvent(const char *)
- void setvisibilityChangedEvent(const char *)
- void setvisibleChangedEvent(const char *)
- void setwidthChangedEvent(const char *)
- void setWindowStateChangedEvent(const char *)
- void setWindowTitleChangedEvent(const char *)
- void setxChangedEvent(const char *)
- void setyChangedEvent(const char *)
- const char *getactiveChangedEvent(void)
- const char *getcontentOrientationChangedEvent(void)
- const char *getfocusObjectChangedEvent(void)
- const char *getheightChangedEvent(void)
- const char *getmaximumHeightChangedEvent(void)
- const char *getmaximumWidthChangedEvent(void)
- const char *getminimumHeightChangedEvent(void)
- const char *getminimumWidthChangedEvent(void)
- const char *getmodalityChangedEvent(void)
- const char *getopacityChangedEvent(void)
- const char *getscreenChangedEvent(void)
- const char *getvisibilityChangedEvent(void)
- const char *getvisibleChangedEvent(void)
- const char *getwidthChangedEvent(void)
- const char *getWindowStateChangedEvent(void)
- const char *getWindowTitleChangedEvent(void)
- const char *getxChangedEvent(void)

- const char *getChangedEvent(void)

83.354 QXYLegendMarker Class

C++ Reference : <http://doc.qt.io/qt-5/qxylegendmarker.html>

Parent Class : QLegendMarker

- QXYSeries * series(void)
- QLegendMarker::LegendMarkerType type(void)

83.355 QXYSeries Class

C++ Reference : <http://doc.qt.io/qt-5/qxyseries.html>

Parent Class : QAbstractSeries

- void append(qreal x, qreal y)
- void append_2(QPointF point)
- void append_3(QList<QPointF> points)
- QPointF at(int index)
- QBrush brush(void)
- void clear(void)
- QColor color(void)
- int count(void)
- void insert(int index, QPointF point)
- QPen pen(void)
- bool pointLabelsClipping(void)
- QColor pointLabelsColor(void)
- QFont pointLabelsFont(void)
- QString pointLabelsFormat(void)
- bool pointLabelsVisible(void)
- QList<QPointF> points(void)
- QVector<QPointF> pointsVector(void)
- bool pointsVisible(void)
- void remove(qreal x, qreal y)
- void remove_2(QPointF point)
- void remove_3(int index)
- void removePoints(int index, int count)
- void replace(qreal oldX, qreal oldY, qreal newX, qreal newY)
- void replace_2(QPointF oldPoint, QPointF newPoint)

- void replace_3(int index, qreal newX, qreal newY)
- void replace_4(int index, QPointF newPoint)
- void replace_5(QList<QPointF> points)
- void replace_6(QVector<QPointF> points)
- void setBrush(QBrush brush)
- void setColor(QColor color)
- void setPen(QPen pen)
- void setPointLabelsClipping(bool enabled)
- void setPointLabelsColor(QColor color)
- void setPointLabelsFont(QFont font)
- void setPointLabelsFormat(QString format)
- void setPointLabelsVisible(bool visible)
- void setPointsVisible(bool visible)
- void setClickedEvent(const char *)
- void setColorChangedEvent(const char *)
- void setDoubleClickedEvent(const char *)
- void setHoveredEvent(const char *)
- void SetPenChangedEvent(const char *)
- void SetPointAddedEvent(const char *)
- void SetPointLabelsClippingChangedEvent(const char *)
- void SetPointLabelsColorChangedEvent(const char *)
- void SetPointLabelsFontChangedEvent(const char *)
- void SetPointLabelsFormatChangedEvent(const char *)
- void SetPointLabelsVisibilityChangedEvent(const char *)
- void SetPointRemovedEvent(const char *)
- void SetPointReplacedEvent(const char *)
- void SetPointsRemovedEvent(const char *)
- void SetPointsReplacedEvent(const char *)
- void SetPressedEvent(const char *)
- void SetReleasedEvent(const char *)
- const char *GetClickedEvent(void)
- const char *GetColorChangedEvent(void)
- const char *GetDoubleClickedEvent(void)
- const char *GetHoveredEvent(void)
- const char *GetPenChangedEvent(void)
- const char *GetPointAddedEvent(void)

- const char *getpointLabelsClippingChangedEvent(void)
- const char *getpointLabelsColorChangedEvent(void)
- const char *getpointLabelsFontChangedEvent(void)
- const char *getpointLabelsFormatChangedEvent(void)
- const char *getpointLabelsVisibilityChangedEvent(void)
- const char *getpointRemovedEvent(void)
- const char *getpointReplacedEvent(void)
- const char *getpointsRemovedEvent(void)
- const char *getpointsReplacedEvent(void)
- const char *getpressedEvent(void)
- const char *getreleasedEvent(void)

83.356 QXmlStreamAttribute Class

C++ Reference : <http://doc.qt.io/qt-5/qxmlstreamattribute.html>

Parameters : void

- bool isDefault(void)
- QStringRef name(void)
- QStringRef namespaceUri(void)
- QStringRef prefix(void)
- QStringRef qualifiedName(void)
- QStringRef value(void)

83.357 QXmlStreamAttributes Class

C++ Reference : <http://doc.qt.io/qt-5/qxmlstreamattributes.html>

Parameters : void

- void append(QString namespaceUri, QString name, QString value)
- void append_2(QString qualifiedName, QString value)
- bool hasAttribute(QString qualifiedName)
- bool hasAttribute_2(QLatin1String qualifiedName)
- bool hasAttribute_3(QString namespaceUri, QString name)
- QStringRef value(QString namespaceUri, QString name)
- QStringRef value_2(QString namespaceUri, QLatin1String name)
- QStringRef value_3(QLatin1String namespaceUri, QLatin1String name)
- QStringRef value_4(QString qualifiedName)
- QStringRef value_5(QLatin1String qualifiedName)

83.358 QXmlStreamEntityDeclaration Class

C++ Reference : <http://doc.qt.io/qt-5/qxmlstreamentitydeclaration.html>

Parameters : void

- QStringRef name(void)
- QStringRef notationName(void)
- QStringRef publicId(void)
- QStringRef systemId(void)
- QStringRef value(void)

83.359 QXmlStreamEntityResolver Class

C++ Reference : <http://doc.qt.io/qt-5/qxmlstreamentityresolver.html>

Parameters : void

83.360 QXmlStreamNamespaceDeclaration Class

C++ Reference : <http://doc.qt.io/qt-5/qxmlstreamnamespacedeclaration.html>

Parameters : void

- QStringRef namespaceUri(void)
- QStringRef prefix(void)

83.361 QXmlStreamNotationDeclaration Class

C++ Reference : <http://doc.qt.io/qt-5/qxmlstreamnotationdeclaration.html>

Parameters : void

- QStringRef name(void)
- QStringRef publicId(void)
- QStringRef systemId(void)

83.362 QXmlStreamReader Class

C++ Reference : <http://doc.qt.io/qt-5/qxmlstreamreader.html>

Parameters : void

- void addData(QByteArray)
- void addData_2(QString)
- void addData_3(const char * data)

- void addExtraNamespaceDeclaration(QXmlStreamNamespaceDeclaration)
- void addExtraNamespaceDeclarations(QXmlStreamNamespaceDeclarations)
- bool atEnd(void)
- QXmlStreamAttributes attributes(void)
- qint64 characterOffset(void)
- void clear(void)
- qint64 columnNumber(void)
- QIODevice *device(void)
- QStringRef documentEncoding(void)
- QStringRef documentVersion(void)
- QStringRef dtdName(void)
- QStringRef dtdPublicId(void)
- QStringRef dtdSystemId(void)
- QXmlStreamEntityDeclarations entityDeclarations(void)
- QXmlStreamEntityResolver *entityResolver(void)
- Error error(void)
- QString errorString(void)
- bool hasError(void)
- bool isCDATA(void)
- bool isCharacters(void)
- bool isComment(void)
- bool isDTD(void)
- bool isEndDocument(void)
- bool isEndElement(void)
- bool isEntityReference(void)
- bool isProcessingInstruction(void)
- bool isStandaloneDocument(void)
- bool isStartDocument(void)
- bool isStartElement(void)
- bool isWhitespace(void)
- qint64 lineNumber(void)
- QStringRef name(void)
- QXmlStreamNamespaceDeclarations namespaceDeclarations(void)
- bool namespaceProcessing(void)
- QStringRef namespaceUri(void)
- QXmlStreamNotationDeclarations notationDeclarations(void)

- QStringRef prefix(void)
- QStringRef processingInstructionData(void)
- QStringRef processingInstructionTarget(void)
- QStringRef qualifiedName(void)
- void raiseError(QString)
- QString readElementText(QXmlStreamReader::ReadElementTextBehaviour)
- TokenType readNext(void)
- bool readNextStartElement(void)
- void setDevice(QIODevice *device)
- void setEntityResolver(QXmlStreamEntityResolver *resolver)
- void setNamespaceProcessing(bool)
- void skipCurrentElement(void)
- QStringRef text(void)
- QString tokenString(void)
- TokenType tokenType(void)

83.363 QXmlStreamWriter Class

C++ Reference : <http://doc.qt.io/qt-5/qxmlstreamwriter.html>

Parameters : void

- bool autoFormatting(void)
- int autoFormattingIndent(void)
- QTextCodec *codec(void)
- QIODevice *device(void)
- bool hasError(void)
- void setAutoFormatting(bool enable)
- void setAutoFormattingIndent(int spacesOrTabs)
- void setCodec(QTextCodec *codec)
- void setCodec_2(const char *codecName)
- void setDevice(QIODevice *device)
- void writeAttribute(QString, QString, QString)
- void writeAttribute_2(QString, QString)
- void writeAttribute_3(QXmlStreamAttribute)
- void writeAttributes(QXmlStreamAttributes)
- void writeCDATA(QString text)
- void writeCharacters(QString text)

- void writeComment(QString text)
- void writeCurrentToken(QXmlStreamReader reader)
- void writeDTD(QString dtd)
- void writeDefaultNamespace(QString namespaceUri)
- void writeEmptyElement(QString namespaceUri, QString name)
- void writeEmptyElement_2(QString qualifiedName)
- void writeEndDocument(void)
- void writeEndElement(void)
- void writeEntityReference(QString name)
- void writeNamespace(QString namespaceUri, QString prefix)
- void writeProcessingInstruction(QString target, QString data)
- void writeStartDocument(QString version)
- void writeStartDocument_2(QString version, bool standalone)
- void writeStartDocument_3(void)
- void writeStartElement(QString namespaceUri, QString name)
- void writeStartElement_2(QString qualifiedName)
- void writeTextElement(QString namespaceUri, QString name, QString text)
- void writeTextElement_2(QString qualifiedName, QString text)

83.364 Qt3DCamera Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dcamera.html>

Parameters : Qt3DCore::QNode *

Parent Class : QEntity

- float aspectRatio(void)
- float bottom(void)
- float exposure(void)
- float farPlane(void)
- float fieldOfView(void)
- float left(void)
- QCameraLens *lens(void)
- float nearPlane(void)
- void pan(float angle)
- void pan_2(float angle, QVector3D axis)
- void panAboutViewCenter(float angle)
- void panAboutViewCenter_2(float angle, QVector3D axis)

- `QQuaternion panRotation(float angle)`
- `QVector3D position(void)`
- `QMatrix4x4 projectionMatrix(void)`
- `Qt3DRRender::QCameraLens::ProjectionType projectionType(void)`
- `float right(void)`
- `void roll(float angle)`
- `void rollAboutViewCenter(float angle)`
- `QQuaternion rollRotation(float angle)`
- `void rotate(QQuaternion q)`
- `void rotateAboutViewCenter(QQuaternion q)`
- `QQuaternion rotation(float angle, QVector3D axis)`
- `void tilt(float angle)`
- `void tiltAboutViewCenter(float angle)`
- `QQuaternion tiltRotation(float angle)`
- `float top(void)`
- `Qt3DCore::QTransform * transform(void)`
- `void translate(QVector3D vLocal, Qt3DRRender::QCamera::CameraTranslationOption option)`
- `void translateWorld(QVector3D vWorld, Qt3DRRender::QCamera::CameraTranslationOption option)`
- `QVector3D upVector(void)`
- `QVector3D viewCenter(void)`
- `QVector3D viewVector(void)`
- `void setAspectRatio(float aspectRatio)`
- `void setBottom(float bottom)`
- `void setExposure(float exposure)`
- `void setFarPlane(float farPlane)`
- `void setFieldOfView(float fieldOfView)`
- `void setLeft(float left)`
- `void setNearPlane(float nearPlane)`
- `void setPosition(QVector3D position)`
- `void setProjectionMatrix(QMatrix4x4 projectionMatrix)`
- `void setProjectionType(Qt3DRRender::QCameraLens::ProjectionType type)`
- `void setRight(float right)`
- `void setTop(float top)`
- `void setUpVector(QVector3D upVector)`
- `void setViewCenter(QVector3D viewCenter)`
- `void viewAll(void)`

- void viewEntity(Qt3DCore::QEntity *entity)
- void viewSphere(QVector3D center, float radius)

83.365 Qt3DWindow Class

C++ Reference : <http://doc.qt.io/qt-5/qt3dextras-qt3dwindow.html>

Parameters : void

Parent Class : QWindow

- Qt3DRender::QFrameGraphNode * activeFrameGraph(void)
- QForwardRenderer * defaultFrameGraph(void)
- void registerAspect(Qt3DCore::QAbstractAspect *aspect)
- void registerAspect_2(QString name)
- Qt3DRender::QRenderSettings * renderSettings(void)
- void setActiveFrameGraph(Qt3DRender::QFrameGraphNode *activeFrameGraph)
- void setRootEntity(Qt3DCore::QEntity *root)
- Qt3DCamera *camera(void)

83.366 RingCodeHighlighter Class

Parameters : QTextDocument *parent

- void setColors(QColor c1,QColor c2,QColor c3,QColor c4,QColor c5)
- void setKeywordsBold(int nStatus)

CHAPTER
EIGHTYFOUR

LOW LEVEL FUNCTIONS

In this chapter we will learn about the low level functions provided by Ring

```
* callgarbagecollector() | callgc()
* variablepointer()      | varptr()
* space()
* nullpointer()         | nullptr()
* object2pointer()      | obj2ptr()
* pointer2object()      | ptr2obj()
* ispointer()           | isptr()
* pointercompare()      | ptrcmp()
* setpointer()          | setptr()
* getpointer()          | getptr()
* pointer2string()      | ptr2str()
* memorycopy()          | memcpy()
* ringvm_cfunctionslist()
* ringvm_functionslist()
* ringvm_classeslist()
* ringvm_packageslist()
* ringvm_memorylist()
* ringvm_calllist()
* ringvm_fileslist()
* ringvm_settrace()
* ringvm_tracedata()
* ringvm_traceevent()
* ringvm_tracefunc()
* ringvm_scopescount()
* ringvm_evalinscope()
* ringvm_passerror()
* ringvm_hideerrorMsg()
* ringvm_callfunc()
* ringvm_see()
* ringvm_give()
* ringvm_info()
```

84.1 callgc() function

Syntax:

callgc()	<i># Short name</i>
callgarbagecollector()	<i># Long name</i>

Use this function to force calling the garbage collector during function execution when you use a loop that create temp. variables that you don't free using the assignment operation.

It's very rare to need this function but it's useful when you create something like event-loop for your game engine and start creating lists on the fly when you call functions.

Example

```
While True
    # process events
    # call functions using temp. lists like myfunc(["temp list"])

    # call the garbage collector
    callgc()
End
```

Tip: In Ring the garbage collector works automatically in the end of function execution or when you use the assignment statement.

84.2 varptr() function

Use the varptr() function when you need to pass a pointer to a C/C++ function.

Syntax:

varptr(cVariableName,cPointerType) ---> Low Level Object (C Pointer)
variablepointer(cVariableName,cPointerType) ---> Low Level Object (C Pointer)

example:

```
r = 10
z = 20
see r + nl
see varptr("r","int")
see varptr("z","int")
```

Output:

10
00E3C740
int
2
00E3BEC0
int
2

Note: the low level object is a list contains three items (The Pointer, The Type, The Status)

84.3 space() function

Use the space function to allocate a specific number of bytes in Memory.

Syntax:

```
Space(nBytesCount) ---> String
```

Example:

```
mystring = space(200)
See "String Size : " + len(mystring) + nl
See "String : " + mystring + nl
See "String Pointer : "
See varptr("mystring", :char)
```

Output:

```
String Size : 200
String :
String Pointer : 00FF8FE8
char
2
```

Note: You may need the space() and VarPtr() functions to pass buffers to C functions.

Tip: To free the memory allocated using the space() function, use the Assignment operator

```
mystring = space(1000) # Allocate memory (1000 bytes)
mystring = NULL        # Free memory stored in mystring
```

Note: We don't need to free the memory if it's a local variable that will be deleted after the function execution.

84.4 nullpointer() function

Syntax:

```
nullptr()           # Short name
nullpointer()       # Long name
```

You may need to pass the NULL pointer to a C function that may expect a pointer as parameter and accept NULL pointers for optional parameters.

Example:

The next example uses the `SDL_BlitSurface()` function from the LibSDL Library through RingSDL. The function accept `SDL_Rect` pointers in the second and the last parameter. Also the function accept NULL pointers, so we can pass them using the `NULLPointer()` Function.

```
SDL_BlitSurface(text, nullpointer(), surface, nullpointer())
```

Note: The previous code doesn't work alone, you need to learn how to use RingSDL first.

Tip: We can pass NULL as parameter instead of using the `NULLPointer()` function

```
SDL_BlitSurface(text, NULL, surface, NULL)
```

84.5 object2pointer() function

Use this function to get a C pointer for Ring lists and objects

Syntax:

<code>obj2ptr(List Object) --> Low Level Object (C Pointer)</code>	<i># Short name</i>
<code>object2pointer(List Object) --> Low Level Object (C Pointer)</code>	<i># Long name</i>

Note: You have to be sure that the Pointer still valid (Doesn't point to deallocated memory)

84.6 pointer2object() function

Use this function to get the Ring list and/or object from the low level object (C Pointer)

Syntax:

<code>ptr2obj(Low Level Object) ---> List Object</code>	<i># Short name</i>
<code>pointer2object(Low Level Object) ---> List Object</code>	<i># Long name</i>

Note: You have to be sure that the Pointer still valid (Doesn't point to deallocated memory)

Example:

```
# Create the list
mylist = 1:5

# Create pointer to the list
x = object2pointer(mylist)
see x

see nl

# Add items to the list
```

(continues on next page)

(continued from previous page)

```
mylist + "welcome"

# print the list items
y = pointer2object(x)
see y
```

Output:

```
0069A5D8
OBJECTPOINTER
0

1
2
3
4
5
welcome
```

Note: In Ring the assignment operator copy lists and objects by value, to copy by reference Just use the object2pointer() and pointer2object() functions.

Tip: The object2pointer() and pointer2object() are used in the stdlib - Tree Class implementation to create a reference for the parent node (object) in the child node (another object).

The functions Object2Pointer() and Pointer2Object() are low level functions

We have to be careful when using them to avoid memory problems

If we created a Pointer to a (Local Variable)

This local variable will be deleted from the memory after the end of the function/method execution

This means that the pointer created with Object2Pointer() will becomes a dangling pointer

i.e. A pointer that points to the memory location of the deallocated memory

Using this invalid pointer could lead to (CRASH or Memory Corruption).

If you will use pointers (Using Object2Pointer() or Pointer2Object) then never use pointers that point to the memory that are deallocated.

In simple words, Keep the memory (Don't delete it if you still need it)

i.e. instead of using (Local Variables) that will be deleted, You can use Class Attributes or Global Variables.

84.7 ispointer() function

Check if the parameter is a pointer (C Object) or not.

Syntax:

<code>IsPtr(vPara) ---> True False</code>	<code># Short name</code>
<code>IsPointer(vPara) ---> True False</code>	<code># Long name</code>

Example :

```
fp = fopen(filename(), "r")
? type(fp)
? ispointer(fp)
```

Output :

```
file
1
```

84.8 ptrcmp() function

We can compare between two pointers (C Objects) using the ptrcmp() function.

Syntax:

<code>ptrcmp(oObject1,oObject2) ---> value = 1 if oObject1 = oObject2</code>	<code>value = 0 if oObject1 != oObject2</code>
<code>pointercompare(oObject1,oObject2) ---> value = 1 if oObject1 = oObject2</code>	<code>value = 0 if oObject1 != oObject2</code>

Example:

```
fp = fopen("ptrcmp.ring", "r")
fp2 = fp
fp3 = fopen("ptrcmp.ring", "r")

see ptrcmp(fp,fp2) + nl
see ptrcmp(fp,fp3) + nl

fclose(fp)
fclose(fp3)
```

Output:

```
1
0
```

84.9 setpointer() function

Set the pointer address to another address

Syntax:

<code>setptr(pointer,nNewAddress)</code>	<i># Short name</i>
<code>setpointer(pointer,nNewAddress)</code>	<i># Long name</i>

Note: Using `setPointer()` and `getPointer()` functions we can change the Memory Address

84.10 getpointer() function

Get the pointer address

Syntax:

<code>getptr(pointer) ---> nAddress</code>	<i># Short name</i>
<code>getpointer(pointer) ---> nAddress</code>	<i># Long name</i>

Example:

```
? "Sample about using setPointer() and getPointer() functions"
? copy("=",50)
pointer = NULLPOINTER()
? pointer
? "Type: " + type(pointer)
? "Address: " + Upper(hex(getpointer(pointer)))
? copy("=",50)
name = "ring"
pointer = varptr(:name,:char)
? pointer
? "Type: " + type(pointer)
? "Address: " + Upper(hex(getpointer(pointer)))
? copy("=",50)
setpointer(pointer, getpointer(pointer) + 1 )
? "After Update"
? "Address: " + Upper(hex(getpointer(pointer)))
? copy("=",50)
```

Output:

```
=====
00000000
NULLPOINTER
0

Type: NULLPOINTER
Address: 0
=====
026E2BA8
char
0
```

(continues on next page)

(continued from previous page)

```
Type: char
Address: 26E2BA8
=====
After Update
Address: 26E2BA9
=====
```

84.11 pointer2string() function

Convert a pointer to a string of binary data

If you want to convert the string to a pointer again use VarPtr() function

Syntax:

<code>ptr2str(pointer,nStart,nCount) ---> cString</code>	<i># Short name</i>
<code>pointer2string(pointer,nStart,nCount) ---> cString</code>	<i># Long name</i>

Note: pointer2String() return another copy of the data

Note: if nStart is Zero, this means starting from the first character

Example:

```
name = "ring"
pointer = varptr(:name,:char)
? pointer
? "Type: " + type(pointer)
? "Address: " + Upper(hex(getpointer(pointer)))

? "Get 4 bytes starting from the pointer address"
mystring = Pointer2String(pointer,0,4)
? mystring

? "Get 2 bytes starting from the pointer address + 1"
mystring2 = Pointer2String(pointer,1,2)
? mystring2
```

Output:

```
01E03380
char
0

Type: char
Address: 1E03380
Get 4 bytes starting from the pointer address
ring
Get 2 bytes starting from the pointer address + 1
in
```

84.12 memcpy() function

Syntax:

<code>memcpy(pDestinationPointer, cSourceString, nSize)</code>	<i># Short name</i>
<code>memorycopy(pDestinationPointer, cSourceString, nSize)</code>	<i># Long name</i>

Example:

```
str = space(9)
pointer = varptr(:str, "char")
memcpy(pointer, "one", 3)
? str
setPointer(pointer, getPointer(pointer)+3)
memcpy(pointer, "one", 3)
? str
setPointer(pointer, getPointer(pointer)+3)
memcpy(pointer, "one", 3)
? str
```

Output:

```
one
oneone
oneoneone
```

84.13 ringvm_cfunctionslist() function

The Function return a list of functions written in C.

Syntax:

<code>RingVM_CFunctionsList()</code>	---> List
--------------------------------------	------------------

Example:

See	<code>RingVM_CFunctionsList()</code>
------------	--------------------------------------

84.14 ringvm_functionslist() function

The Function return a list of functions written in Ring.

Each List Member is a list contains the next items

- Function Name
- Program Counter (PC) - Function Position in Byte Code.
- Source Code File Name
- Private Flag (For Private Methods in Classes)

Syntax:

```
RingVM_FunctionsList() ---> List
```

Example:

```
test()

func test
    see ringvm_functionslist()
```

Output:

```
test
8
B:/ring/tests/scripts/functionslist.ring
0
```

84.15 ringvm_classeslist() function

The Function return a list of Classes.

Each List Member is a list contains the next items

- Class Name
- Program Counter (PC) - Class Position in Byte Code.
- Parent Class Name
- Methods List
- Flag (Is parent class information collected)
- Pointer to the package (or NULL if no package is used)

Syntax:

```
RingVM_ClassesList() ---> List
```

Example:

```
see ringvm_classeslist()

class class1
    func f1
class class2 from class1
class class3 from class1
```

Output:

```
class1
9

f1
13
B:/ring/tests/scripts/classeslist.ring
0
0
```

(continues on next page)

(continued from previous page)

```
00000000
class2
16
class1
0
00000000
class3
20
class1
0
00000000
```

84.16 ringvm_packageslist() function

The Function return a list of Packages.

Each List Member is a list contains the next items

- Package Name
- Classes List

Syntax:

```
RingVM_PackagesList () ---> List
```

Example:

```
see ringvm_packageslist()

package package1
    class class1

package package2
    class class1

package package3
    class class1
```

Output:

```
package1
class1
11

0
00FEF838
package2
class1
17

0
00FEF978
package3
class1
```

(continues on next page)

(continued from previous page)

23

0

00FEFF68

84.17 ringvm_memorylist() function

The Function return a list of Memory Scopes and Variables.

Each List Member is a list contains variables in a different scope.

Each Item in the scope list is a list contains the next items

- Variable Name
- Variable Type
- Variable Value
- Pointer Type (List/Item) if the value is a list
- Private Flag (if the variable is an attribute in a Class)

Syntax:

```
RingVM_MemoryList() ---> List
```

Example:

```
x = 10
test()
func test
    y = 20
    see ringvm_memorylist()
```

Output:

```
true
2
1
0
0
false
2
0
0
0
n1
1

0
0
null
1

0
```

(continues on next page)

(continued from previous page)

```
0
ring_gettemp_var
4
00000000
0
0
ccatcherror
1
NULL
0
0
ring_settemp_var
4
00000000
0
0
ring_tempflag_var
2
0
0
0
stdin
3
50512DB8
file
0
0
0
stdout
3
50512DD8
file
0
0
0
stderr
3
50512DF8
file
0
0
0
this
4
00000000
0
0
sysargv
3
B:\ring\bin\ring
B:/ring/tests/scripts/memorylist.ring
0
0
x
2
10
0
```

(continues on next page)

(continued from previous page)

```
0
Y
2
20
0
0
```

84.18 ringvm_calllist() function

The Function return a list of the functions call list.

Each List Member is a list contains the next items

- Function Type
- Function Name
- Program Counter (PC)
- Stack Pointer (SP)
- Temp. Memory List
- Method or Function Flag
- Caller PC
- FuncExec Flag
- ListStart Flag
- Nested Lists Pointer
- State List

Syntax:

```
RingVM_CallList() ---> List
```

Example:

```
hello()
func hello
    test()

func test
    mylist = ringvm_calllist()
    for t in mylist see t[2] + nl next
```

Output:

```
function hello() in file B:/ring/tests/scripts/calllist.ring
called from line 1
function test() in file B:/ring/tests/scripts/calllist.ring
called from line 3
ringvm_calllist
```

84.19 ringvm_fileslist() function

Function return a list of the Ring Files.

Syntax:

```
RingVM_FilesList() ---> List
```

Example:

```
load "stdlib.ring"
see ringvm_fileslist()
```

Output:

```
B:/ring/tests/scripts/fileslist.ring
B:\ring\bin\stdlib.ring
eval
stdlib.ring
stdlib.rh
stdclasses.ring
stdfunctions.ring
stdbase.ring
stdstring.ring
stdlist.ring
stdstack.ring
stdqueue.ring
stdmath.ring
stddatetime.ring
stdfile.ring
stdsystem.ring
stddebug.ring
stddatatype.ring
stdconversion.ring
stdodbc.ring
stdmysql.ring
stdsecurity.ring
stdinternet.ring
stdhashtable.ring
stdtree.ring
```

84.20 ringvm_settrace()

The function ringvm_settrace() determine the Trace function name

The trace function is a Ring function that will be called for each event

Syntax:

```
RingVM_SetTrace(cCode)
```

84.21 ringvm_tracedata()

Inside the function that we will use for tracing events

We can use the ringvm_tracedata() function to get the event data.

The event data is a list contains the next items

- The Source Code Line Number
- The Source File Name
- The Function/Method Name
- Method or Function (Bool : True=Method, False=Function/File)

Syntax:

```
RingVM_TraceData() ---> aDataList
```

84.22 ringvm_traceevent()

Inside the function that we will use for tracing events

We can use ringvm_traceevent() to know the event type

- New Line
- Before Function
- After Function
- Runtime Error
- Before C Function
- After C Function

Syntax:

```
RingVM_TraceEvent() ---> nTraceEvent
```

84.23 ringvm_tracefunc()

The function return the name of the function that we are using for tracing events.

Syntax:

```
RingVM_TraceEvent() ---> cCode
```

84.24 ringvm_scopescount()

We can use the RingVM_ScopesCount() function to know the number of scopes used in the application.

In the start of the program, We have the (global scope only)

When we call a function, A new scope is created.

When the function execution is done, the function scope is deleted.

Syntax:

```
RingVM_ScopesCount () ---> nScopes
```

84.25 ringvm_evalinscope()

The function ringvm_evalinscope() is similar to the eval() function

Unlike eval() which execute the code in the current scope

Using RingVM_EvalInScope() we can execute the code in a specific scope.

Syntax:

```
RingVM_EvalInScope (nScope, cCode)
```

84.26 ringvm_passerror()

When we have runtime error, After printing the Error message, Ring will end the execution of the program.

Using ringvm_passerror() we can avoid that, and continue the execution of our program.

Syntax:

```
RingVM_PassError ()
```

84.27 ringvm_hideerrmsg()

We can disable/enable displaying the runtime error messages using the RingVM_HideErrorMsg() function.

Syntax:

```
RingVM_HideErrorMsg (lStatus)
```

84.28 ringvm_callfunc()

We can call a function from a string without using eval() using the ringvm_callfunc()

Syntax:

```
RingVM_CallFunc(cFuncName)
```

84.29 Example - Using the Trace Functions

The next example use the Trace Functions to trace the program Events!

In practical, We will use the Trace Library instead of these low level functions!

```
load "tracelib.ring"

ringvm_settrace("mytrace()")

see "Hello, world!" + nl
see "Welcome" + nl
see "How are you?" +nl
mytest()
new myclass { mymethod() }

func mytest
    see "Message from mytest" + nl

func mytrace
    see "===== The Trace function is Active =====" + nl +
        "Trace Function Name : " + ringvm_TraceFunc() + nl +
        "Trace Event : "
    switch ringvm_TraceEvent()
        on TRACEEVENT_NEWLINE
        on TRACEEVENT_NEWFUNC
        on TRACEEVENT_RETURN
        on TRACEEVENT_ERROR
        on TRACEEVENT_BEFORCFUNC
        on TRACEEVENT_AFTERCFUNC
    off
    see nl +
        "Line Number : " + ringvm_tracedata() [TRACEDATA_LINENUMBER] + nl +
        "File Name : " + ringvm_tracedata() [TRACEDATA_FILENAME] + nl +
        "Function Name : " + ringvm_tracedata() [TRACEDATA_FUNCNAME] + nl +
        "Method or Function : "
    if ringvm_tracedata() [TRACEDATA_METHODORFUNC] =
        TRACEDATA_METHODORFUNC_METHOD
        see "Method"
    else
        if ringvm_tracedata() [TRACEDATA_FUNCNAME] = NULL
            see "Command"
        else
            see "Function"
        ok
    ok
    see nl + Copy("=", 42) + nl
```

(continues on next page)

(continued from previous page)

```
class myclass
    func mymethod
        see "Message from mymethod" + nl
```

Output:

```
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : After C Function
Line Number : 3
File Name   : test1.ring
Function Name : ringvm_settrace
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 5
File Name   : test1.ring
Function Name :
Method or Function : Command
=====
Hello, world!
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 6
File Name   : test1.ring
Function Name :
Method or Function : Command
=====
Welcome
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 7
File Name   : test1.ring
Function Name :
Method or Function : Command
=====
How are you?
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 8
File Name   : test1.ring
Function Name :
Method or Function : Command
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Function
Line Number : 8
File Name   : test1.ring
Function Name : mytest
Method or Function : Function
```

(continues on next page)

(continued from previous page)

```
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 12
File Name : test1.ring
Function Name : mytest
Method or Function : Function
=====
Message from mytest
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 14
File Name : test1.ring
Function Name : mytest
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : Return
Line Number : 8
File Name : test1.ring
Function Name :
Method or Function : Command
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 9
File Name : test1.ring
Function Name :
Method or Function : Command
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 43
File Name : test1.ring
Function Name :
Method or Function : Command
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : Before C Function
Line Number : 9
File Name : test1.ring
Function Name : ismethod
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : After C Function
Line Number : 9
File Name : test1.ring
Function Name : ismethod
Method or Function : Function
```

(continues on next page)

(continued from previous page)

```
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Function
Line Number : 9
File Name : test1.ring
Function Name : mymethod
Method or Function : Method
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 44
File Name : test1.ring
Function Name : mymethod
Method or Function : Method
=====
Message from mymethod
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : Return
Line Number : 9
File Name : test1.ring
Function Name :
Method or Function : Command
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : Before C Function
Line Number : 9
File Name : test1.ring
Function Name : ismethod
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : After C Function
Line Number : 9
File Name : test1.ring
Function Name : ismethod
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : Before C Function
Line Number : 9
File Name : test1.ring
Function Name : ismethod
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : After C Function
Line Number : 9
File Name : test1.ring
Function Name : ismethod
Method or Function : Function
```

(continues on next page)

(continued from previous page)

```
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 11
File Name : test1.ring
Function Name :
Method or Function : Command
=====
```

84.30 Example - The Trace Library

The next example uses the Trace functions provided by the Ring language to create the Trace library.

Using the Trace library we have nice Tracing tools and Interaction debugger too.

```
# Trace Events
TRACEEVENT_NEWLINE      = 1
TRACEEVENT_NEWFUNC      = 2
TRACEEVENT_RETURN        = 3
TRACEEVENT_ERROR         = 4
TRACEEVENT_BEFOREFUNC   = 5
TRACEEVENT_AFTERFUNC    = 6

# Trace Data
TRACEDATA_LINENUMBER   = 1
TRACEDATA_FILENAME       = 2
TRACEDATA_FUNCNAME      = 3
TRACEDATA_METHODORFUNC  = 4

# Method of Function
TRACEDATA_METHODORFUNC_METHOD      = TRUE
TRACEDATA_METHODORFUNC_NOTMETHOD  = FALSE

TRACE_BREAKPOINTS = TRUE

TRACE_TEMPLIST = []

func Trace cType
    switch trim(lower(cType))
    on :AllEvents
        ringvm_settrace("TraceLib_AllEvents()")
    on :Functions
        ringvm_settrace("TraceLib_Functions()")
    on :PassError
        ringvm_settrace("TraceLib_PassError()")
    on :Debugger
        ringvm_settrace("TraceLib_Debugger()")
    on :LineByLine
        ringvm_settrace("TraceLib_LineByLine()")
    off

func TraceLib_AllEvents
    if right(ringvm_tracedata() [TRACEDATA_FILENAME],13) = "tracelib.ring"
```

(continues on next page)

(continued from previous page)

```

        return
ok
see "===== The Trace function is Active =====" + nl +
    "Trace Function Name : " + ringvm_TraceFunc() + nl +
    "Trace Event : "
switch ringvm_TraceEvent()
    on TRACEEVENT_NEWLINE           see "New Line"
    on TRACEEVENT_NEWFUNC          see "New Function"
    on TRACEEVENT_RETURN            see "Return"
    on TRACEEVENT_ERROR             see "Error"
    on TRACEEVENT_BEFORCFUNC       see "Before C Function"
    on TRACEEVENT_AFTERCFUNC       see "After C Function"
off
see nl +
    "Line Number : " + ringvm_tracedata()[TRACEDATA_LINENUMBER] + nl +
    "File Name   : " + ringvm_tracedata()[TRACEDATA_FILENAME] + nl +
    "Function Name : " + ringvm_tracedata()[TRACEDATA_FUNCNAME] + nl +
    "Method or Function : "
if ringvm_tracedata()[TRACEDATA_METHODORFUNC] =
    TRACEDATA_METHODORFUNC_METHOD
    see "Method"
else
    if ringvm_tracedata()[TRACEDATA_FUNCNAME] = NULL
        see "Command"
    else
        see "Function"
ok
ok
see nl + Copy("=",42) + nl

func TraceLib_Functions
    if right(ringvm_tracedata()[TRACEDATA_FILENAME],13) = "tracelib.ring"
        return
ok
switch ringvm_TraceEvent()
    on TRACEEVENT_NEWFUNC
        see "Open Func : " +
            ringvm_TraceData()[TRACEDATA_FUNCNAME] + nl
    on TRACEEVENT_RETURN
        see "Return to Func : " +
            ringvm_TraceData()[TRACEDATA_FUNCNAME] + nl
off

func TraceLib_PassError
    if right(ringvm_tracedata()[TRACEDATA_FILENAME],13) = "tracelib.ring"
        return
ok
switch ringvm_TraceEvent()
    on TRACEEVENT_ERROR
        see nl
        see "TraceLib : After Error !" + nl
        ringvm_passerror()
off

func TraceLib_Debugger
    if right(ringvm_tracedata()[TRACEDATA_FILENAME],13) = "tracelib.ring"
        return

```

(continues on next page)

(continued from previous page)

```

ok
switch ringvm_TraceEvent()
    on TRACEEVENT_ERROR
        _BreakPoint()
off

func TraceLib_LineByLine
    if right(ringvm_tracedata() [TRACEDATA_FILENAME],13) = "tracelib.ring" or
        ringvm_TraceEvent() != TRACEEVENT_NEWLINE
    return
ok
aList = ringvm_tracedata()
see "Before Line : " + aList[TRACEDATA_LINENUMBER] + nl
_BreakPoint()

func BreakPoint
    if not TRACE_BREAKPOINTS
        return
ok
_BreakPoint()

func _BreakPoint
    see nl+nl+Copy("=",60) + nl +
    Copy(" ",20)+"Interactive Debugger" + nl +
    Copy("=",60) + nl +
    "Command (Exit)      : End Program" + nl +
    "Command (Cont)     : Continue Execution" + nl +
    "Command (Locals)   : Print local variables names" + nl +
    "Command (LocalsData) : Print local variables data" + nl +
    "Command (Globals)  : Print global variables names" + nl +
    "We can execute Ring code" + nl +
    Copy("=",60) + nl
    while true
        see nl + "code:> "
        give cCode
        cmd = trim(lower(cCode))
        if cmd = "exit" or cmd = "bye"
            shutdown()
        ok
        nScope = ringvm_scopescount() -2
        switch cmd
            on "locals"
                ringvm_EvalInScope(nScope,"see locals() callgc()")
                loop
            on "localsdata"
                PrintLocalsData(nScope)
                loop
            on "globals"
                ringvm_EvalInScope(nScope,"see globals() callgc()")
                loop
            on "cont"
                ringvm_passerror()
                exit
        off
    Try
        ringvm_EvalInScope(nScope,cCode)
    catch

```

(continues on next page)

(continued from previous page)

```

        see cCatchError
    done
end

func NoBreakPoints
    TRACE_BREAKPOINTS = FALSE


func PrintLocalsData nScope
    if nScope = 1    # Global
        ringvm_Evalinscope(nScope, 'TRACE_TEMPLIST = globals()')
    else
        ringvm_Evalinscope(nScope, 'TRACE_TEMPLIST = locals() callgc()')
    ok
    see nl
    aTempList = TRACE_TEMPLIST
    TRACE_TEMPLIST = []
    nSpaces = 5
    for TRACE_ITEM in aTempList
        if len(TRACE_ITEM) + 5 > nSpaces
            nSpaces = len(TRACE_ITEM) + 5
        ok
    next
    for TRACE_ITEM in aTempList
        see "Variable : " + TRACE_ITEM
        cVarName = TRACE_ITEM
        see copy(" ",nSpaces-len(cVarName)) + " Type : "
        ringvm_Evalinscope(nScope,"see type(" + TRACE_ITEM +")")
        ringvm_Evalinscope(nScope,"see Copy(' ',fabs(15-len(type(" +
                           TRACE_ITEM +")))))")
        see " Value : "
        ringvm_Evalinscope(nScope,"see " + TRACE_ITEM)
        see nl
    next

```

84.31 ringvm_see() function

Using the ringvm_see() function we can redefine the behavior of the See command

Also we can use ring_see() to have the original behavior

Example:

```

see "Hello world" + nl
see 123 + nl
see ["one","two","three"]
see new point {x=10 y=20 z=30}

func ringvm_see t
    ring_see("We want to print: ")
    ring_See(t)

class point x y z

```

Output:

```
We want to print: Hello world
We want to print: 123
We want to print: one
two
three
We want to print: x: 10.000000
y: 20.000000
z: 30.000000
```

84.32 ringvm_give() function

Using the ringvm_give() function we can redefine the behavior of the Give command

Example:

```
see "Name: " give name
see "Hello " + name

func ringvm_give
    see "Mahmoud" + nl
    return "Mahmoud"
```

Output:

```
Name: Mahmoud
Hello Mahmoud
```

84.33 ringvm_info() function

The ringvm_info() is an internal function that return a list of information about the Ring VM structure.

It's used only by the Ring Team in advanced tests to check the VM status.

Syntax:

```
ringvm_info() ---> List of information about the VM structure
```

CHAPTER
EIGHTYFIVE

TUTORIAL: RING EXTENSIONS IN C/C++

In this chapter we will see simple examples about using C code in Ring programs

85.1 Hello World

Sample : ring/extensions/tutorial/helloworld

The file mylib.c contains

```
#include "ring.h"

#include "stdlib.h"

RING_FUNC(ring_myfunction)
{
    printf("Hello, World!");
}

RING_API void ringlib_init(RingState *pRingState)
{
    ring_vm_funcregister("myfunction", ring_myfunction);
}
```

As we see in the source code, we start with including the ring.h file which contains the definitions for Ring API

Then we use the RING_FUNC macro to define new functions, it's a good idea to start the function definition with **ring_** to make these definitions unique and different than normal C functions

Then we have the function ringlib_init that will be called when the extension is loaded by the Ring VM

In this function we use the ring_vm_funcregister() function to register the new functions in Ring VM

Then we build the extension using :

buildvc.bat

The file buildvc.bat contains the next commands to build the extension using Visual C/C++

```
cls
call ../../src/locatevc.bat
cl /c /DEBUG mylib.c -I"..\..\..\include"
link /DEBUG mylib.obj ..\..\..\lib\ring.lib /DLL /OUT:mylib.dll /SUBSYSTEM:CONSOLE,
  ↵"5.01"
del mylib.obj
```

Then we test the function using

```
ring test.ring
```

The file test.ring contains

```
? "Loading Library"
loadlib("mylib.dll")

? "Calling a C Function"
myfunction()
```

Output

```
Loading Library
Calling a C Function
Hello, World!
```

85.2 Build the extension on different platforms

Sample : ring/extensions/tutorial/helloworld2

This extension is the same as the first one but in this time, we support Windows, Linux and macOS.

We will use the next files

```
buildvc.bat
buildgcc.sh
buildclang.sh
```

Where we use buildvc.bat in Windows, buildgcc.sh in Linux and buildclang.sh in macOS

The file buildgcc.sh contains the next commands

```
gcc -c -fpic mylib.c -I $PWD/../../include
gcc -shared -o libmylib.so mylib.o -L $PWD/../../lib -lring
sudo cp libmylib.so /usr/lib
sudo cp libmylib.so /usr/lib64
```

The file buildclang.sh contains

```
clang -c -fpic mylib.c -I $PWD/../../include
clang -dynamiclib -o libmylib.dylib mylib.o -L $PWD/../../lib -lring
cp libmylib.dylib /usr/local/lib
```

This time we use mylib.ring instead of using LoadLib() function directly

In mylib.ring we have the next code

```
if iswindows()
    LoadLib("mylib.dll")
but ismacosx()
    LoadLib("libmylib.dylib")
else
    LoadLib("libmylib.so")
ok
```

The file test.ring contains

```
? "Loading Library"
load "mylib.ring"

? "Calling a C Function"
myfunction()
```

Then we test the function using

```
ring test.ring
```

Output

```
Loading Library
Calling a C Function
Hello, World!
```

85.3 Sum Two Numbers

Sample : ring/extensions/tutorial/sumtwonumbers

In this extension we learn how to create a C function to sum two numbers

This extension is an update to the (Hello World 2) extension in : ring/extensions/tutorial/helloworld2 folder

In mylib.c we update the file to add

```
RING_FUNC(ring_sumtwonumbers)
{
    double nNum1,nNum2,nSum;
    // Check Parameters Count
    if (RING_API_PARACOUNT != 2) {
        RING_API_ERROR(RING_API_MISS2PARA);
        return;
    }
    // Check Parameters Type
    if ( ! (RING_API_ISNUMBER(1) && RING_API_ISNUMBER(2)) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return;
    }
    // Sum Numbers
    nNum1 = RING_API_GETNUMBER(1);
    nNum2 = RING_API_GETNUMBER(2);
    nSum = nNum1 + nNum2 ;
    // Return Output
    RING_API_RETNUMBER(nSum);
}
```

Then we register the new function

```
ring_vm_funcregister("sumtwonumbers",ring_sumtwonumbers);
```

The previous code is written to check errors, and to be easy to understand

We can write short code like

```
RING_API_RETNUMBER(RING_API_GETNUMBER(1) + RING_API_GETNUMBER(2));
```

The file test.ring contains

```
? "Loading Library"
load "mylib.ring"

? "Calling a C Function"
myfunction()

? "Sum Two Numbers (3,5)"
? SumTwoNumbers(3,5)
```

Then we test the function using

```
ring test.ring
```

Output

```
Loading Library
Calling a C Function
Hello, World!
Sum Two Numbers (3,5)
8
```

85.4 Say Hello

Sample : ring/extensions/tutorial/sayhello

In this extension we learn how to create a C function that get a name as string then say hello.

This extension is an update to the (sumtwonumbers) extension in : ring/extensions/tutorial/sumtwonumbers folder

In mylib.c we update the file to add

```
RING_FUNC(ring_sayhello)
{
    // Check Parameters Count
    if (RING_API_PARACOUNT != 1) {
        RING_API_ERROR(RING_API_MISS1PARA);
        return;
    }
    // Check Parameters Type
    if ( ! RING_API_ISSTRING(1) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return;
    }
    printf("Hello %s\n", RING_API_GETSTRING(1));
}
```

Then we register the new function

```
ring_vm_funcregister("sayhello", ring_sayhello);
```

The file test.ring contains

```
? "Loading Library"
load "mylib.ring"
```

(continues on next page)

(continued from previous page)

```
? "Calling a C Function"
myfunction()

? "Sum Two Numbers (3,5)"
? SumTwoNumbers(3,5)

? "Say Hello"
SayHello("Mahmoud")
```

Then we test the function using

```
ring test.ring
```

Output

```
Loading Library
Calling a C Function
Hello, World!
Sum Two Numbers (3,5)
8
Say Hello
Hello Mahmoud
```

85.5 Sum List of Numbers

Sample : ring/extensions/tutorial/sumlist

In this extension we learn how to create a C function that sum list of numbers.

This extension is an update to the (sayhello) extension in : ring/extensions/tutorial/sayhello folder

In mylib.c we update the file to add

```
RING_FUNC(ring_sumlist)
{
    List *pList;
    int x,nSum;
    // Check Parameters Count
    if (RING_API_PARACOUNT != 1) {
        RING_API_ERROR(RING_API_MISS1PARA);
        return;
    }
    // Check Parameters Type
    if ( ! RING_API_ISLIST(1) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return;
    }
    // Sum List Numbers
    nSum = 0;
    pList = RING_API_GETLIST(1);
    for(x=1 ; x <= ring_list_getsize(pList) ; x++) {
        if ( ring_list_isdouble(pList,x) ) {
            nSum += (int) ring_list_getdouble(pList,x) ;
        }
    }
}
```

(continues on next page)

(continued from previous page)

```

    }
    // Return Output
    RING_API_RETNUMBER(nSum);
}

```

Then we register the new function

```
ring_vm_funcregister("sumlist",ring_sumlist);
```

The file test.ring contains

```

? "Loading Library"
load "mylib.ring"

? "Calling a C Function"
myfunction()

? "Sum Two Numbers (3,5)"
? SumTwoNumbers(3,5)

? "Say Hello"
SayHello("Mahmoud")

? "Sum List contains numbers from 1 to 10"
aList = 1:10
? SumList(aList)

```

Then we test the function using

```
ring test.ring
```

Output

```

Loading Library
Calling a C Function
Hello, World!
Sum Two Numbers (3,5)
8
Say Hello
Hello Mahmoud
Sum List contains numbers from 1 to 10
55

```

85.6 Increment List Items

Sample : ring/extensions/tutorial/incrementlist

In this extension we learn how to create a C function that increment the list items.

This extension is an update to the (sumlist) extension in : ring/extensions/tutorial/sumlist folder

In mylib.c we update the file to add

```
RING_FUNC(ring_inclist)
{
```

(continues on next page)

(continued from previous page)

```

List *pList;
int x,nSum;
// Check Parameters Count
if (RING_API_PARACOUNT != 2) {
    RING_API_ERROR(RING_API_MISS2PARA);
    return;
}
// Check Parameters Type
if ( ! ( RING_API_ISLIST(1) && RING_API_ISNUMBER(2) ) ) {
    RING_API_ERROR(RING_API_BADPARATYPE);
    return;
}
// Increment List Items
nSum = 0;
pList = RING_API_GETLIST(1);
for(x=1 ; x <= ring_list_getsize(pList) ; x++) {
    if (ring_list_isdouble(pList,x) ) {
        ring_list_setdouble(pList,x,
            ring_list_getdouble(pList,x) +
            RING_API_GETNUMBER(2));
    }
}
// Return Output
RING_API RETLIST(pList);
}

```

Then we register the new function

```
ring_vm_funcregister("inclist",ring_inclist);
```

The file test.ring contains

```

? "Loading Library"
load "mylib.ring"

? "Calling a C Function"
myfunction()

? "Sum Two Numbers (3,5)"
? SumTwoNumbers(3,5)

? "Say Hello"
SayHello("Mahmoud")

? "Sum List contains numbers from 1 to 10"
aList = 1:10
? SumList(aList)

? "Increment List Items"
? inclist(aList,10)

```

Then we test the function using

```
ring test.ring
```

Output

```

Loading Library
Calling a C Function
Hello, World!
Sum Two Numbers (3,5)
8
Say Hello
Hello Mahmoud
Sum List contains numbers from 1 to 10
55
Increment List Items
11
12
13
14
15
16
17
18
19
20

```

85.7 Filter List Items

Sample : ring/extensions/tutorial/filterlist

In this extension we learn how to create a C function that filter the list items.

This extension is an update to the (incrementlist) extension in : ring/extensions/tutorial/incrementlist folder

In mylib.c we update the file to add

```

RING_FUNC(ring_filterlist)
{
    List *pList;
    int x;
    // Check Parameters Count
    if (RING_API_PARACOUNT != 2) {
        RING_API_ERROR(RING_API_MISS2PARA);
        return;
    }
    // Check Parameters Type
    if ( ! ( RING_API_ISLIST(1) && RING_API_ISNUMBER(2) ) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return;
    }
    // Filter List Items
    pList = RING_API_GETLIST(1);
    for(x = ring_list_getsize(pList) ; x >= 1 ; x--)
        if ( ring_list_isdouble(pList,x) )
            if ( ! (ring_list_getdouble(pList,x) >
                     RING_API_GETNUMBER(2)) )
                ring_list_deleteitem(pList,x) ;
    // Return Output
    RING_API RETLIST(pList);
}

```

Then we register the new function

```
ring_vm_funcregister("filterlist",ring_filterlist);
```

The file test.ring contains

```
? "Loading Library"
load "mylib.ring"

? "Calling a C Function"
myfunction()

? "Sum Two Numbers (3,5)"
? SumTwoNumbers(3,5)

? "Say Hello"
SayHello("Mahmoud")

? "Sum List contains numbers from 1 to 10"
aList = 1:10
? SumList(aList)

? "Increment List Items"
? inclist(aList,10)

? "Filter List Items (Items > 15)"
? filterlist(aList,15)
```

Then we test the function using

```
ring test.ring
```

Output

```
Loading Library
Calling a C Function
Hello, World!
Sum Two Numbers (3,5)
8
Say Hello
Hello Mahmoud
Sum List contains numbers from 1 to 10
55
Increment List Items
11
12
13
14
15
16
17
18
19
20

Filter List Items (Items > 15)
16
17
```

(continues on next page)

(continued from previous page)

```
18
19
20
```

85.8 Replicate List Items

Sample : ring/extensions/tutorial/replicatelist

In this extension we learn how to create a C function that add more items to the list.

This extension is an update to the (filterlist) extension in : ring/extensions/tutorial/filterlist folder

In mylib.c we update the file to add

```
RING_FUNC(ring_replicatelist)
{
    List *pList;
    int x,y,nTimes,nSize;
    // Check Parameters Count
    if (RING_API_PARACOUNT != 2) {
        RING_API_ERROR(RING_API_MISS2PARA);
        return;
    }
    // Check Parameters Type
    if ( ! ( RING_API_ISLIST(1) && RING_API_ISNUMBER(2) ) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return;
    }
    // Replicate List Items
    pList = RING_API_GETLIST(1);
    nSize = ring_list_getsize(pList);
    nTimes = (int) RING_API_GETNUMBER(2);
    if (nTimes < 1) {
        RING_API_ERROR("Error: The second parameter must be >= 1 \n");
        return;
    }
    for(x = 1 ; x <= nTimes ; x++)
        for(y = 1 ; y <= nSize ; y++)
            if ( ring_list_isdouble(pList,y) )
                ring_list_adddouble(pList,
                    ring_list_getdouble(pList,y));
    // Return Output
    RING_API RETLIST(pList);
}
```

Then we register the new function

```
ring_vm_funcregister("replicatelist",ring_replicatelist);
```

The file test.ring contains

```
? "Loading Library"
load "mylib.ring"

? "Calling a C Function"
```

(continues on next page)

(continued from previous page)

```

myfunction()

? "Sum Two Numbers (3,5)"
? SumTwoNumbers(3,5)

? "Say Hello"
SayHello("Mahmoud")

? "Sum List contains numbers from 1 to 10"
aList = 1:10
? SumList(aList)

? "Increment List Items"
? inclist(aList,10)

? "Filter List Items (Items > 15)"
? filterlist(aList,15)

aList = 1:3
? "Replicate list (1:3) three times then print the items (We expect 12 items)"
? replicatelist(aList,3)

```

Then we test the function using

```
ring test.ring
```

Output

```

Loading Library
Calling a C Function
Hello, World!
Sum Two Numbers (3,5)
8
Say Hello
Hello Mahmoud
Sum List contains numbers from 1 to 10
55
Increment List Items
11
12
13
14
15
16
17
18
19
20

Filter List Items (Items > 15)
16
17
18
19
20

```

(continues on next page)

(continued from previous page)

```
Replicate list (1:3) three times then print the items (We expect 12 items)
1
2
3
1
2
3
1
2
3
1
2
3
```

85.9 Generate List

Sample : ring/extensions/tutorial/generatelist

In this extension we learn how to create a C function that create new list and add items to the list.

This extension is an update to the (replicatelist) extension in : ring/extensions/tutorial/replicatelist folder

In mylib.c we update the file to add

```
RING_FUNC(ring_generatelist)
{
    List *pList;
    int x,nSize;
    // Check Parameters Count
    if (RING_API_PARACOUNT != 1) {
        RING_API_ERROR(RING_API_MISS1PARA);
        return;
    }
    // Check Parameters Type
    if ( ! RING_API_ISNUMBER(1) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return;
    }
    // Create the List
    pList = RING_API_NEWTLIST;
    // Generate List Items
    nSize = (int) RING_API_GETNUMBER(1);
    if (nSize < 1) {
        RING_API_ERROR("Error: The list size must be >= 1 \n");
        return;
    }
    for(x = 1 ; x <= nSize ; x++)
        ring_list_adddouble(pList, (double) x);
    // Return Output
    RING_API_RETLIST(pList);
}
```

Then we register the new function

```
ring_vm_funcregister("generatelist",ring_generatelist);
```

The file test.ring contains

```
? "Loading Library"
load "mylib.ring"

? "Calling a C Function"
myfunction()

? "Sum Two Numbers (3,5)"
? SumTwoNumbers(3,5)

? "Say Hello"
SayHello("Mahmoud")

? "Sum List contains numbers from 1 to 10"
aList = 1:10
? SumList(aList)

? "Increment List Items"
? inclist(aList,10)

? "Filter List Items (Items > 15)"
? filterlist(aList,15)

aList = 1:3
? "Replicate list (1:3) three times then print the items (We expect 12 items)"
? replicatelist(aList,3)

? "Create list contains 5 items using C code"
aList = GenerateList(5)
? aList
```

Then we test the function using

```
ring test.ring
```

Output

```
Loading Library
Calling a C Function
Hello, World!
Sum Two Numbers (3,5)
8
Say Hello
Hello Mahmoud
Sum List contains numbers from 1 to 10
55
Increment List Items
11
12
13
14
15
16
17
18
19
20
```

(continues on next page)

(continued from previous page)

```

Filter List Items (Items > 15)
16
17
18
19
20

Replicate list (1:3) three times then print the items (We expect 12 items)
1
2
3
1
2
3
1
2
3
1
2
3

Create list contains 5 items using C code
1
2
3
4
5

```

85.10 Display List

Sample : ring/extensions/tutorial/displaylist

In this extension we learn how to create a C function that display all of the list items including nested lists

In mylib.c we update the file to add

```

void mylib_displaylist(List *pList);

RING_FUNC(ring_displaylist)
{
    List *pList;
    // Check Parameters Count
    if (RING_API_PARACOUNT != 1) {
        RING_API_ERROR(RING_API_MISS1PARA);
        return;
    }
    // Check Parameters Type
    if ( ! RING_API_ISLIST(1) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return;
    }
    // Get the List
    pList = RING_API_GETLIST(1);

```

(continues on next page)

(continued from previous page)

```

    // Display the List Items including Nested Lists
        mylib_displaylist(pList);
}

void mylib_displaylist(List *pList) {
    int x;
    for (x=1; x <= ring_list_getsize(pList); x++) {
        if ( ring_list_isdouble(pList,x) ) {
            printf("Number : %f \n", ring_list_getdouble(pList,x) );
        } else if ( ring_list_isstring(pList,x) ) {
            printf("String : %s \n", ring_list_getstring(pList,x) );
        } else if ( ring_list_islist(pList,x) ) {
            printf("Sub List..\n");
            mylib_displaylist( ring_list_getlist(pList,x) );
        }
    }
}

```

Then we register the new function

```
ring_vm_funcregister("displaylist",ring_displaylist);
```

The file test.ring contains

```

load "stdlib.ring"

? "Loading Library"
load "mylib.ring"

? "Calling a C Function"
myfunction()

? "Sum Two Numbers (3,5)"
? SumTwoNumbers(3,5)

? "Say Hello"
SayHello("Mahmoud")

? "Sum List contains numbers from 1 to 10"
aList = 1:10
? SumList(aList)

? "Increment List Items"
? inclist(aList,10)

? "Filter List Items (Items > 15)"
? filterlist(aList,15)

aList = 1:3
? "Replicate list (1:3) three times then print the items (We expect 12 items)"
? replicatelist(aList,3)

? "Create list contains 5 items using C code"
aList = GenerateList(5)
? aList

? "Create List (3,2)"

```

(continues on next page)

(continued from previous page)

```
aList = newList(3,2)
aList[1][1] = "R 1 C 1"
aList[1][2] = "R 1 C 2"
aList[2][1] = "R 2 C 1"
aList[2][2] = "R 2 C 2"
aList[3][1] = "R 3 C 1"
aList[3][2] = "R 3 C 2"
? "Print the List using Ring"
? aList
? "Print the List by calling C Code"
displayList(aList)
```

Then we test the function using

```
ring test.ring
```

Output

```
Loading Library
Calling a C Function
Hello, World!
Sum Two Numbers (3,5)
8
Say Hello
Hello Mahmoud
Sum List contains numbers from 1 to 10
55
Increment List Items
11
12
13
14
15
16
17
18
19
20

Filter List Items (Items > 15)
16
17
18
19
20

Replicate list (1:3) three times then print the items (We expect 12 items)
1
2
3
1
2
3
1
2
3
```

(continues on next page)

(continued from previous page)

```

1
2
3

Create list contains 5 items using C code
1
2
3
4
5

Create List (3,2)
Print the List using Ring
R 1 C 1
R 1 C 2
R 2 C 1
R 2 C 2
R 3 C 1
R 3 C 2

Print the List by calling C Code
Sub List..
String : R 1 C 1
String : R 1 C 2
Sub List..
String : R 2 C 1
String : R 2 C 2
Sub List..
String : R 3 C 1
String : R 3 C 2

```

85.11 Update Table

Sample : ring/extensions/tutorial/updatetable

In this extension we learn how to create a C function that update a table contains rows and columns

In mylib.c we update the file to add

```

RING_FUNC(ring_updatetable)
{
    List *pList, *pRow;
    int nRow, nCol;
    // Check Parameters Count
    if (RING_API_PARACOUNT != 2) {
        RING_API_ERROR(RING_API_MISS2PARA);
        return;
    }
    // Check Parameters Type
    if ( ! ( RING_API_ISLIST(1) && RING_API_ISNUMBER(2) ) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return;
    }
    // Get the List (Represent a Table)
    pList = RING_API_GETLIST(1);

```

(continues on next page)

(continued from previous page)

```
// Update the Table Rows and Columns
for (nRow = 1 ; nRow <= ring_list_getsize(pList) ; nRow++ ) {
    if ( ring_list_islist(pList,nRow) ) {
        pRow = ring_list_getlist(pList,nRow);
        for (nCol = 1 ; nCol <= ring_list_getsize(pRow) ; nCol++ ) {
            if ( ring_list_isdouble(pRow,nCol) ) {
                ring_list_setdouble(pRow,nCol,RING_API_GETNUMBER(2));
            } else {
                RING_API_ERROR("Error : We expect numbers!\n");
                return ;
            }
        }
    } else {
        RING_API_ERROR("Error : The parameter is not a table! \n");
        return ;
    }
}
```

Then we register the new function

```
ring_vm_funcregister("updatetable",ring_updatetable);
```

The file test.ring contains

```
load "stdlib.ring"

? "Loading Library"
load "mylib.ring"

? "Calling a C Function"
myfunction()

? "Sum Two Numbers (3,5)"
? SumTwoNumbers(3,5)

? "Say Hello"
SayHello("Mahmoud")

? "Sum List contains numbers from 1 to 10"
aList = 1:10
? SumList(aList)

? "Increment List Items"
? inclist(aList,10)

? "Filter List Items (Items > 15)"
? filterlist(aList,15)

aList = 1:3
? "Replicate list (1:3) three times then print the items (We expect 12 items)"
? replicatelist(aList,3)

? "Create list contains 5 items using C code"
aList = GenerateList(5)
? aList
```

(continues on next page)

(continued from previous page)

```
? "Create List (3,2)"
aList = newList(3,2)
aList[1][1] = "R 1 C 1"
aList[1][2] = "R 1 C 2"
aList[2][1] = "R 2 C 1"
aList[2][2] = "R 2 C 2"
aList[3][1] = "R 3 C 1"
aList[3][2] = "R 3 C 2"
? "Print the List using Ring"
? aList
? "Print the List by calling C Code"
displayList(aList)
? ""

? "Create List (2,2)"
aList = newList(2,2)
? "Update the list using C code - set all cells to 10"
UpdateTable(aList,10)
? "aList[1][1] : " + aList[1][1]
? "aList[1][2] : " + aList[1][2]
? "aList[2][1] : " + aList[2][1]
? "aList[2][2] : " + aList[2][2]
```

Then we test the function using

```
ring test.ring
```

Output

```
Loading Library
Calling a C Function
Hello, World!
Sum Two Numbers (3,5)
8
Say Hello
Hello Mahmoud
Sum List contains numbers from 1 to 10
55
Increment List Items
11
12
13
14
15
16
17
18
19
20

Filter List Items (Items > 15)
16
17
18
19
20
```

(continues on next page)

(continued from previous page)

```
Replicate list (1:3) three times then print the items (We expect 12 items)
1
2
3
1
2
3
1
2
3
1
2
3

Create list contains 5 items using C code
1
2
3
4
5

Create List (3,2)
Print the List using Ring
R 1 C 1
R 1 C 2
R 2 C 1
R 2 C 2
R 3 C 1
R 3 C 2

Print the List by calling C Code
Sub List..
String : R 1 C 1
String : R 1 C 2
Sub List..
String : R 2 C 1
String : R 2 C 2
Sub List..
String : R 3 C 1
String : R 3 C 2

Create List (2,2)
Update the list using C code - set all cells to 10
aList[1][1] : 10
aList[1][2] : 10
aList[2][1] : 10
aList[2][2] : 10
```

85.12 Create Table

Sample : ring/extensions/tutorial/createtable

In this extension we learn how to create a C function that create a table contains rows and columns

In mylib.c we update the file to add

```
RING_FUNC(ring_createtable)
{
    List *pList, *pRow;
    int x,y,nRows,nCols;
    // Check Parameters Count
    if (RING_API_PARACOUNT != 2) {
        RING_API_ERROR(RING_API_MISS2PARA);
        return;
    }
    // Check Parameters Type
    if ( ! ( RING_API_ISNUMBER(1) && RING_API_ISNUMBER(2) ) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return;
    }
    // Create the List
    pList = RING_API_NEWTLIST;
    // Create the table items
    nRows = (int) RING_API_GETNUMBER(1);
    nCols = (int) RING_API_GETNUMBER(2);
    if ( (nRows < 1) || (nCols < 1) ) {
        RING_API_ERROR("Error: The table rows and columns must be >= 1 \n");
        return;
    }
    for(x = 1 ; x <= nRows ; x++) {
        pRow = ring_list_newlist(pList);
        for(y = 1 ; y <= nCols ; y++)
            ring_list_adddouble(pRow, 0.0);
    }
    // Return Output
    RING_API_RETLIST(pList);
}
```

Then we register the new function

```
ring_vm_funcregister("createtable",ring_createtable);
```

The file test.ring contains

```
load "stdlib.ring"

? "Loading Library"
load "mylib.ring"

? "Calling a C Function"
myfunction()

? "Sum Two Numbers (3,5)"
? SumTwoNumbers(3,5)

? "Say Hello"
```

(continues on next page)

(continued from previous page)

```

SayHello("Mahmoud")

? "Sum List contains numbers from 1 to 10"
aList = 1:10
? SumList(aList)

? "Increment List Items"
? inclist(aList,10)

? "Filter List Items (Items > 15)"
? filterlist(aList,15)

aList = 1:3
? "Replicate list (1:3) three times then print the items (We expect 12 items)"
? replicatelist(aList,3)

? "Create list contains 5 items using C code"
aList = GenerateList(5)
? aList

? "Create List (3,2)"
aList = newList(3,2)
aList[1][1] = "R 1 C 1"
aList[1][2] = "R 1 C 2"
aList[2][1] = "R 2 C 1"
aList[2][2] = "R 2 C 2"
aList[3][1] = "R 3 C 1"
aList[3][2] = "R 3 C 2"
? "Print the List using Ring"
? aList
? "Print the List by calling C Code"
displayList(aList)
? ""

? "Create List (2,2)"
aList = newList(2,2)
? "Update the list using C code - set all cells to 10"
UpdateTable(aList,10)
? "aList[1][1] : " + aList[1][1]
? "aList[1][2] : " + aList[1][2]
? "aList[2][1] : " + aList[2][1]
? "aList[2][2] : " + aList[2][2]
? ""

? "Create List (3,3) using C code"
aList = CreateTable(3,3)
? "aList[1][1] : " + aList[1][1]
? "aList[1][2] : " + aList[1][2]
? "aList[1][3] : " + aList[1][3]
? "aList[2][1] : " + aList[2][1]
? "aList[2][2] : " + aList[2][2]
? "aList[2][3] : " + aList[2][3]
? "aList[3][1] : " + aList[3][1]
? "aList[3][2] : " + aList[3][2]
? "aList[3][3] : " + aList[3][3]

```

Then we test the function using

```
ring test.ring
```

Output

```
Loading Library
Calling a C Function
Hello, World!
Sum Two Numbers (3,5)
8
Say Hello
Hello Mahmoud
Sum List contains numbers from 1 to 10
55
Increment List Items
11
12
13
14
15
16
17
18
19
20

Filter List Items (Items > 15)
16
17
18
19
20

Replicate list (1:3) three times then print the items (We expect 12 items)
1
2
3
1
2
3
1
2
3
1
2
3

Create list contains 5 items using C code
1
2
3
4
5

Create List (3,2)
Print the List using Ring
R 1 C 1
```

(continues on next page)

(continued from previous page)

```
R 1 C 2
R 2 C 1
R 2 C 2
R 3 C 1
R 3 C 2

Print the List by calling C Code
Sub List..
String : R 1 C 1
String : R 1 C 2
Sub List..
String : R 2 C 1
String : R 2 C 2
Sub List..
String : R 3 C 1
String : R 3 C 2

Create List (2,2)
Update the list using C code - set all cells to 10
aList[1][1] : 10
aList[1][2] : 10
aList[2][1] : 10
aList[2][2] : 10

Create List (3,3) using C code
aList[1][1] : 0
aList[1][2] : 0
aList[1][3] : 0
aList[2][1] : 0
aList[2][2] : 0
aList[2][3] : 0
aList[3][1] : 0
aList[3][2] : 0
aList[3][3] : 0
```

EXTENSION USING THE C/C++ LANGUAGES

We can extend the Ring Virtual Machine (RingVM) by adding new functions written in the C programming language or C++. The RingVM comes with many functions written in C that we can call like any Ring function.

We can extend the language by writing new functions then rebuilding the RingVM again, or we can create shared library (DLL/So) file to extend the RingVM without the need to rebuild it.

The Ring language source code comes with two files to add new modules to the RingVM, ring_ext.h and ring_ext.c

86.1 ring_ext.h

The file ring_ext.h contains constants that we can change to include/exclude modules during the build process.

```
#ifndef ringext_h
#define ringext_h
/* Constants */
#define RING_VM_LISTFUNCS      1
#define RING_VM_REFMETA        1
#define RING_VM_MATH           1
#define RING_VM_FILE           1
#define RING_VM_OS             1
#define RING_VM_MYSQL          1
#define RING_VM_ODBC           1
#define RING_VM_OPENSSL         1
#define RING_VM_CURL            1
#define RING_VM_DLL             1
#endif
```

86.2 ring_ext.c

The file ring_ext.c check constants defined in ring_ext.h before calling the start-up function in each module.

Each module contains a function that register the module functions in the RingVM.

```
#include "ring.h"

void ring_vm_extension ( RingState *pRingState )
{
    /* Reflection and Meta-programming */
    #if RING_VM_REFMETA
        ring_vm_refmeta_loadfunctions(pRingState);
    #endif
}
```

(continues on next page)

(continued from previous page)

```

#endif
/* List Functions */
#if RING_VM_LISTFUNCS
    ring_vm_listfuncs_loadfunctions(pRingState);
#endif
/* Math */
#if RING_VM_MATH
    ring_vm_math_loadfunctions(pRingState);
#endif
/* File */
#if RING_VM_FILE
    ring_vm_file_loadfunctions(pRingState);
#endif
/* OS */
#if RING_VM_OS
    ring_vm_os_loadfunctions(pRingState);
#endif
/* MySQL */
#if RING_VM_MYSQL
    ring_vm_mysql_loadfunctions(pRingState);
#endif
/* ODBC */
#if RING_VM_ODBC
    ring_vm_odbc_loadfunctions(pRingState);
#endif
/* OPENSSL */
#if RING_VM_OPENSSL
    ring_vm_openssl_loadfunctions(pRingState);
#endif
/* CURL */
#if RING_VM_CURL
    ring_vm_curl_loadfunctions(pRingState);
#endif
/* DLL */
#if RING_VM_DLL
    ring_vm_dll_loadfunctions(pRingState);
#endif
}

```

86.3 Module Organization

Each module starts by include the ring header file (ring.h). This files contains the Ring API that we can use to extend the RingVM.

Each module comes with a function to register the module functions in the RingVM. The registration is done by using `ring_vm_funcregister()` function.

The `ring_vm_funcregister()` function takes two parameters, the first is the function name that will be used by Ring programs to call the function. The second parameter is the function pointer in the C program.

for example, the `ring_vmmath.c` module contains the next code to register the module functions

```

#include "ring.h"

void ring_vm_math_loadfunctions ( RingState *pRingState )

```

(continues on next page)

(continued from previous page)

```
{
    ring_vm_funcregister("sin",ring_vm_math_sin);
    ring_vm_funcregister("cos",ring_vm_math_cos);
    ring_vm_funcregister("tan",ring_vm_math_tan);
    ring_vm_funcregister("asin",ring_vm_math_asin);
    ring_vm_funcregister("acos",ring_vm_math_acos);
    ring_vm_funcregister("atan",ring_vm_math_atan);
    ring_vm_funcregister("atan2",ring_vm_math_atan2);
    ring_vm_funcregister("sinh",ring_vm_math_sinh);
    ring_vm_funcregister("cosh",ring_vm_math_cosh);
    ring_vm_funcregister("tanh",ring_vm_math_tanh);
    ring_vm_funcregister("exp",ring_vm_math_exp);
    ring_vm_funcregister("log",ring_vm_math_log);
    ring_vm_funcregister("log10",ring_vm_math_log10);
    ring_vm_funcregister("ceil",ring_vm_math_ceil);
    ring_vm_funcregister("floor",ring_vm_math_floor);
    ring_vm_funcregister("fabs",ring_vm_math fabs);
    ring_vm_funcregister("pow",ring_vm_math_pow);
    ring_vm_funcregister("sqrt",ring_vm_math_sqrt);
    ring_vm_funcregister("unsigned",ring_vm_math_unsigned);
    ring_vm_funcregister("decimals",ring_vm_math_decimals);
    ring_vm_funcregister("murmur3hash",ring_vm_math_murmur3hash);
}
}
```

Tip: Remember that the function `ring_vm_math_loadfunctions()` will be called by the `ring_vm_extension()` function (in the `ring_ext.c` file).

86.4 Function Structure

Each module function may contains the next steps

- 1 - Check Parameters Count
- 2 - Check Parameters Type
- 3 - Get Parameters Values
- 4 - Execute Code/Call Functions
- 5 - Return Value

The structure is very similar to any function (Input - Process - Output) But here we will use the Ring API for the steps 1,2,3 and 5.

86.5 Check Parameters Count

We can check the parameters count using the RING_API_PARACOUNT macro.

We can compare RING_API_PARACOUNT with any numeric value using == or != operators.

Example:

```
if ( RING_API_PARACOUNT != 1 ) {
    /* code */
}
```

Example:

```
if ( RING_API_PARACOUNT == 1 ) {
    /* code */
}
```

86.6 Display Error Message

We can display error messages using the RING_API_ERROR() function.

The function will display the error and end the execution of the program.

Note: the behaviour of this function can be changed by the Ring code using Try/Catch/Done statements, so in your C code, use Return after this function.

Syntax:

```
RING_API_ERROR(const char *cErrorMsg);
```

The Ring API comes with some of predefined error messages that we can use

```
#define RING_API_MISS1PARA "Bad parameters count, the function expect one parameter"
#define RING_API_MISS2PARA "Bad parameters count, the function expect two parameters"
#define RING_API_MISS3PARA "Bad parameters count, the function expect three parameters
↪"
#define RING_API_MISS4PARA "Bad parameters count, the function expect four parameters"
#define RING_API_BADPARATYPE "Bad parameter type!"
#define RING_API_BADPARACOUNT "Bad parameters count!"
#define RING_API_BADPARARANGE "Bad parameters value, error in range!"
#define RING_API_NOTPOINTER "Error in parameter, not pointer!"
#define RING_API_NULLPOINTER "Error in parameter, NULL pointer!"
#define RING_API_EMPTYLIST "Bad parameter, empty list!"
```

86.7 Check Parameters Type

We can check the parameter type using the next functions

```
int RING_API_ISNUMBER(int nParameterNumber);
int RING_API_ISSTRING(int nParameterNumber);
int RING_API_ISLIST(int nParameterNumber);
int RING_API_ISCPOINTER(int nParameterNumber);
int RING_API_ISPOINTER(int nParameterNumber); // List or C Pointer
```

The output of these functions will be 1 (True) or 0 (False).

86.8 Get Parameters Values

We can get parameters values using the next functions

```
double RING_API_GETNUMBER(int nParameterNumber);
const char *RING_API_GETSTRING(int nParameterNumber);
int RING_API_GETSTRINGSIZE(int nParameterNumber);
List *RING_API_GETLIST(int nParameterNumber);
void *RING_API_GETCPOINTER(int nParameterNumber, const char *cPointerType);
int RING_API_GETPOINTERTYPE(int nParameterNumber);
```

86.9 Return Value

We can return values from our function using the next functions.

```
RING_API_RETNUMBER(double nValue);
RING_API_RETSTRING(const char *cString);
RING_API_RETSTRING2(const char *cString, int nStringSize);
RING_API_RETLIST(List *pList);
RING_API_RETCPOINTER(void *pValue, const char *cPointerType);
RING_API_RETMANAGEDCPOINTER(void *pValue, const char *cPointerType,
                           void (* pFreeFunc)(void *, void *))
```

86.10 Function Prototype

When we define new function to be used for RingVM extension, we use the next prototype

```
void my_function_name( void *pPointer );
```

or we can use the RING_FUNC() Macro

```
RING_FUNC(my_function_name);
```

86.11 Sin() Function Implementation

The next code represents the sin() function implementation using the Ring API and the sin() C function.

```
void ring_vm_math_sin ( void *pPointer )
{
    if ( RING_API_PARACOUNT != 1 ) {
        RING_API_ERROR(RING_API_MISS1PARA);
        return ;
    }
    if ( RING_API_ISNUMBER(1) ) {
        RING_API_RETNUMBER(sin(RING_API_GETNUMBER(1)));
    } else {
        RING_API_ERROR(RING_API_BADPARATYPE);
    }
}
```

86.12 Fopen() and Fclose() Functions Implementation

The next code represents the fopen() function implementation using the Ring API and the fopen() C Function.

The function takes two parameters, the first parameter is the file name as string. The second parameter is the mode as string.

In the file ring_vmfile.h we have some constants to use as the pointer type like

```
#define RING_VM_POINTER_FILE      "file"
#define RING_VM_POINTER_FILEPOS   "filepos"
```

The function implementation in ring_vmfile.c

```
void ring_vm_file_fopen ( void *pPointer )
{
    FILE *fp ;
    if ( RING_API_PARACOUNT != 2 ) {
        RING_API_ERROR(RING_API_MISS2PARA);
        return ;
    }
    if ( RING_API_ISSTRING(1) && RING_API_ISSTRING(2) ) {
        fp = fopen(RING_API_GETSTRING(1),RING_API_GETSTRING(2));
        RING_API_RETCPOINTER(fp,RING_VM_POINTER_FILE);
    } else {
        RING_API_ERROR(RING_API_BADPARATYPE);
    }
}
```

The next code represents the fclose() function implementation

```
void ring_vm_file_fclose ( void *pPointer )
{
    FILE *fp ;
    if ( RING_API_PARACOUNT != 1 ) {
        RING_API_ERROR(RING_API_MISS1PARA);
        return ;
    }
}
```

(continues on next page)

(continued from previous page)

```

if ( RING_API_ISCPOINTER(1) ) {
    fp = (FILE *) RING_API_GETCPOINTER(1,RING_VM_POINTER_FILE) ;
    if ( fp != NULL ) {
        RING_API_RETNUMBER(fclose(fp));
        RING_API_SETNULLPOINTER(1);
    }
} else {
    RING_API_ERROR(RING_API_BADPARATYPE);
}
}

```

From fopen() and fclose() implementation we learned

- 1 - how to return C pointer using RING_API_RETCPOINTER() function
- 2 - how to check if the parameter is a pointer using the RING_API_ISCPOINTER() function
- 3 - how to get C pointer value using the RING_API_GETCPOINTER() function
- 4 - how to set the C pointer variable (in RingVM) to NULL using the RING_API_SETNULLPOINTER() function

86.13 Ring API - List Functions

In this section we will learn about the list functions provided by the Ring API to create new lists and manipulate the list items.

```

List * ring_list_new ( int nSize ) ;
void ring_list_newitem ( List *pList ) ;
Item * ring_list_getitem ( List *pList,int index ) ;
List * ring_list_delete ( List *pList ) ;
void ring_list_deleteitem ( List *pList,int index ) ;
void ring_list_print ( List *pList ) ;
int ring_list_gettime ( List *pList, int index ) ;
void ring_list_setint ( List *pList, int index ,int number ) ;
void ring_list_addint ( List *pList,int x ) ;
void ring_list_setpointer ( List *pList, int index ,void *pValue ) ;
void ring_list_addpointer ( List *pList,void *pValue ) ;
void ring_list_setfuncpointer ( List *pList, int index ,void (*pFunc)(void *) ) ;
void ring_list_addfuncpointer ( List *pList,void (*pFunc)(void *) ) ;
int ring_list_isfuncpointer ( List *pList, int index ) ;
void ring_list_setdouble ( List *pList, int index ,double number ) ;
void ring_list_adddouble ( List *pList,double x ) ;
void ring_list_setstring ( List *pList, int index ,const char *str ) ;
void ring_list_setstring2 ( List *pList, int index ,const char *str,int nStrSize ) ;
void ring_list_addstring ( List *pList,const char *str ) ;
void ring_list_addstring2 ( List *pList,const char *str,int nStrSize ) ;
List * ring_list_newlist ( List *pList ) ;
List * ring_list_getlist ( List *pList, int index ) ;
void ring_list_setlist ( List *pList, int index ) ;
void ring_list_setactiveitem ( List *pList, Items *pItems, int index ) ;
void ring_list_copy ( List *pNewList, List *pList ) ;
int ring_list_isnumber ( List *pList, int index ) ;
int ring_list_isstring ( List *pList, int index ) ;
int ring_list_islist ( List *pList, int index ) ;
int ring_list_ispointer ( List *pList, int index ) ;
void ring_list_deleteallitems ( List *pList ) ;

```

(continues on next page)

(continued from previous page)

```

void ring_list_insertitem ( List *pList,int x ) ;
void ring_list_insertint ( List *pList,int nPos,int x ) ;
void ring_list_insertdouble ( List *pList,int nPos,double x ) ;
void ring_list_insertpointer ( List *pList,int nPos,void *pValue ) ;
void ring_list_insertstring ( List *pList,int nPos,const char *str ) ;
void ring_list_insertstring2 ( List *pList,int nPos,const char *str,int nStrSize ) ;
void ring_list_insertfuncpointer ( List *pList,int nPos,void (*pFunc)(void * ) ) ;
List * ring_list_insertlist ( List *pList,int nPos ) ;
int ring_list_isiteminside ( List *pList,Item *pItem ) ;
int ring_list_findstring ( List *pList,const char *str,int nColumn ) ;
int ring_list_finddouble ( List *pList,double nNum1,int nColumn ) ;
void ring_list_sortnum ( List *pList,int left,int right,int nColumn ) ;
void ring_list_sortstr ( List *pList,int left,int right,int nColumn ) ;
int ring_list_binarysearchnum ( List *pList,double nNum1,int nColumn ) ;
int ring_list_binarysearchstr ( List *pList,const char *cFind,int nColumn ) ;
void ring_list_swap ( List *pList,int x,int y ) ;
double ring_list_getdoublecolumn ( List *pList,int nIndex,int nColumn ) ;
char * ring_list_getstringcolumn ( List *pList,int nIndex,int nColumn ) ;
void ring_list_genarray ( List *pList ) ;
void ring_list_deletearray ( List *pList ) ;
void ring_list_genhashtable ( List *pList ) ;
void ring_list_genhashtable2 ( List *pList ) ;
void ring_list_refcopy ( List *pNewList, List *pList ) ;
void ring_list_clear ( List *pList ) ;
/* Macro */
ring_list_isdouble(pList,index)
ring_list_isint(pList,index)
ring_list_deletelastitem(x)
ring_list_gethashtable(x)
ring_list_getint(pList,index)
ring_list_getpointer(pList,index)
ring_list_getfuncpointer(pList,index)
ring_list_callfuncpointer(pList,index,x)
ring_list_getdouble(pList,index)
ring_list_getstring(pList,index)
ring_list_getstringobject(pList,index)
ring_list_getstringsize(pList,index)
ring_list_getsize(x) (x->nSize)

```

86.14 Ring API - String Functions

In this section we will learn about the string functions provided by the Ring API to create new string and manipulate the string content.

```

String * ring_string_new ( const char *str ) ;
String * ring_string_new2 ( const char *str,int nStrSize ) ;
String * ring_string_delete ( String *pString ) ;
int ring_string_size ( String *pString ) ;
void ring_string_set ( String *pString,const char *str ) ;
void ring_string_set2 ( String *pString,const char *str,int nStrSize ) ;
void ring_string_add ( String *pString,const char *str ) ;
void ring_string_add2 ( String *pString,const char *str,int nStrSize ) ;
void ring_string_print ( String *pString ) ;
void ring_string_setfromint ( String *pString,int x ) ;

```

(continues on next page)

(continued from previous page)

```

char * ring_string_lower ( char *cStr ) ;
char * ring_string_upper ( char *cStr ) ;
char * ring_string_lower2 ( char *cStr,int nStrSize ) ;
char * ring_string_upper2 ( char *cStr,int nStrSize ) ;
char * ring_string_find ( char *cStr1,char *cStr2 ) ;
char * ring_string_find2 ( char *cStr1,int nStrSize1,char *cStr2,int nStrSize2 ) ;
/* Macro */
ring_string_tolower(x)
ring_string_toupper(x)
ring_string_get(x)

```

86.15 MySQL_Columns() Function Implementation

The next code presents the MySQL_Columns() function implementation.

This function returns table columns information.

```

void ring_vm_mysql_columns ( void *pPointer )
{
    MYSQL *con ;
    MYSQL_RES *result ;
    int nColumns,x ;
    MYSQL_ROW row ;
    MYSQL_FIELD *field ;
    List *pList, *pList2 ;
    if ( RING_API_PARACOUNT != 1 ) {
        RING_API_ERROR(RING_API_MISS1PARA);
        return ;
    }
    if ( RING_API_ISCPOINTER(1) ) {
        con = (MYSQL *) RING_API_GETCPOINTER(1,RING_VM_POINTER_MYSQL) ;
        if ( con == NULL ) {
            return ;
        }
        result = mysql_store_result(con);
        if ( result == NULL ) {
            RING_API_RETNUMBER(0);
            return ;
        }
        pList = RING_API_NEWTLIST ;
        nColumns = mysql_num_fields(result);
        if ( row = mysql_fetch_row(result) ) {
            while ( field = mysql_fetch_field(result) ) {
                pList2 = ring_list_newlist(pList);
                ring_list_addstring(pList2,field->name);
                ring_list_adddouble(pList2,field->length);
                ring_list_adddouble(pList2,field->type);
                ring_list_adddouble(pList2,field->flags);
            }
        }
        mysql_free_result(result);
        RING_API_RETLIST(pList);
    } else {
        RING_API_ERROR(RING_API_BADPARATYPE);
    }
}

```

(continues on next page)

(continued from previous page)

```

    }
}

```

Lists are of type List, in the previous function we declared two pointers of type List using List *pList, *pList2;

Note: The function uses RING_API_NEWTLIST to create new list instead of ring_list_new() to create the list in Temp. Memory related to the function scope. This way we can return the list from the function. Also we don't delete the list, if it's stored in a variable by Ring Code it will be saved, if not it will be automatically deleted by RingVM.

The list can contain sub lists, we used the function ring_list_newlist() to create a sublist.

The function ring_list_addstring() is used to add string items to the list/sublist.

The function ring_list_adddouble() is used to add numeric items to the list/sublist.

Note: All numeric items in lists returned from RingVM extension functions must be of type double and added to the list using ring_list_adddouble() function.

We return the list from the extension function using the RING_API RETLIST() function.

86.16 Dynamic/Shared Libraries (DLL/So/Dylib) and LoadLib() function

Instead of rebuilding the RingVM after writing new functions using C/C++ and the Ring API, we can create a DLL/So/Dylib file and dynamically use the functions provided by this file in the runtime using the LoadLib() function.

Dynamic library example in C

```

#include "ring.h"

RING_DLL __declspec(dllexport)

RING_FUNC(ring_ringlib_dlfunc)
{
    printf("Message from dlfunc");
}

RING_DLL void ringlib_init(RingState *pRingState)
{
    ring_vm_funcregister("dlfunc",ring_ringlib_dlfunc);
}

```

the idea is to create the ringlib_init() function, this function will be called by the RingVM when we use the generated DLL file through the LoadLib() function.

Inside the ringlib_init() function we can register the module function or call a function that does the registration process for all the module functions.

The next Ring code demonstrates how to use the DLL library during the runtime.

```

See "Dynamic DLL" + NL
LoadLib("ringlib.dll")
dlfunc()

```

Output:

```
Dynamic DLL
Message from dlfunc
```

86.17 Using RING_API_RETMANAGEDCPOINTER()

Using RING_API_RETMANAGEDCPOINTER() the Ring extensions written in C/C++ languages can return a managed pointer to Ring. This pointer can be controlled by the Ring VM using reference counting.

This is important to avoid the need to write code that free the unmanaged resources like QPixmap objects in RingQt.

Also the Code Generator for extensions is updated to automatically use RING_API_RETMANAGEDCPOINTER() based on need.

Syntax:

```
RING_API_RETMANAGEDCPOINTER(void *pValue, const char *cPointerType,
                           void (* pFreeFunc) (void *,void *))
```

Example:

The next example from ring_qt.cpp - QPixmap Class - Scaled() Method.

```
RING_FUNC(ring_QPixmap_scaled)
{
    QPixmap *pObject ;
    if ( RING_API_PARACOUNT != 5 ) {
        RING_API_ERROR(RING_API_BADPARACOUNT) ;
        return ;
    }
    RING_API_IGNORECPOINTERTYPE ;
    if ( ! RING_API_ISCPOINTER(1) ) {
        RING_API_ERROR(RING_API_BADPARATYPE) ;
        return ;
    }
    pObject = (QPixmap *) RING_API_GETCPOINTER(1,"QPixmap") ;
    if ( ! RING_API_ISNUMBER(2) ) {
        RING_API_ERROR(RING_API_BADPARATYPE) ;
        return ;
    }
    if ( ! RING_API_ISNUMBER(3) ) {
        RING_API_ERROR(RING_API_BADPARATYPE) ;
        return ;
    }
    if ( ! RING_API_ISNUMBER(4) ) {
        RING_API_ERROR(RING_API_BADPARATYPE) ;
        return ;
    }
    if ( ! RING_API_ISNUMBER(5) ) {
        RING_API_ERROR(RING_API_BADPARATYPE) ;
        return ;
    }
    {
        QPixmap *pValue ;
        pValue = new QPixmap() ;
        *pValue = pObject->scaled( (int ) RING_API_GETNUMBER(2),
                                   (int ) RING_API_GETNUMBER(3) ) ;
    }
}
```

(continues on next page)

(continued from previous page)

```
        (int ) RING_API_GETNUMBER(3),
        (Qt::AspectRatioMode ) (int) RING_API_GETNUMBER(4),
        (Qt::TransformationMode ) (int) RING_API_GETNUMBER(5));
    RING_API_RETMANAGEDCPOINTER(pValue,"QPixmap",ring_QPixmap_freefunc);
}
```

The function that will free the memory takes two parameters (Ring State and the allocated Memory Pointer)

Example:

```
void ring_QPixmap_freefunc(void *pState, void *pPointer)
{
    QPixmap *pObject ;
    pObject = (QPixmap *) pPointer;
    delete pObject ;
}
```

CHAPTER
EIGHTYSEVEN

EMBEDDING RING LANGUAGE IN C/C++ PROGRAMS

We can use the Ring language from C/C++ programs using the next functions

```
RingState *ring_state_init();
ring_state_runcode(RingState *pState, const char *cCode);
ring_state_delete(RingState *pState);
```

87.1 Ring State

The idea is to use the ring_state_init() to create new state for the Ring Language then call the ring_state_runcode() function to execut Ring code using the same state. When we are done, we call the ring_state_delete() to free the memory.

Example:

```
#include "ring.h"
#include "stdlib.h"
int main(int argc, char *argv[])
{
    RingState *pState = ring_state_init();
    printf("welcome\n");
    ring_state_runcode(pState, "see 'hello world from the ring programming language'+nl
");
    ring_state_delete(pState);
}
```

Output:

```
welcome
hello world from the ring programming language
```

87.2 Ring State Functions

The Ring API comes with the next functions to create and delete the state. Also we have functions to create new variables and get variables values.

```
RingState * ring_state_init ( void ) ;
RingState * ring_state_delete ( RingState *pRingState ) ;
void ring_state_runcode ( RingState *pRingState, const char *cStr ) ;
List * ring_state_findvar ( RingState *pRingState, const char *cStr ) ;
```

(continues on next page)

(continued from previous page)

```
List * ring_state_newvar ( RingState *pRingState, const char *cStr ) ;
void ring_state_main ( int argc, char *argv[] ) ;
void ring_state_runfile ( RingState *pRingState, const char *cFileName ) ;
void ring_state_runobjectfile ( RingState *pRingState, const char *cFileName ) ;
```

87.3 Ring State Variables

We can create more than one ring state in the same program and we can create and modify variable values.

To get the variable list we can use the `ring_state_findvar()` function.

To create new variable we can use the `ring_state_newvar()` function.

Example:

```
#include "ring.h"
#include "stdlib.h"

int main(int argc, char *argv[])
{
    List *pList;

    RingState *pState = ring_state_init();
    RingState *pState2 = ring_state_init();

    printf("welcome\n");
    ring_state_runcode(pState, "see 'hello world from the ring programming language'+nl
    ↵");

    printf("Again from C we will call ring code\n");
    ring_state_runcode(pState, "for x = 1 to 10 see x + nl next");

    ring_state_runcode(pState2, "for x = 1 to 5 see x + nl next");

    printf("Now we will display the x variable value from ring code\n");
    ring_state_runcode(pState, "see 'x value : ' + x + nl ");
    ring_state_runcode(pState2, "see 'x value : ' + x + nl ");

    pList = ring_state_findvar(pState, "x");

    printf("Printing Ring variable value from C , %.0f\n",
           ring_list_getdouble(pList, RING_VAR_VALUE));

    printf("now we will set the ring variable value from C\n");
    ring_list_setdouble(pList, RING_VAR_VALUE, 20);

    ring_state_runcode(pState, "see 'x value after update : ' + x + nl ");

    pList = ring_state_newvar(pState, "v1");
    ring_list_setdouble(pList, RING_VAR_VALUE, 10);

    pList = ring_state_newvar(pState, "v2");
    ring_list_setdouble(pList, RING_VAR_VALUE, 20);

    ring_state_runcode(pState, "see 'v1 + v2 = ' see v1+v2 see nl");
```

(continues on next page)

(continued from previous page)

```
ring_state_runcode(pState, "see 'end of test' + nl");

ring_state_delete(pState);
ring_state_delete(pState2);
}
```

Output:

```
welcome
hello world from the ring programming language
Again from C we will call ring code
1
2
3
4
5
6
7
8
9
10
1
2
3
4
5
Now we will display the x variable value from ring code
x value : 11
x value : 6
Printing Ring variable value from C , 11
now we will set the ring variable value from C
x value after update : 20
v1 + v2 = 30
end of test
```

CHAPTER
EIGHTYEIGHT

CODE GENERATOR FOR WRAPPING C/C++ LIBRARIES

In this chapter we will learn how to use the code generator to wrap C/C++ Libraries to use it in our Ring applications.

88.1 Using the tool

The code generator program is `parsec.ring` that can be executed as any ring code using the ring language.

URL : <https://github.com/ring-lang/ring/tree/master/extensions/codegen>

for example to read a configuration file called `test.cf` to generate the source code file `test.c` run `parsec.ring` as in the next command

```
ring parsec.ring test.cf test.c
```

88.2 Configuration file

The configuration file (`*.cf`) is the input file that we pass to the code generator. This file determine the functions prototypes that we need to use from a C/C++ library.

Writing configuration files is simple according to the next rules

88.3 Using the function prototype

- To generate code that wraps a C function, we just write the C function prototype

Example:

```
ALLEGRO_DISPLAY *al_create_display(int w, int h)
void al_destroy_display(ALLEGRO_DISPLAY *display)
int al_get_new_display_flags(void)
void al_set_new_display_flags(int flags)
int al_get_new_display_option(int option, int *importance)
```

The previous example will guide the code generator to generate 5 functions that wraps the `al_create_display()`, `al_destroy_display()`, `al_get_new_display_flags()`, `al_set_new_diply_flas()` and `al_get_new_display_option()` functions.

The generated code will be as in the next example

```

RING_FUNC(ring_al_create_display)
{
    if ( RING_API_PARACOUNT != 2 ) {
        RING_API_ERROR(RING_API_MISS2PARA);
        return ;
    }
    if ( ! RING_API_ISNUMBER(1) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return ;
    }
    if ( ! RING_API_ISNUMBER(2) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return ;
    }
    RING_API RETCPOINTER(al_create_display( (int ) RING_API_GETNUMBER(1),
                                            (int ) RING_API_GETNUMBER(2)), "ALLEGRO_DISPLAY");
}

RING_FUNC(ring_al_destroy_display)
{
    if ( RING_API_PARACOUNT != 1 ) {
        RING_API_ERROR(RING_API_MISS1PARA);
        return ;
    }
    if ( ! RING_API_ISPOINTER(1) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return ;
    }
    al_destroy_display((ALLEGRO_DISPLAY *) RING_API_GETCPOINTER(1, "ALLEGRO_DISPLAY"));
}

RING_FUNC(ring_al_get_new_display_flags)
{
    if ( RING_API_PARACOUNT != 0 ) {
        RING_API_ERROR(RING_API_BADPARACOUNT);
        return ;
    }
    RING_API RETNUMBER(al_get_new_display_flags());
}

RING_FUNC(ring_al_set_new_display_flags)
{
    if ( RING_API_PARACOUNT != 1 ) {
        RING_API_ERROR(RING_API_MISS1PARA);
        return ;
    }
    if ( ! RING_API_ISNUMBER(1) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return ;
    }
    al_set_new_display_flags( (int ) RING_API_GETNUMBER(1));
}

```

(continues on next page)

(continued from previous page)

```
RING_FUNC(ring_al_get_new_display_option)
{
    if ( RING_API_PARACOUNT != 2 ) {
        RING_API_ERROR(RING_API_MISS2PARA);
        return ;
    }
    if ( ! RING_API_ISNUMBER(1) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return ;
    }
    if ( ! RING_API_ISSTRING(2) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return ;
    }
    RING_API_RETNUMBER(al_get_new_display_option( (int) RING_API_GETNUMBER(1),
                                                RING_API_GETINTPOINTER(2)));
    RING_API_ACCEPTINTVALUE(2) ;
}
```

from the previous example we can see how much of time and effort is saved using the Code Generator.

88.4 Adding code to the generated code

- To generate code directly type it between <code> and </code>

Example :

```
<code>
    /* some C code will be written here */
</code>
```

We use this feature when we need to do something without the help of the code generator. for example including header files and defining constants using Macro.

88.5 Prefix for Functions Names

- To determine a prefix in all of the functions names type it between <funcstart> and </funcstart> for example when we wrap the Allegro game programming library and we need all of the library functions to start with “al” we type the next code in the configuration file

```
<funcstart>
al
</funcstart>
```

88.6 Generate function to wrap structures

- To generate functions that wrap structures (create/delete/get structure members)

just type the structures names between <struct> and </struct> also after the structure name you can type the structure members between { } separated by comma.

Example

```
<struct>
ALLEGRO_COLOR
ALLEGRO_EVENT { type , keyboard.keycode , mouse.x , mouse.y }
</struct>
```

from the previous example we will generate two function to create/delete the structure ALLEGRO_COLOR Also we will generate two functions to create/delete the structure ALLEGRO_EVENT and four functions to get the structure ALLEGRO_EVENT members (type, keyboard.keycode, mouse.x, mouse.y).

88.7 Determine Structure Members Types

You can determine the pointer name before the strucuture member name.

Example:

```
SDL_Surface {flags,SDL_PixelFormat *format,w,h,pitch,void *pixels}
```

88.8 Defining Constants

You can define constants using <constant> and </constant>

The generator will generate the required functions to get the constant values

And will define the constants to be used with the same name in Ring code using *.rh file that will be generated too.

rh = Ring Header

Example:

```
<constant>
MIX_DEFAULT_FORMAT
SDL_QUIT
SDL_BUTTON_LEFT
SDL_BUTTON_MIDDLE
SDL_BUTTON_RIGHT
</constant>
```

Note: You will need to pass the *.rh file name to parsec.ring after the generated source file name.

Example:

```
ring ..\codegen\parsec.ring libsdl.cf ring_libsdl.c ring_libsdl.rh
```

88.9 Register New Functions

We can register functions by typing the function prototype between <register> and </register>. We need this feature only when we don't provide the function prototype as input directly where we need to write the code of this function.

Example:

```
<register>
void al_exit(void)
</register>

<code>
RING_FUNC (ring_al_exit)
{
    if ( RING_API_PARACOUNT != 0 ) {
        RING_API_ERROR (RING_API_BADPARACOUNT);
        return ;
    }
exit(0);
}
</code>
```

In the previous example we register the al_exit() function. This function is not part of the Allegro Library, it's just an extra function that we need to add. Then the code if this function is written inside <code> and </code>. This function call the exit() function from the C language library.

88.10 Writing comments in the configuration file

- To type comments just type it between <comment> and </comment>

Example:

```
<comment>
configuration files
</comment>
```

88.11 Executing code during code generation

- To ask from the code generator to execute Ring code during reading the configuration file, just write the code between <runcode> and </runcode>

Example:

```
<runcode>
aNumberTypes + "al_fixed"
</runcode>
```

The previous line of code adds the string "al_fixed" to the list aNumberTypes. This list contains types that can be considered as numbers when the code generator finds it in the function prototype.

88.12 Enum and Numbers

We have the list aEnumTypes to use for adding each Enumeration we uses in the functions prototype.

Example:

```
<runcode>
aNumberTypes + "qreal"
aNumberTypes + " qint64"
aEnumTypes + "Qt::GestureType"
aEnumTypes + "Qt::GestureFlag"
</runcode>
```

88.13 Filtering using Expressions

using <filter> and </filter> we can include/exclude parts of the configuration file based on a condition, for example

```
<filter> iswindows()
    ... functions related to windows
</filter>
```

88.14 Constants Type

The default type for constant is Number But Some constants may be another type, for example (pointer : void *) before using <constant> and </constant> we can use <runcode> and </runcode> to determine the constant type using two global variables used by the code generator.

The first variable is \$nDefaultConstantType which can be * C_CONSTANT_TYPE_NUMBER * C_CONSTANT_TYPE_STRING * C_CONSTANT_TYPE_POINTER

if we are using C_CONSTANT_TYPE_POINTER then we will need the second global variable which is \$cDefaultConstantPointerType to determine the pointer type.

Example :

The next example uses this feature to define constants in the FreeGLUT library

```
<runcode>
$nDefaultConstantType = C_CONSTANT_TYPE_POINTER
$cDefaultConstantPointerType = "void"
</runcode>
<constant>
    GLUT_STROKE_ROMAN
    GLUT_STROKE_MONO_ROMAN
    GLUT_BITMAP_9_BY_15
    GLUT_BITMAP_8_BY_13
    GLUT_BITMAP_TIMES_ROMAN_10
    GLUT_BITMAP_TIMES_ROMAN_24
    GLUT_BITMAP_HELVETICA_10
    GLUT_BITMAP_HELVETICA_12
    GLUT_BITMAP_HELVETICA_18
</constant>
```

88.15 Configuration file for the Allegro Library

The next configuration file enable us to use the Allegro library functions. The configuration file size is less than 1000 lines. when the code generator take this file as input the generated source code file in the C language will be 12000 lines of code!

We can see this configuration file as a complete example about using the code generator Also we can use it to know the functions that can be used from RingAllegro when you use it to create 2D games!

```

<code>
#define ALLEGRO_NO_MAGIC_MAIN

#include <allegro5/allegro.h>
#include "allegro5/allegro_image.h"
#include <allegro5/allegro_font.h>
#include <allegro5/allegro_ttf.h>
#include <allegro5/allegro_audio.h>
#include <allegro5/allegro_acodec.h>
#include <allegro5/allegro_opengl.h>
#include <allegro5/allegro_direct3d.h>
#include <allegro5/allegro_color.h>
#include <allegro5/allegro_memfile.h>
#include "allegro5/allegro_native_dialog.h"
#include <allegro5/allegro_physfs.h>
#include <allegro5/allegro_primitives.h>
</code>

<funcstart>
al
</funcstart>

<struct>
ALLEGRO_EVENT { type , keyboard.keycode , mouse.x , mouse.y }
ALLEGRO_TIMEOUT
ALLEGRO_SAMPLE_ID
ALLEGRO_COLOR
</struct>

<register>
void al_exit(void)
</register>

<code>
RING_FUNC (ring_al_exit)
{
    if ( RING_API_PARACOUNT != 0 ) {
        RING_API_ERROR(RING_API_BADPARACOUNT);
        return ;
    }
    exit(0);
}
</code>

int al_init(void)

<comment>
configuration files

```

(continues on next page)

(continued from previous page)

```
</comment>

<runcode>
aNumberTypes + "al_fixed"
</runcode>

ALLEGRO_CONFIG *al_create_config(void)
void al_destroy_config(ALLEGRO_CONFIG *config)
ALLEGRO_CONFIG *al_load_config_file(const char *filename)
ALLEGRO_CONFIG *al_load_config_file_f(ALLEGRO_FILE *file)
bool al_save_config_file(const char *filename, const ALLEGRO_CONFIG *config)
bool al_save_config_file_f(ALLEGRO_FILE *file, const ALLEGRO_CONFIG *config)
void al_add_config_section(ALLEGRO_CONFIG *config, const char *name)
```

Note: we just provided part of the configuration file, for complete copy check the Ring source code distribution.

88.16 Threads Support

Next, another part of the configutaiton file, it's important because we can learn from it how to add threads to our Ring applications by using a threads library.

The idea is using ring_vm_mutexfunctions() and ring_vm_runcodefromthread() to execute Ring code.

```
<comment>
Threads
</comment>

<code>
void *al_func_thread(ALLEGRO_THREAD *thread, void *pPointer)
{
    List *pList;
    VM *pVM;
    const char *cStr;
    pList = (List *) pPointer ;
    pVM = (VM *) ring_list_getpointer(pList,2);
    cStr = ring_list_getstring(pList,1);
    ring_vm_runcodefromthread(pVM,cStr);
    ring_list_delete(pList);
    return NULL;
}

RING_FUNC(ring_al_create_thread)
{
    ALLEGRO_THREAD *pThread;
    List *pList;
    if ( RING_API_PARACOUNT != 1 ) {
        RING_API_ERROR(RING_API_MISS1PARA);
        return ;
    }
    if ( ! RING_API_ISSTRING(1) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return ;
    }
}
```

(continues on next page)

(continued from previous page)

```

    }
    pList = ring_list_new(0);
    ring_list_addstring(pList,RING_API_GETSTRING(1));
    ring_list_addpointer(pList,pPointer);
    ring_vm_mutexfunctions((VM *) pPointer,al_create_mutex,
                           al_lock_mutex,al_unlock_mutex,al_destroy_mutex);
    pThread = al_create_thread(al_func_thread, pList);
    al_start_thread(pThread);
    RING_API RETCPOINTER(pThread, "ALLEGRO_THREAD");
}

RING_FUNC(ring_al_run_detached_thread)
{
    List *pList;
    if ( RING_API_PARACOUNT != 1 ) {
        RING_API_ERROR(RING_API_MISS1PARA);
        return ;
    }
    if ( ! RING_API_ISSTRING(1) ) {
        RING_API_ERROR(RING_API_BADPARATYPE);
        return ;
    }
    pList = ring_list_new(0);
    ring_list_addstring(pList,RING_API_GETSTRING(1));
    ring_list_addpointer(pList,pPointer);
    ring_vm_mutexfunctions((VM *) pPointer,al_create_mutex,
                           al_lock_mutex,al_unlock_mutex,al_destroy_mutex);
    al_run_detached_thread(al_func_thread, pList);
}
</code>

<register>
ALLEGRO_THREAD *al_create_thread(void)
void al_run_detached_thread(void)
</register>

void al_start_thread(ALLEGRO_THREAD *thread)
void al_join_thread(ALLEGRO_THREAD *thread, void **ret_value)
void al_set_thread_should_stop(ALLEGRO_THREAD *thread)
bool al_get_thread_should_stop(ALLEGRO_THREAD *thread)
void al_destroy_thread(ALLEGRO_THREAD *thread)
ALLEGRO_MUTEX *al_create_mutex(void)
ALLEGRO_MUTEX *al_create_mutex_recursive(void)
void al_lock_mutex(ALLEGRO_MUTEX *mutex)
void al_unlock_mutex(ALLEGRO_MUTEX *mutex)
void al_destroy_mutex(ALLEGRO_MUTEX *mutex)
ALLEGRO_COND *al_create_cond(void)
void al_destroy_cond(ALLEGRO_COND *cond)
void al_wait_cond(ALLEGRO_COND *cond, ALLEGRO_MUTEX *mutex)

```

88.17 Code Generator Rules for Wrapping C++ Classes

- We can define classes between <class> and </class>
- Between <class> and <class> we set attributes like “name, nonew, para, parent, codename, passvmpointer, abstract and staticmethods”
- we set the attributes using the style attributename:value or attributename only if no values are required
- The “name” attribute determine the class name in C++ code and this name will be the default name in the Ring code
- The nonew instruction means that we don’t need new/delete methods
- The parent attribute determine the parent class name
- The codename attribute determine another class name in C++ code
- The passvmpoint instruction means passing the Ring VM pointer to the class constructor when we create new objects, this happens when we set the codename attribute to a class that we will define and this class need the Virtual Machine pointer (for example to use it to execute Ring code from C++ code).
- The abstract instruction means that no new method is required for this class “no objects will be created”.
- The staticmethods instruction means that method doesn’t need an object to be called.
- Using <nodllstartup> we can avoid #include “ring.h”, We need this to write our startup code.
- Using <libinitfunc> we can change the function name that register the library functions
- Using <ignorecpointertype> we can ignore pointer type check
- Using the aStringTypes list when can defined new types that treated like const char *
- Using the aBeforeReturn list when can define code that is inserted after the variable name when we return that variable from a function
- Using the aNewMethodName list we can define another method name to be used in Ring code when we call the C++ method. this feature is required because some C++ method may be identical to Ring Keywords like “load”, “next”, “end” and “done”.
- in method prototype - when we use @ in the method name, we mean that we have the same method with different parameters (As in C++)

88.18 Using configuration file that wrap C++ Library

To run the code generator to generate code for using C++ library in the Ring application, we can do that as we did with using C libraries but here we will generate *.cpp file instead of *.c file*. *Also we will determine another file to be generated (.ring)*. This file will contains classes in Ring code that wraps C++ functions for using C++ classes and objects.

```
ring parsec.ring generator\qt.cf ring_qt.cpp ring_qt.ring
```

88.19 Configuration file for the Qt Framework

The next configuration file is used to wrap many Qt classes. The configuration file is around 3500 lines and generate C++ code around 56000 lines and generate also Ring code around 9000 lines.

```
<nodllstartup>

<libinitfunc> ring_qt_start

<ignorecpointertype>

<code>

extern "C" {
    #include "ring.h"
}

#include "ring_qt.h"
#include "gpushbutton.h"
#include "gaction.h"
#include "glineedit.h"
#include "gtextedit.h"
#include "glistwidget.h"
#include "gtreeview.h"
#include "gtreewidget.h"
#include "gcombobox.h"
#include "gtabwidget.h"
#include "gtablewidget.h"
#include "gprogressbar.h"
#include "gspinbox.h"
#include "gslider.h"
#include "gdial.h"
#include "gwebview.h"
#include "gcheckbox.h"
#include "gradiobutton.h"
#include "gbuttongroup.h"
#include "gvideowidget.h"
#include "gtimer.h"
#include "gtcpserver.h"
#include "giodevice.h"
#include "gabstractsocket.h"
#include "gtcpsocket.h"
#include "gcolordialog.h"
#include "gallevents.h"
#include <QApplication>
#include <QObject>
#include <QWidget>
#include <QLabel>
#include <QPixmap>
#include <QIcon>
#include <QSize>
#include <QPushButton>
#include <QMainWindow>
#include <QVBoxLayout>
#include <QHBoxLayout>
#include <QLineEdit>
#include <QTextEdit>
```

(continues on next page)

(continued from previous page)

```
#include <QListWidget>
#include <QTreeView>
#include <QDir>
#include <QFileSystemModel>
#include <QTreeWidget>
#include <QTreeWidgetItem>
#include <QComboBox>
#include <QVariant>
#include <QMenuBar>
#include <QMenu>
#include <QToolBar>
#include <QMainWindow>
#include <QStatusBar>
#include <QDockWidget>
#include <QTabWidget>
#include <QTableWidget>
#include <QTableWidgetItem>
#include <QSizePolicy>
#include <QFrame>
#include <QAbstractScrollArea>
#include <QAbstractItemView>
#include <QProgressBar>
#include <QSpinBox>
#include <QSlider>
#include <QAbstractSlider>
#include <QDateEdit>
#include <QDateTimeEdit>
#include <QAbstractSpinBox>
#include <QDial>
#include <QWebView>
#include <QUrl>
#include <QCheckBox>
#include <QRadioButton>
#include <QButtonGroup>
#include <QMediaPlayer>
#include <QMediaPlaylist>
#include <QVideoWidget>
#include <QPrinter>
#include <QAction>
#include <QEvent>
#include <QMessageBox>
#include <QTimer>
#include <QFileDialog>
#include <QPainter>
#include <QPicture>
#include <QPen>
#include <QColor>
#include <QPrinter>
#include <QFont>
#include <QWebSettings>
#include <QBrush>
#include <QByteArray>
#include <QIODevice>
#include <QAbstractSocket>
#include <QTcpSocket>
#include <QTcpServer>
#include <QNetworkProxy>
```

(continues on next page)

(continued from previous page)

```

#include <QHostAddress>
#include <QHostInfo>
#include <QList>
#include <QFileInfo>
#include <QDirModel>
#include <QMModelIndex>
#include <QFontDialog>
#include <QDialog>
#include <QTextCursor>
#include <QTextBlock>
#include <QTextDocumentFragment>
#include <QColorDialog>
#include <QHeaderView>
#include <QStringList>
#include <QKeySequence>
#include <QLCDNumber>
#include <QInputDialog>
#include <QDesktopWidget>
#include <QRect>
#include <QTextDocument>

extern "C" {

    #define RING_DLL __declspec(dllexport)

    RING_DLL void ringlib_init(RingState *pRingState)
    {
        new QApplication(pRingState->argc,pRingState->argv);
        ring_qt_start(pRingState) ;
    }

}

</code>

<runcode>
aStringTypes + "QString"
aBeforeReturn + ["QString",".toStdString().c_str()"]
aNewMethodName + ["QWebView","load","loadpage"]
aNewMethodName + ["QMediaPlaylist","load","loadfile"]
aNewMethodName + ["QMediaPlaylist","next","movenext"]
aNewMethodName + ["QPainter","end","endpaint"]
aNewMethodName + ["QPicture","load","loadfile"]
aNewMethodName + ["QLineEdit","end","endtext"]
aNewMethodName + ["QDialog","done","donedialog"]
aNewMethodName + ["QTextDocument","end","enddoc"]
aNewMethodName + ["QTextBlock","next","nextblock"]
</runcode>

<class>
name: qApp
nonew
</class>

<register>
void exec(void)

```

(continues on next page)

(continued from previous page)

```

void quit(void)
void processEvents(void)
</register>

<code>

RING_FUNC(ring_qApp_quit)
{
    qApp->quit();
}

RING_FUNC(ring_qApp_exec)
{
    qApp->exec();
}

RING_FUNC(ring_qApp_processEvents)
{
    qApp->processEvents();
}

</code>

<class>
name: QObject
para: void
</class>

bool blockSignals(bool block)
QObjectList children(void)
void dumpObjectInfo(void)
void dumpObjectTree(void)
bool inherits(const char *className)
void installEventFilter(QObject *filterObj)
bool isWidgetType(void)
void killTimer(int id)
void moveToThread(QThread *targetThread)
QString objectName(void)
QObject *parent(void)
QVariant property(const char *name)
void removeEventFilter(QObject *obj)
void setObjectName(QString)
void setParent(QObject *parent)
bool setProperty(const char *name, QVariant)
bool signalsBlocked(void)
int startTimer(int interval)
QThread *thread(void)
void deleteLater(void)

<class>
name: QWidget
para: void
parent: QObject
</class>

bool acceptDrops(void)
QString accessibleDescription(void)

```

(continues on next page)

(continued from previous page)

```

QString accessibleName(void)
void activateWindow(void)
void addAction(QAction *action)
void adjustSize(void)
bool autoFillBackground(void)
int backgroundRole(void)
QSize baseSize(void)
QWidget *childAt(int x, int y)
 QRect childrenRect(void)
 QRegion childrenRegion(void)
void clearFocus(void)
void clearMask(void)
QMargins contentsMargins(void)
 QRect contentsRect(void)
int contextMenuPolicy(void)
QCursor cursor(void)
int effectiveWinId(void)
void ensurePolished(void)
int focusPolicy(void)
QWidget *focusProxy(void)
QWidget *focusWidget(void)
QFont font(void)
QFontInfo fontInfo(void)
QFontMetrics fontMetrics(void)
int foregroundRole(void)
 QRect frameGeometry(void)
QSize frameSize(void)
 QRect geometry(void)
void getContentsMargins(int *left, int *top, int *right, int *bottom)
void grabGesture(int gesture, int flags)
void grabKeyboard(void)
void grabMouse(void)
int grabShortcut(QKeySequence , int context)
QGraphicsEffect *graphicsEffect(void)
QGraphicsProxyWidget *graphicsProxyWidget(void)
bool hasFocus(void)
bool hasMouseTracking(void)
int height(void)
int heightForWidth(int w)
int inputMethodHints(void)
QVariant inputMethodQuery(int query)
void insertAction(QAction *before, QAction *action)
bool isActiveWindow(void)
bool isAncestorOf(QWidget *child)
bool isEnabled(void)
bool isEnabledTo(QWidget *ancestor)
bool isFullScreen(void)
bool isHidden(void)
bool isMaximized(void)
bool isMinimized(void)
bool isModal(void)
bool isVisible(void)
bool isVisibleTo(QWidget *ancestor)
bool isWindow(void)
bool isWindowModified(void)
QLayout *layout(void)
int layoutDirection(void)

```

(continues on next page)

(continued from previous page)

```

QLocale locale(void)
QPoint mapFrom(QWidget *parent, QPoint)
QPoint mapFromGlobal(QPoint)
QPoint mapFromParent(QPoint)
QPoint mapTo(QWidget *parent, QPoint)
QPoint mapToGlobal(QPoint pos)
QPoint mapToParent(QPoint pos)
QRegion mask(void)
int maximumHeight(void)
QSize maximumSize(void)
int maximumWidth(void)
int minimumHeight(void)
QSize minimumSize(void)
int minimumWidth(void)
void move(int x, int y)
QWidget *nativeParentWidget(void)
QWidget *nextInFocusChain(void)
QRect normalGeometry(void)
void overrideWindowFlags(int flags)
QPalette palette(void)
QWidget *parentWidget(void)
QPoint pos(void)
QWidget *previousInFocusChain(void)
QRect rect(void)
void releaseKeyboard(void)
void releaseMouse(void)
void releaseShortcut(int id)
void removeAction(QAction *action)
void render(QPaintDevice *target, QPoint, QRegion, int)
void repaint(int x, int y, int w, int h)
void resize(int w, int h)
bool restoreGeometry(QByteArray)
QByteArray saveGeometry(void)
void scroll(int dx, int dy)
void setAcceptDrops(bool on)
void setAccessibleDescription(QString)
void setAccessibleName(QString)
void setAttribute(int attribute, bool on)
void setAutoFillBackground(bool enabled)
void setBackgroundRole(int role)
void setBaseSize(int basew, int baseh)
void setContentsMargins(int left, int top, int right, int bottom)
void setContextMenuPolicy(int policy)
void setCursor(QCursor)
void setFixedHeight(int h)
void setFixedSize(int w, int h)
void setFixedWidth(int w)
void setFocus(int reason)
void setFocusPolicy(int policy)
void setFocusProxy(QWidget *w)
void setFont(QFont)
void setForegroundRole(int role)
void setGeometry(int x, int y, int w, int h)
void setGraphicsEffect(QGraphicsEffect *effect)
void setInputMethodHints(int hints)
void setLayout(QLayout *layout)
void setLayoutDirection(int direction)

```

(continues on next page)

(continued from previous page)

```

void setLocale(QLocale)
void setMask(QBitmap)
void setMaximumHeight(int maxh)
void setMaximumSize(int maxw, int maxh)
void setMaximumWidth(int maxw)
void setMinimumHeight(int minh)
void setMinimumSize(int minw, int minh)
void setMinimumWidth(int minw)
void setMouseTracking(bool enable)
void setPalette(QPalette)
void setParent(QWidget *parent)
void setShortcutAutoRepeat(int id, bool enable)
void setShortcutEnabled(int id, bool enable)
void setSizeIncrement(int w, int h)
void setSizePolicy(int horizontal, int vertical)
void setStatusTip(QString)
void setStyle(QStyle *style)
void setToolTip(QString)
void setUpdatesEnabled(bool enable)
void setWhatsThis(QString)
void setWindowFilePath(QString)
void setWindowFlags(int type)
void setWindowIcon(QIcon)
void setWindowIconText(QString)
void setWindowModality(int windowModality)
void setWindowOpacity(double level)
void setWindowRole(QString)
void setWindowState(int windowState)
QSize size(void)
QSize sizeIncrement(void)
QSizePolicy sizePolicy(void)
void stackUnder(QWidget *w)
QString statusTip(void)
QStyle *style(void)
QString styleSheet(void)
bool testAttribute(int attribute)
QString toolTip(void)
bool underMouse(void)
void ungrabGesture(int gesture)
void unsetCursor(void)
void unsetLayoutDirection(void)
void unsetLocale(void)
void update(int x, int y, int w, int h)
void updateGeometry(void)
bool updatesEnabled(void)
QRegion visibleRegion(void)
QString whatsThis(void)
int width(void)
int winId(void)
QWidget *window(void)
QString windowFilePath(void)
int windowFlags(void)
QIcon windowIcon(void)
QString windowIconText(void)
int windowModality(void)
double windowOpacity(void)
QString windowRole(void)

```

(continues on next page)

(continued from previous page)

```

int windowState(void)
QString windowTitle(void)
int windowType(void)
int x(void)
int y(void)
bool close(void)
void hide(void)
void lower(void)
void raise(void)
void setDisabled(bool disable)
void setEnabled(bool)
void setHidden(bool hidden)
void setStyleSheet(QString)
void setWindowModified(bool)
void setWindowTitle(QString)
void show(void)
void showFullScreen(void)
void showMaximized(void)
void showMinimized(void)
void showNormal(void)
QWidget *find(int id)
QWidget *keyboardGrabber(void)
QWidget *mouseGrabber(void)
void setTabOrder(QWidget *first, QWidget *second)

<class>
name: QLabel
para: QWidget *
parent: QWidget
</class>

int alignment(void)
QWidget *buddy(void)
bool hasScaledContents(void)
bool hasSelectedText(void)
int indent(void)
int margin(void)
QMovie *movie(void)
bool openExternalLinks(void)
QPicture *picture(void)
QPixmap *pixmap(void)
QString selectedText(void)
int selectionStart(void)
void setAlignment(int)
void setBuddy(QWidget *buddy)
void setIndent(int)
void setMargin(int)
void setOpenExternalLinks(bool open)
void setScaledContents(bool)
void setSelection(int start, int length)
void setTextFormat(int)
void setTextInteractionFlags(int flags)
void setWordWrap(bool on)
QString text(void)
int textFormat(void)
int textInteractionFlags(void)
bool wordWrap(void)

```

(continues on next page)

(continued from previous page)

```

void clear(void)
void setMovie(QMovie *movie)
void setNum(double num)
void setPicture(QPicture)
void setPixmap(QPixmap)
void setText(QString)

<class>
name: QPushButton
para: QWidget *
parent: QWidget
codename: GPushButton
passvmpointer
</class>

void setText(const char *)
void setClickEvent(const char *)
void setIcon(QIcon)
void setIconSize(QSize)

<class>
name: QLineEdit
para: QWidget *
parent: QWidget
codename: GLineEdit
passvmpointer
</class>

int alignment(void)
void backspace(void)
QCompleter *completer(void)
QMenu *createStandardContextMenu(void)
void cursorBackward(bool mark, int steps)
void cursorForward(bool mark, int steps)
int cursorMoveStyle(void)
int cursorPosition(void)
int cursorPositionAt(QPoint)
void cursorWordBackward(bool mark)
void cursorWordForward(bool mark)
void del(void)
void deselect(void)
QString displayText(void)
bool dragEnabled(void)
int echoMode(void)
void end(bool mark)
void getTextMargins(int *left, int *top, int *right, int *bottom)
bool hasAcceptableInput(void)
bool hasFrame(void)
bool hasSelectedText(void)
void home(bool mark)
QString inputMask(void)
void insert(QString)
bool isModified(void)
bool isReadOnly(void)
bool isRedoAvailable(void)
bool isUndoAvailable(void)
int maxLength(void)

```

(continues on next page)

(continued from previous page)

```

QString placeholderText(void)
QString selectedText(void)
int selectionStart(void)
void setAlignment(int flag)
void setCompleter(QCompleter *c)
void setCursorMoveStyle(int style)
void setCursorPosition(int)
void setDragEnabled(bool b)
void setEchoMode(int)
void setFrame(bool)
void setInputMask(QString)
void setMaxLength(int)
void setModified(bool)
void setPlaceholderText(QString)
void setReadOnly(bool)
void setSelection(int start, int length)
void setTextMargins(int left, int top, int right, int bottom)
void setValidator(QValidator *v)
QString text(void)
QMargins textMargins(void)
QValidator *validator(void)

void clear(void)
void copy(void)
void cut(void)
void paste(void)
void redo(void)
void selectAll(void)
void setText(QString)
void undo(void)

void setTextChangedEvent(const char *)
void setcursorPositionChangedEvent(const char *)
void seteditingFinishedEvent(const char *)
void setreturnPressedEvent(const char *)
void setselectionChangedEvent(const char *)
void settextEditedEvent(const char *)

```

Note: Most of the content of the previous configuration file is removed from this documentation, for a complete version see the Ring source code distribution.

88.20 Static Methods

Starting from Ring 1.8 the code generator support the staticmethods option.

So the code generator can know that the class doesn't need an object to call the methods.

Example:

```

<class>
name: QStandardPaths
para: void
nonew

```

(continues on next page)

(continued from previous page)

```
staticmethods
</class>

QString displayName(QStandardPaths::StandardLocation type)
QString findExecutable(QString executableName, QStringList paths))
```

88.21 Loading Files

Starting from Ring 1.9 the code generator support the <loadfile> command.

```
<loadfile> filename.cf
```

This is useful to separate the extension configuration file to many files

Example:

The file : qt_module_network.cf in the RingQt Extension

```
<comment>
    Module (network)
</comment>

<loadfile> qabstractsocket.cf
<loadfile> qnetworkproxy.cf
<loadfile> qtcpsocket.cf
<loadfile> qtcpserver.cf
<loadfile> qhostaddress.cf
<loadfile> qhostinfo.cf
<loadfile> qnetworkrequest.cf
<loadfile> qnetworkaccessmanager.cf
<loadfile> qnetworkreply.cf
```

88.22 Managed Classes

Starting from Ring 1.9 the code generator support the <managed> option when defining classes.

Using this option, the generator will use RING_API_RETMANAGEDCPOINTER() to return the C pointer.

So the Garbage Collector will manage these C pointers.

Example

```
<class>
name: QFont
para: QString, int, int, bool
managed
</class>
```

88.23 Configuration Files Examples

You can learn from the next examples

- RingAllegro : <https://github.com/ring-lang/ring/blob/master/extensions/ringallegro/allegro.cf>
- RingQt : <https://github.com/ring-lang/ring/blob/master/extensions/ringqt/classes/qt.cf>
- RingLibSDL : <https://github.com/ring-lang/ring/blob/master/extensions/ringsdl/libsdl.cf>

After modifying the configuration file, You will need to generate the code, You can learn from the next examples

- RingAllegro : <https://github.com/ring-lang/ring/blob/master/extensions/ringallegro/gencode.bat>
- RingQt : <https://github.com/ring-lang/ring/blob/master/extensions/ringqt/gencode.bat>
- RingLibSDL : <https://github.com/ring-lang/ring/blob/master/extensions/ringsdl/gencode.bat>

After generating the code, You will need to build the library, You can learn from the next examples

- RingAllegro : <https://github.com/ring-lang/ring/blob/master/extensions/ringallegro/buildvc.bat>
- RingQt : <https://github.com/ring-lang/ring/blob/master/extensions/ringqt/buildmingw32.bat>
- RingLibSDL : <https://github.com/ring-lang/ring/blob/master/extensions/ringsdl/buildvc.bat>

CHAPTER
EIGHTYNINE

CREATE YOUR FIRST EXTENSION

In this chapter we will create RingBeep

RingBeep is a simple extension for the beep() function in Windows API

Just a simple example about creating extensions

89.1 Location

You will find this extension in the ring/extensions/ringbeep folder

89.2 Steps to create the extension

At first we write the configuration file in : ringbeep.cf

```
notepad ringbeep.cf
```

The file ringbeep.cf contains

```
<code>
#include "windows.h"
</code>

int Beep(int dwFreq,int dwDuration)
```

Then we run : gencode.bat to generate ringbeep.c

```
gencode.bat
```

The gencode.bat contains the next command to call Ring Extensions Generator

```
ring ..\codegen\parsec.ring ringbeep.cf ringbeep.c
```

Then we build the extension using :

```
buildvc.bat
```

The file buildvc.bat contains the next commands to build the extension using Visual C/C++

```
cls
call ../../src/locatevc.bat
cl /c /DEBUG ringbeep.c -I"..\..\include"
link /DEBUG ringbeep.obj ..\..\lib\ring.lib kernel32.lib /DLL /OUT:ringbeep.dll ^
/SUBSYSTEM:CONSOLE,"5.01"
del ringbeep.obj
```

89.3 Testing the extension

Then we test the function using

```
ring test.ring
```

The file test.ring contains

```
loadlib("ringbeep.dll")

for f = 750 to 1000 step 50
    beep(f,300)
next
```

LANGUAGE DESIGN

In this chapter we will learn about the basic concepts behind the language design.

90.1 Why Ring?

The language is simple, trying to be natural, encourage organization and comes with transparent and visual implementation. It comes with compact syntax and a group of features that enable the programmer to create natural interfaces and declarative domain-specific languages in a fraction of time. It is very small, fast and comes with smart garbage collector that puts the memory under the programmer control. It supports many programming paradigms, comes with useful and practical libraries. The language is designed for productivity and developing high quality solutions that can scale.

90.2 Designed for a Clear Goal

- Applications programming language.
- Productivity and developing high quality solutions that can scale.
- Small and fast language that can be embedded in C/C++ projects.
- Simple language that can be used in education and introducing Compiler/VM concepts.
- General-Purpose language that can be used for creating domain-specific libraries, frameworks and tools.
- Practical language designed for creating the next version of the Programming Without Coding Technology software.

90.3 Simple

Ring is a very simple language, and has a very straightforward syntax. It encourages programmers to program without boilerplate code

See "Hello, World!"

The Main function is optional and will be executed after the statements, and is useful for using the local scope.

Func Main
 See "Hello, World!"

Uses Dynamic Typing and Lexical scoping. No \$ is required before the variable name! You can use the ‘+’ operator for string concatenation and the language is weakly typed and will convert automatically between numbers and strings based on the context.

```
nCount = 10      # Global variable
Func Main
    nID = 1 # Local variable
    See "Count = " + nCount + nl + " ID = " + nID
```

90.4 Trying to be natural

Ring is not case-sensitive

```
See "Enter your name ? "
Give name
See "Hello " + Name      # Name is the same as name
```

The list index starts from 1

```
aList = ["one", "two", "three"]
See aList[1]      # print one
```

Call functions before definition

```
one()
two()
three()
Func one
    See "One" + nl
Func two
    See "two" + nl
Func three
    See "three" + nl
```

The assignment operator uses Deep copy (no references in this operation)

```
aList = ["one", "two", "three"]
aList2 = aList
aList[1] = 1
see aList[1]      # print 1
see aList2[1]      # print one
```

Pass numbers and strings by value, but pass lists and objects by reference. The for in loop can update the list items.

```
Func Main
    aList = [1,2,3]
    update(aList)
    see aList      # print one two three

Func update aList
    for x in aList
        switch x
        on 1 x = "one"
        on 2 x = "two"
        on 3 x = "three"
```

(continues on next page)

(continued from previous page)

```
    off
next
```

Using Lists during definition

```
aList = [ 1,2,3,4,5] , aList[1] , aList[1]
see aList      # print 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5
```

Exit from more than one loop

```
for x = 1 to 10
    for y = 1 to 10
        see "x=" + x + " y=" + y + nl
        if x = 3 and y = 5
            exit 2      # exit from 2 loops
        ok
    next
next
```

90.5 Encourage Organization

The language encourage organization, Forget bad days using languages where the programmer start with function then class then function and a strange mix between things!

Each source file follow the next structure

- Load Files
- Statements and Global Variables
- Functions
- Packages and Classes

This enable us to use Packages, Classes and Functions without the need to use a keyword to end these components.

We can write one line comments and multi-line comments The comment starts with # or // Multi-line comments are written between /* and */

```
/*
Program Name : My first program using Ring
Date        : 2015.05.08
*/
See "What is your name? "      # print message on screen
give cName                    # get input from the user
see "Hello " + cName          # say hello!

// See "Bye!"
```

90.6 Compact Syntax

The language is not line sensitive, you don't need to write ; after statements, also you don't need to press ENTER or TAB, so we can write the next code

```
See "The First Message" See "Another message in the same line! " + nl
See "Enter your name?" Give Name See "Hello " + Name
```

The next code create a class called Point contains three attributes X,Y and Z. No keywords is used to end the package/class/function definition. Also, we can write the attributes names directly below the class name.

```
Class Point X Y Z
```

We can use classes and functions before their definition, In this example we will create new object, set the object attributes then print the object values.

```
o1 = New point o1.x=10 o1.y=20 o1.z=30 See o1 Class Point X Y Z
```

Instead of using the dot '.' operator to access the object attributes and methods we can use braces {} to access the object, then we can use the object attributes and methods.

```
o1 = New point { x=10 y=20 z=30 } See o1 Class Point X Y Z
```

Now we will call a method after accessing the object using {}

```
oPerson = new Person
{
    Name = "Somebody"
    Address = "Somewhere"
    Phone = "0000000"
    Print() # here we call the Print() method
}
Class Person Name Address Phone
    Func Print
        See "Name :" + name + nl +
            "Address :" + Address + nl +
            "Phone : " + phone + nl
```

When we use {} to access the object then write any attribute name, the language will check the class for any setter/getter methods that will be called automatically.

```
New Number {
    See one # Execute GetOne()
    See two # Execute GetTwo()
    See three # Execute GetThree()
}
Class Number one two three
    Func GetOne
        See "Number : One" + nl
        return 1
    Func GetTwo
        See "Number : Two" + nl
        return 2
    Func GetThree
        See "Number : Three" + nl
        return 3
```

90.7 Define Natural Statements

After the object access using { } if the class contains a method called BraceEnd() it will be executed!

```
TimeForFun = new journey
# The first surprise!
TimeForFun {
    Hello it is me           # What a beatiful programming world!
}
# Our Class
Class journey
    hello=0 it=0 is=0 me=0
    func GetHello
        See "Hello" + nl
    func braceEnd
        See "Goodbye!" + nl
```

We can execute code written in strings using the Eval() function

```
cCode = "See 'Code that will be executed later!' "
Eval(cCode)      # execute the code to print the message
```

We can create a list then execute code generated from that list

```
aWords = ["hello","it","is","me"]
for word in aWords cCode=word+"=0" eval(cCode) next
```

We can read text files using the Read(cFileName) function and we can write files using the Write(cFileName,cString) function.

```
See "Enter File Name:" Give cFileName See Read(cFileName) # Print the file content
```

The next example presents how to create a class that defines two instructions The first instruction is : I want window
The second instruction is : Window title = Expression Also keywords that can be ignored like the 'the' keyword

```
New App
{
    I want window
    The window title = "hello world"
}

Class App
    # Attributes for the instruction I want window
    i want window
    nWantwindow = 0
    # Attributes for the instruction Window title
    # Here we don't define the window attribute again
    title
    nWindowTitle = 0
    # Keywords to ignore, just give them any value
    the=0

    func geti
        if nWantwindow = 0
            nWantwindow++
        ok
```

(continues on next page)

(continued from previous page)

```

func getwant
    if nWantwindow = 1
        nWantwindow++
    ok

func getWindow
    if nWantwindow = 2
        nWantwindow= 0
        see "Instruction : I want window" + nl
    ok
    if nWindowTitle = 0
        nWindowTitle++
    ok

func setTitle cValue
    if nWindowTitle = 1
        nWindowTitle=0
        see "Instruction : Window Title = " + cValue + nl
    ok

```

To complete the previous example, use read() to get the content of a file that contains

```
I want window
The window title = "hello world"
```

Then use eval() to execute the content of that file!. Also, you can update the methods GetWindow() and SetTitle() to create Real windows using the GUI Library

90.8 Define Declarative Languages

We learned how to use Natural statements to execute our code and using the same features we can use nested structures to execute our code.

The next example from the Web library, generate HTML document using the Bootstrap library. No HTML code is written directly in this example, we created a similar language (just as example) Then using this declarative language that uses nested structures, we generated the HTML Document.. The idea in this example is that the GetDiv() and GetH1() methods return an object that we can access using {} and after each object access the method BraceEnd() will be executed to send the generated HTML to the parent object until we reach to the root where BraceEnd() will print the output.

```

Load "weplib.ring"
Import System.Web

Func Main

    BootStrapWebPage()
    {
        div
        {
            classname = :container
            div
            {
                classname = :jumbotron

```

(continues on next page)

(continued from previous page)

```

        H1 { text("Bootstrap Page") }

    }
div
{
    classname = :row
    for x = 1 to 3
        div
        {
            classname = "col-sm-4"
            H3 { html("Welcome to the Ring programming language") }
            P { html("Using a scripting language is very fun!") }
        }
    next
}
}
}

```

The classes that power the declarative interface looks like this

```

Class Link from ObjsBase
    title link
    Func braceend
        cOutput = nl+GetTabs() + "<a href=''" +
                    Link + "'> "+ Title + " </a> " + nl

Class Div from ObjsBase
    Func braceend
        cOutput += nl+'<div'
        addattributes()
        AddStyle()
        getobjsdata()
        cOutput += nl+"</div>" + nl
        cOutput = TabMLString(cOutput)

```

90.9 Transparent Implementation

Ring comes with transparent implementation. We can know what is happening in each compiler stage and what is going on during the run-time by the Virtual Machine Example : ring helloworld.ring -tokens -rules -ic

See "Hello, World!"

Output

```

=====
Tokens - Generated by the Scanner
=====

Keyword : SEE
Literal : Hello, World!
EndLine

=====
=====
```

(continues on next page)

(continued from previous page)

Grammar Rules Used by The Parser

```
=====
Rule : Program --> {Statement}
Line 1
Rule : Factor --> Literal
Rule : Range --> Factor
Rule : Term --> Range
Rule : Arithmetic --> Term
Rule : BitShift --> Arithmetic
Rule : BitAnd --> BitShift
Rule : BitOrXOR --> BitAnd
Rule : Compare --> BitOrXOR
Rule : EqualOrNot --> Compare
Rule : LogicNot -> EqualOrNot
Rule : Expr --> LogicNot
Rule : Statement --> 'See' Expr
=====
```

Byte Code - Before Execution by the VM

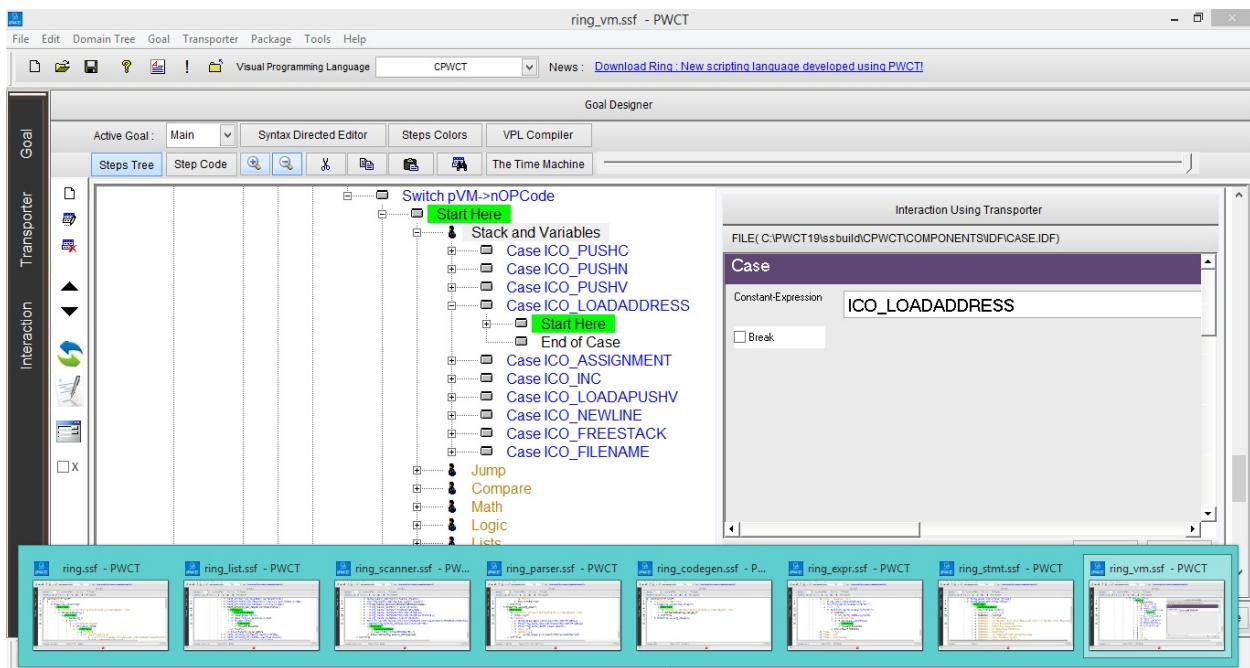
PC	OPCode	Data
1	FuncExE	
2	PushC	Hello, World!
3	Print	
4	ReturnNull	

Hello, World!

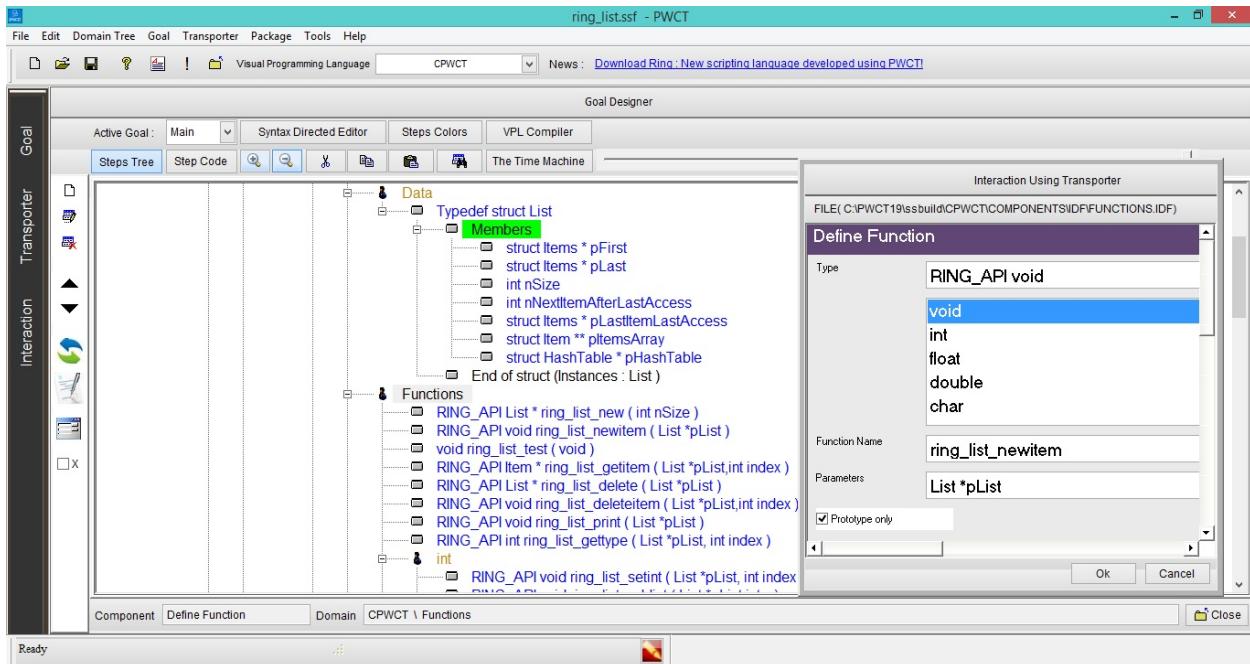
90.10 Visual Implementation

The Ring programming language is designed using the PWCT visual programming tool and you will find the visual source of the language in the folder “language/visualsrc” - *.ssf files and the generated source code (In the C Language) in the language/src folder and the language/include folder.

The next screen shot from the ring_vm.ssf file (Generate ring_vm.c and ring_vm.h)



The next screen shot from the ring_list.ssf file (Generate ring_list.c and ring_list.h)



90.11 Smart Garbage Collector

Avoid memory problems :-

- Invalid Memory Access
- Memory leaks
- Uninitialized Memory Access
- Dangling pointer

Rules :-

- Global variables always stay in the memory, until you delete these variables using the assignment statement.
- Local variables always deleted after the end of the function.
- The programmer have full control on when to delete the variable from the memory using the Assignment statement.

Example:

```
aList = [1,2,3,4,5]
aList = "nice"
```

After the second line directly, The list [1,2,3,4,5] will be deleted from the memory and we will have a string “nice”

- The programmer can call the function callgc() to force running the garbage collector.
- If we have a reference to a variable (when we pass objects and lists to functions), then deleting variables will be based on reference counting, if no references everything will be deleted, but if we have a reference, the data will stay in memory.

90.12 No Global Interpreter (VM) Lock - No GIL

When we use threads in Ring applications, We don't have global interpreter (VM) lock (No GIL)

So threads can work in parallel and execute Ring instructions at the same time

This is better for threads and concurrency (More Faster!)

90.13 Fast Enough For Many Applications

Ring is designed to be a simple, small and flexible language in the first place, but also it is fast enough for many applications.

Ring can do each of the next tasks in around 1 second using normal computers in the market during the last 5 years

- (1) Compiling 100,000 lines of code
- (2) Executing empty loop that count from 1 to 10,000,000
- (3) Executing 1000 search operation using linear search in a list contains 100,000 items, trying to find the last item (The worst case)
- (4) Creating list contains 1,000,000 items then summing all of the list items
- (5) Adding 20,000 items to the ListWidget in GUI applications

- (6) Adding 5,000 nodes to the TreeWidget in GUI applications
- (7) Printing 10,000 messages to the terminal in Console applications

Also when we need more speed we can use C/C++ extensions!

WHAT IS NEW IN RING 1.1?

In this chapter we will learn about the changes and new features in Ring 1.1 release.

91.1 List of changes and new features

Ring 1.1 comes with many new features

- Better Natural Language Programming Support
- Generate/Execute Ring Object Files (*.ringo)
- Syntax Flexibility and different styles for I/O and Control Structures
- New Functions and Changes
- StdLib functions and classes written in Ring
- RingLibSDL
- Demo Project - Game Engine for 2D Games
- RingSQLite
- Better Code Generator for Extensions
- Using Self.Attribute in the Class Region to define new attributes
- Using This.Attribute in nested Braces inside the Class Methods
- Better Documentation

91.2 Better Natural Language Programming Support

Ring is an innovative language because of it's compact syntax, smart implementation (small, transparent & visual) and it's ability to create declarative and natural domain specific languages in a fraction of time.

This release add support for calling methods when an expression is evaluated

check this example:

```
# Natural Code
new program {
    Accept 2 numbers then print the sum
}

# Natural Code Implementation
```

(continues on next page)

(continued from previous page)

```

class program
    # Keywords
        Accept=0 numbers=0 then=0 print=0 the=0 sum=0

    # Execution
    func braceexpraval x
        value = x
    func getnumbers
        for x=1 to value
            see "Enter Number (" + x + ") :" give nNumber
            aNumbers + nNumber
        next
    func getsum
        nSum = 0
        for x in aNumbers nSum+= x next
        see "The Sum : " + nSum
    private
        value=0 aNumbers= []

```

Output:

```

Enter Number (1) :3
Enter Number (2) :4
The Sum : 7

```

for more information see the “Natural Language Programming” chapter.

91.3 Generate/Execute Ring Object Files (*.ringo)

This feature enable you to distribute your applications without distributing the source code. Also it makes application distribution a simple process where you get one Ring object file for the complete project (many source code files). Also using Ring object file remove the loading time required for compiling the application.

Check the “command line options” chapter to know more about this feature.

91.4 Syntax Flexibility and different styles for I/O and Control Structures

Programmers are sensitive to the programming language syntax. Great programmers know how to work using many different styles but each programmer may have his/her favorite style.

Each programming language comes with a style that you may like or not. Ring is just one of these languages, but as a response to many programmers asking for a better syntax we decided to provide more options.

Also some of these features are very necessary for Natural Language Programming.

Example :

We have two commands to change language keywords and operators.

```

ChangeRingOperator + plus
ChangeRingKeyword see print

```

(continues on next page)

(continued from previous page)

```
Print 5 plus 5

ChangeRingOperator plus +
ChangeRingKeyword print see
```

We have new styles (Optional) for Input/Output.

Example :

```
Put "What is your name? "
Get cName
Put "Hello " + cName
```

Example :

```
Load "stdlib.ring"

Print("What is your name? ")      # print message on screen
cName=GetString()                # get input from the user
print("Hello #{cName}")          # say hello!
```

We have new styles (optional) for control structures.

Example :

```
While True

    Put "
        Main Menu
        -----
        (1) Say Hello
        (2) About
        (3) Exit

    " Get nOption

    Switch nOption
    Case 1
        Put "Enter your name : "
        Get name
        Put "Hello " + name + nl
    Case 2
        Put "Sample : using while loop" + nl
    Case 3
        Bye
    Else
        Put "bad option..." + nl
    End
End
```

Example :

```
Load "stdlib.ring"

While True {

    print("
```

(continues on next page)

(continued from previous page)

```

Main Menu
-----
(1) Say Hello
(2) About
(3) Exit

")

nOption = GetString()

switch nOption {
case 1
    print("Enter your name : ")
    name = getstring()
    print("Hello #{name}\n")
case 2
    print("Sample : using switch statement\n")
case 3
    Bye
else
    print("bad option...\n")
}

}

```

Check the next chapters:-

- Getting Started - Second Style
- Getting Started - Third Style
- Control Structures - Second Style - May looks like Lua and Ruby
- Control Structures - Third Style - May looks like C (uses braces)
- Syntax Flexibility

Note: All of these styles are provided automatically by the compiler at the same time, It's better to select one style for the same project (you can create your style as a mix from these styles) for example you can use Put/Get and Braces.

91.5 New Functions and Changes

Changed:

- get() function : changed to sysget()
- sort() function : can now work on list of objects
- find() function : can now work on list of objects

Added:

- clockspersisecond()
- CurrentDir()
- ExeFileName()

- ChDir()
- ExeFolder()
- varptr()
- space()
- nullpointer()
- object2pointer()
- pointer2object()

Check the next chapters

- System Functions
- Object Oriented Programming (OOP)
- Low Level Functions

91.6 StdLib functions and classes written in Ring

Ring 1.1 comes with a library called StdLib, it's written in Ring by the help of Ring Team

The library provide a useful group of new functions and classes

Example:

```
Load "stdlib.ring"

Puts("Test Times()")
Times ( 3 , func { see "Hello, World!" + nl } )
```

Example:

```
Load "stdlib.ring"

Puts("Test Map()")
See Map( 1:10 , func x { return x*x } )
```

Example:

```
Load "stdlib.ring"

Puts("Test Filter()")
See Filter( 1:10 , func x { if x <= 5 return true else return false ok } )
```

Example:

```
Load "stdlib.ring"

See "Testing the String Class" + nl
oString = new string("Hello, World!")
oString.println()
oString.upper().println()
oString.lower().println()
oString.left(5).println()
oString.right(6).println()
```

Example:

```
Load "stdlib.ring"

oList = new list ( [1,2,3] )
oList.Add(4)
oList.print()
```

Example:

```
Load "stdlib.ring"

oStack = new Stack
oStack.push(1)
oStack.push(2)
oStack.push(3)
see oStack.pop() + nl
```

Example:

```
Load "stdlib.ring"

oQueue = new Queue
oQueue.add(1)
oQueue.add(2)
oQueue.add(3)
see oQueue.remove() + nl
```

Example:

```
Load "stdlib.ring"

ohashable = new hashtable
See "Test the hashtable Class Methods" + nl
ohashable {
    Add("Egypt", "Cairo")
    Add("KSA", "Riyadh")
    see self["Egypt"] + nl
    see self["KSA"] + nl
    see contains("Egypt") + nl
    see contains("USA") + nl
    see index("KSA") + NL
    print()
    delete(index("KSA"))
    see copy("*", 60) + nl
    print()
}
```

Example:

```
Load "stdlib.ring"

otree = new tree
See "Test the tree Class Methods" + nl
otree {
    set("The first step") # set the root node value
    see value() + nl
    Add("one")
```

(continues on next page)

(continued from previous page)

```

Add("two")
Add("three") {
    Add("3.1")
    Add("3.2")
    Add("3.3")
    see children
}
see children
oTree.children[2] {
    Add("2.1") Add("2.2") Add("2.3") {
        Add("2.3.1") Add("2.3.2") Add("test")
    }
}
oTree.children[2].children[3].children[3].set("2.3.3")
}
see copy("*", 60) + nl
oTree.print()

```

Check the next chapters:

- StdLib Functions
- StdLib Classes

91.7 RingLibSDL

Ring 1.0 provided RingAllegro to be able to create games using the Allegro game programming library

Now Ring 1.1 provide RingLibSDL also so we can have the choice between Allegro or LibSDL

Example:

```

Load "libsdl.ring"

SDL_Init(SDL_INIT_EVERYTHING)
win = SDL_CreateWindow("Hello World!", 100, 100, 640, 480, SDL_WINDOW_SHOWN)
SDL_Delay(2000)
SDL_DestroyWindow(win)
SDL_Quit()

```

See the RingLibSDL Chapter.

91.8 Demo Project - Game Engine for 2D Games

In practice we would create a game engine in a language like C/C++ to get the best performance then provide Ring classes to use the engine.

But many 2D Games are simple and creating a game engine in Ring will be fast enough in many cases

Also this would be a good demo project to learn about the language concepts where we build things using Object Oriented Programming (OOP) then access the power that we have using declarative programming using nested structures or using natural programming.

In this project we selected the first way (declarative programming using nested structures)

Example:

```

Load "gameengine.ring" # Give Control to the Game Engine

func main # Called by the Game Engine

    oGame = New Game # Create the Game Object
    {
        title = "My First Game"
        text {
            x = 10 y=50
            animate = false
            size = 20
            file = "fonts/pirulen.ttf"
            text = "game development using ring is very fun!"
            color = rgb(0,0,0) # Color = black
        }
        text {
            x = 10 y=150
            # Animation Part =====
            animate = true # Use Animation
            direction = GE_DIRECTION_INCVERTICAL # Increase y
            point = 400 # Continue until y=400
            nStep = 3 # Each time y+= 3
            =====
            size = 20
            file = "fonts/pirulen.ttf"
            text = "welcome to the real world!"
            color = rgb(0,0,255) # Color = Blue
        }
        Sound { # Play Sound
            file = "sound/music1.wav" # Sound File Name
        }
    } # Start the Events Loop
}

```

See the “Demo Project - Game Engine for 2D Games” chapter.

91.9 RingSQLite

Ring 1.0 provided support for ODBC to use any database and provided native support for MySQL.

Now Ring 1.1 provide native support for SQLite database too.

Example:

```

oSQLite = sqlite_init()

sqlite_open(oSQLite, "mytest.db")

sql = "CREATE TABLE COMPANY(" +
      "ID INT PRIMARY KEY     NOT NULL," +
      "NAME      TEXT      NOT NULL," +
      "AGE       INT      NOT NULL," +
      "ADDRESS   CHAR(50), " +
      "SALARY    REAL );"

sqlite_execute(oSQLite,sql)

```

(continues on next page)

(continued from previous page)

```

sql = "INSERT INTO COMPANY (ID,NAME,AGE,ADDRESS,SALARY) " +
      "VALUES (1, 'Mahmoud', 29, 'Jeddah', 20000.00 ); " +
      "INSERT INTO COMPANY (ID,NAME,AGE,ADDRESS,SALARY) " +
      "VALUES (2, 'Ahmed', 27, 'Jeddah', 15000.00 ); " +
      "INSERT INTO COMPANY (ID,NAME,AGE,ADDRESS,SALARY) " +
      "VALUES (3, 'Mohammed', 31, 'Egypt', 20000.00 ); " +
      "INSERT INTO COMPANY (ID,NAME,AGE,ADDRESS,SALARY) " +
      "VALUES (4, 'Ibrahim', 24, 'Egypt ', 65000.00 );"

sqlite_execute(oSQLite,sql)

aResult = sqlite_execute(oSQLite,"select * from COMPANY")
for x in aResult
    for t in x
        see t[2] + nl
    next
next
see copy("*",50) + nl
for x in aResult
    see x["name"] + nl
next
sqlite_close(oSQLite)

```

91.10 Better Code Generator for Extensions

We are using the code generator (written in Ring) every day to add new libraries to Ring.

The generator is used to create RingQt and RingAllegro

Also in Ring 1.1 it's used to create RingLibSDL.

more features are added like

- Set/Get structure members (numbers & pointers)
- Using constants
- Better Generated Code

See the Code Generator chapter.

91.11 Using Self.Attribute in the Class Region to define new attributes

We can use Self.Attribute in the Class Region (after the class name and before any methods) to define new attributes.

```

class Person
    name           # Define name as attribute if it's not a global variable
    address
    phone

class person2
    self.name     # Must Define the attribute

```

(continues on next page)

(continued from previous page)

```
self.address  
self.phone
```

91.12 Using This.Attribute in nested Braces inside the Class Methods

We can use nested braces {} while we are inside methods to access another objects, In this case the current object scope will be changed while we are inside the brace and Self will point to the object that we access using braces {}. In this case we can use This.Attribute and This.Method() to access the object that will be created from the current class.

Check the Object Oriented Programming chapter for more information.

Also Check the Weight History Application in GUI Development using RingQt chapter.

91.13 Better Documentation

Ring 1.1 documentation (800 pages) is better than Ring 1.0 documentation (340 pages)

Many chapters are added for providing better information about the language like:

- Language Reference
- Scope Rules
- FAQ

And more!

WHAT IS NEW IN RING 1.2?

In this chapter we will learn about the changes and new features in Ring 1.2 release.

92.1 List of changes and new features

Ring 1.2 comes with many new features

- New Functions
- Better Functions
- Better Ring Notepad
- Better RingQt
- Objects Library for RingQt
- RingLibCurl
- Better Call Command
- Using NULL instead of NULLPointer()
- Display Warnings Option
- Better Quality

92.2 New Functions

- PtrCmp() Function is a new function that compare between C pointers like the GUI objects.
- PrevFileName() Function is added to return the previous active source file name.
- RingVM_CFunctionsList() Function is added to return a list of functions written in C.
- RingVM_FunctionsList() Function is added to return a list of functions written in Ring.
- RingVM_ClassesList() Function is added to return a list of Classes.
- RingVM_PackagesList() Function is added to return a list of Packages.
- RingVM_MemoryList() Function is added to return a list of Memory Scopes and Variables.
- RingVM_CallList() Function is added to return a list of the functions call list.
- RingVM_FilesList() Function is added to return a list of the Ring Files.

Example:

```

fp = fopen("ptrcmp.ring", "r")
fp2 = fp
fp3 = fopen("ptrcmp.ring", "r")

see ptrcmp(fp, fp2) + nl
see ptrcmp(fp, fp3) + nl

fclose(fp)
fclose(fp3)

```

Output:

```

1
0

```

Also we can compare between them using the '=' operator

Example:

```

fp = fopen("ptrcmp2.ring", "r")
fp2 = fopen("ptrcmp2.ring", "r")
fp3 = fp
see fp = fp2
see nl
see fp = fp3
fclose(fp)
fclose(fp2)

```

Output:

```

0
1

```

Example:

The next function in stdlib.ring uses the PrevFileName() to know if the file of the caller function is the main source file of the program or not.

```

Func IsMainSourceFile
    if PrevFileName() = sysargv[2]
        return true
    ok
    return false

```

92.3 Better Functions

The find() function is updated to support searching in lists using C pointers like GUI Objects.

The type() function is updated to display the C pointers types (like the GUI Object Class Name).

92.4 Better Ring Notepad

The Ring Notepad will save the current line number of opened files to be restored when we switch between files.

Also Ring Notepad will ask the user to save the file if the file content is changed when the user switch between files.

92.5 Better RingQt

RingQt classes are updated to include methods to get events (The code that will be executed when an event is fired). This is necessary to enable/disable events for some time or to get the events information.

For example the next code disable an event then call a method then enable the event again.

```
cEvent = oView.oListResult.getCurrentItemChangedEvent()
oView.oListResult.setCurrentItemChangedEvent("")
FindValueAction()          # Call Method while an event is disabled
oView.oListResult.setCurrentItemChangedEvent(cEvent)
```

Also the QAllEvents class is updated where we can set the output from the event function to be true or false using a new method added to the class called setEventOutput.

```
Load "guilib.ring"

MyApp = New qApp {
    win = new QWidget() {
        setWindowTitle("Hello World")
        setGeometry(100,100,370,250)
        lineedit1 = new QLineEdit(win) {
            setGeometry(10,100,350,30)
            setInputMask("9999;_")
            oFilter = new QAllEvents(lineedit1)
            oFilter.setFocusOutEvent("pMove()")
            installEventFilter(oFilter)
        }
        lineedit2 = new QLineEdit(win) {
            setGeometry(10,150,350,30)
        }
        show()
    }
    exec()
}

func pMove
    win.setWindowTitle("xxxx")
    oFilter.setEventOutput(False)
```

92.6 Objects Library for RingQt

Ring 1.2 comes with the Objects library for RingQt applications. Instead of using global variables for windows objects and connecting events to objects using the object name, the Objects Library will manage the GUI objects and will provide a more natural API to quickly create one or many windows from the same class and the library provide a way to quickly set methods to be executed when an event is fired. Also the library provide a natural interface to quickly use the parent or the caller windows from the child or sub windows.

The Objects Library is designed to be used with the MVC Design Pattern.

The Objects Library is merged in RingQt so you can use it directly when you use RingQt

Example :

```
load "guilib.ring"

new qApp {
    open_window( :MainWindowController )
    exec()
}

class MainWindowController from WindowsControllerParent
    oView = new MainWindowView
    func SubWindowAction
        Open_window( :SubWindowController )
        Last_Window().SetParentObject(self)

    class MainWindowView from WindowsViewParent
        win = new QWidget() {
            SetWindowTitle("Main Window")
            btnSub = new QPushButton(win) {
                setText("Sub Window")
                setClickEvent( Method( :SubWindowAction ) )
            }
            resize(400,400)
        }

        class SubWindowController from WindowsControllerParent
            oView = new SubWindowView
            func SetMainWindowTitleAction
                Parent().oView.win.SetWindowTitle("Message from the Sub Window")
                oView.win.SetWindowTitle("Click Event Done!")

            class SubWindowView from WindowsViewParent
                win = new QWidget() {
                    SetWindowTitle("Sub Window")
                    btnMsg = new QPushButton(win) {
                        setText("Set Main Window Title")
                        setClickEvent( Method( :SetMainWindowTitleAction ) )
                    }
                    btnClose = new QPushButton(win) {
                        Move(200,0)
                        setText("Close")
                        setClickEvent( Method( :CloseAction ) )
                    }
                    resize(400,400)
                }
            }
        }
    }
}
```

92.7 RingLibCurl

The LibCurl library is used starting from Ring 1.0 for the Download() and SendEmail() functions implementation. In Ring 1.2 more functions are added to provide a powerful library (RingLibCurl) around LibCurl.

Example:

```
load "libcurl.ring"

curl = curl_easy_init()

cPostThis = "page=4&Number1=4&Number2=5"
curl_easy_setopt(curl, CURLOPT_URL, "http://localhost/ringapp/index.ring?page=3")
curl_easy_setopt(curl, CURLOPT_POSTFIELDS, cPostThis)

curl_easy_perform(curl)

curl_easy_cleanup(curl)
```

92.8 Better Call Command

The Call command is updated to support calling functions from object attributes also (not only variables).

For example the next code from the Stars Fighter Game

```
cFunc = oself.keypress
call cFunc(oGame,oSelf,Key_Space)
```

Can be written in one line

```
call oself.keypress(oGame,oSelf,Key_Space)
```

92.9 Using NULL instead of NULLPointer()

We can pass NULL to functions instead of using NULLPointer()

For example the next code from RingLibSDL

```
SDL_RenderCopy(SDL_ren,tex,NULLPointer(),rect)
```

Can be written as in the next line

```
SDL_RenderCopy(SDL_ren,tex,NULL,rect)
```

92.10 Display Warnings Option

In Ring 1.2 the Ring compiler is updated to include the Display Warnings option (-w)

Example:

```
load "stdlib.ring"
load "stdlib.ring"
```

compiling the program using the Display Warnings option will display the file duplication warning, While without that option the error will pass silent.

This is a warning (not an error) because in large projects you may use the same file more than one time. For example it's common to start each file with the next code. where the function IsMainSourceFile() is part from the stdlib.ring

```
load "stdlib.ring"
if IsMainSourceFile()
    // Testing
ok
```

92.11 Better Quality

Ring 1.2 is more stable, We discovered and fixed more bugs during Ring usage everyday in practical projects. Some functions are optimized to be faster like the SubStr() function. Also the documentation is more better.

CHAPTER
NINETYTHREE

WHAT IS NEW IN RING 1.3?

In this chapter we will learn about the changes and new features in Ring 1.3 release.

93.1 List of changes and new features

Ring 1.3 comes with many new features

- Better RingQt
- Better Ring Notepad
- Ring mode for Emacs Editor
- Better StdLib
- Better Loop/Exit Command
- New Functions
- Return Self by Reference
- Using ‘<’ and ‘:’ operators as ‘from’ keyword
- Embedding Ring in Ring without sharing the State
- RingZip Library
- Form Designer

93.2 Better RingQt

(1) Another version of QPixMap class is added (QPixMap2) which takes (int width,int height) during object init.

Example:

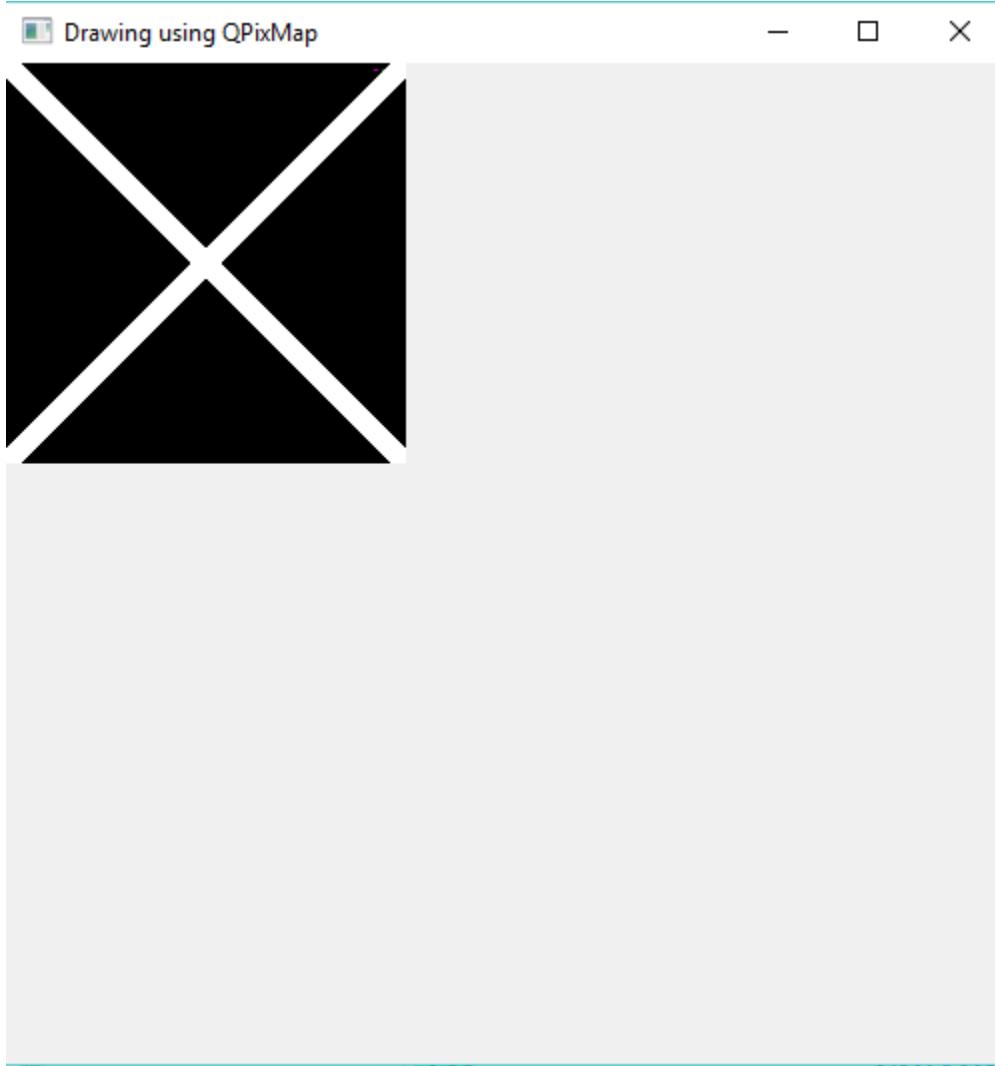
```
Load "guilib.ring"
New qapp
{
    win1 = new QWidget()
    {
        setWindowTitle("Drawing using QPixMap")
        setGeometry(100,100,500,500)
        label1 = new QLabel(win1)
        {
            setGeometry(10,10,400,400)
```

(continues on next page)

(continued from previous page)

```
        settext("")
    }
imageStock = new qlabel(win1)
{
    image = new qPixMap2(200,200)
    color = new QColor() {
        setRgb(255,255,255)
    }
    pen = new QPen() {
        setColor(color)
        setWidth(10)
    }
    new QPainter() {
        begin(image)
        setPen(pen)
        drawLine(0,0,200,200)
        drawLine(200,0,0,200)
        endPaint()
    }
    setPixmap(image)
}
show()
exec()
}
```

Screen Shot:



(2) The Objects Library is updated to include the next functions

- Last_WindowID()
- Open_WindowNoShow()
- Open_WindowAndLink()

Also the class name (WindowViewBase) is changed to (WindowsViewParent).

In The next code for example the Open_WindowAndLink() will create an object from the SecondWindowController Class Then will add the Method SecondWindow() to the FirstWindowController Class Also will add the Method FirstWindow() to the SecondWindowController Class

So the SendMessage() method in FirstWindowController class can use the SecondWindow() method to access the object.

```
class firstwindowController from windowsControllerParent

    oView = new firstwindowView

    func OpenSecondWindow
        Open_WindowAndLink (:SecondWindowController, self)
```

(continues on next page)

(continued from previous page)

```

func SendMessage
    if IsSecondWindow()
        SecondWindow().setMessage("Message from the first window")
    ok

func setMessage cMessage
    oView.Label1.setText(cMessage)

```

(3) The next classes are added to RingQt

- QPixmap2
- QScrollArea
- QSplitter
- QCompleter
- QCompleter2
- QCompleter3
- QProcess
- QMdiArea
- QMdiSubWindow
- QCursor
- QListWidget
- QDesktopServices

(4) Many constants are defined in qt.rh (loaded by guilib.ring)

(5) New Classes names - Index Start from 1

We added new classes to RingQt - another version of classes where the class names doesn't start with the "q" letter
Also updated methods so the index start from 1 when we deal with the GUI controls like

- ComboBox
- ListView
- TableWidget
- TreeWidget

These classes are inside guilib.ring under the package name : System.GUI

To use it

```

load "guilib.ring"

import System.GUI

```

This doesn't have any effect on our previous code, It's just another choice for better code that is consistent with Ring rules.

Also the form designer is updated to provide us the choice between using classes where (index start from 0) or (index start from 1)

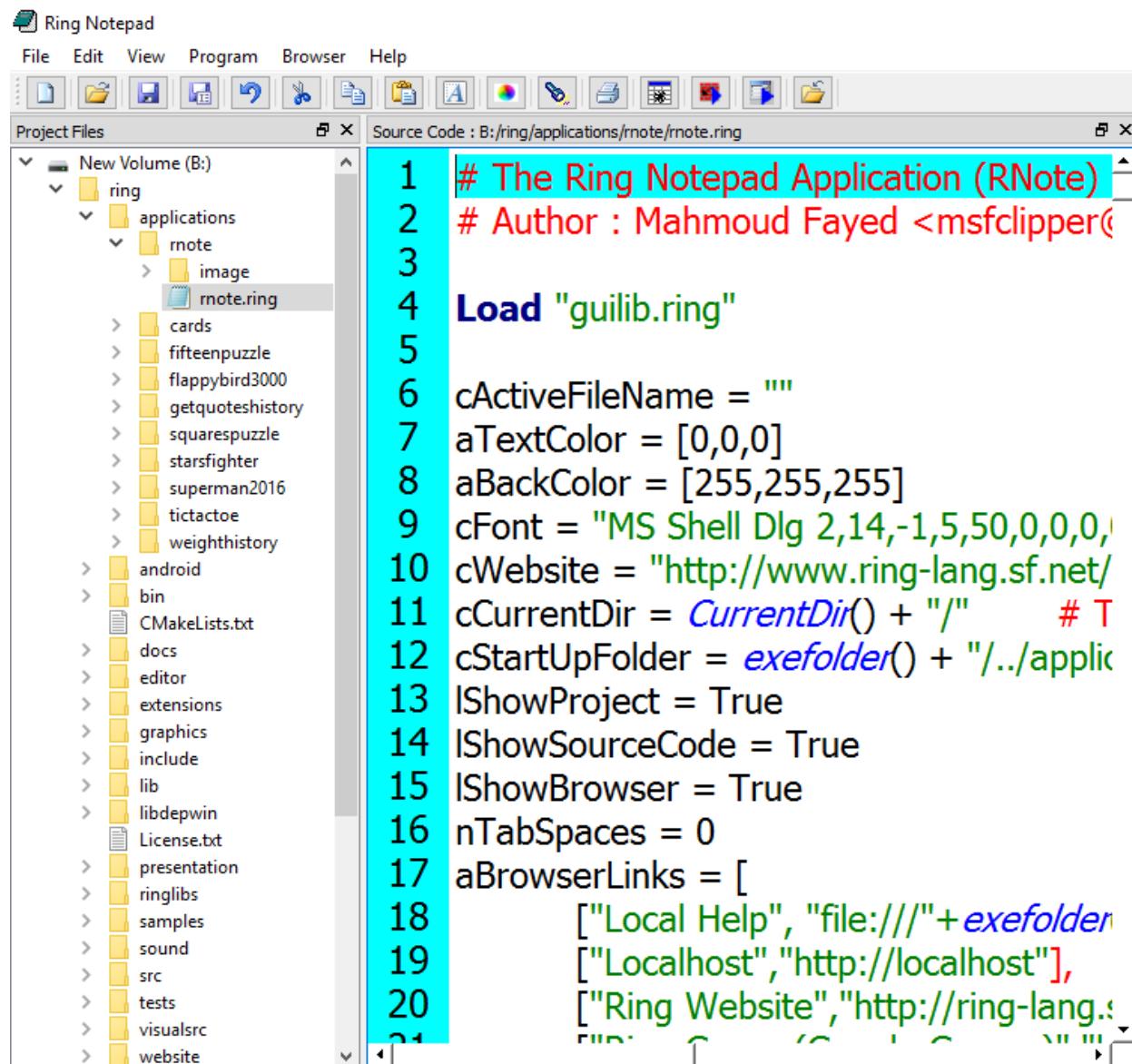
Example (Uses the Form Designer)

- (1) <https://github.com/ring-lang/ring/blob/master/samples/UsingFormDesigner/indexstart/indexstartView.ring>
 - (2) <https://github.com/ring-lang/ring/blob/master/samples/UsingFormDesigner/indexstart/indexstartController.ring>

93.3 Better Ring Notepad

- (1) Using QPlainTextEdit instead of QTextEdit
 - (2) Displaying the line number for each line in the source code file.

Screen Shot:



- (3) Auto-Complete for Ring functions names, classes and words in the opened file.

Source Code

```
1 load "guilib.ring"
2
3 new qApp {
4     new qWid
5         exec()
6 }
```

QWidget methods:

- qwidget()
- qwidget()
- qwidget_acceptdrops()
- qwidget_accessibleDescription()
- qwidget_accessibleName()
- qwidget_activateWindow()
- qwidget_addAction()
- qwidget_adjustSize()
- qwidget_autoFillBackground()
- qwidget_backgroundRole()
- qwidget_baseSize()
- qwidget_childAt()
- qwidget_childrenRect()
- qwidget_childrenRegion()

(4) Functions and Methods List

The screenshot shows the Ring Notepad interface. On the left is a project tree with files like New Volume (B:), ring, applications, mote, image, mote.ring, cards, fifteenpuzzle, flappybird3000, getquoteshistory, squarespuzzles, starsfighter, superman2016, tictacto, weighthistory, android, bin, CMakelists.txt, docs, editor, extensions, graphics, include, lib, libdepwin, License.txt, presentation, ringlibs, samples, sound, src, tests, visualsrc, and website. The main window shows source code for 'mote.ring' with line numbers 1106 to 1126. The code includes a function 'AutoComplete' which creates a QStringList 'oList' and adds various Ring keywords to it. A call to 'AddItems' is made with 'aKeywords'. The right side of the interface has a 'Functions List(58)' panel listing numerous Ring functions such as autocomplete(), displayfunctionslist(), gotoline(), loadsettings(), msgbox(), pabout(), pbrowserlink(), pchangefile(), pchecksavbeforechange(), pcolor(), pcolor2(), pcopy(), pcursorpositionchanged(), pcut(), pdebug(), pfind(), pfindvalue(), pfont(), pfunctionslist(), and pproto().

```

1106
1107 Func AutoComplete
1108     oList = new QStringList()
1109     # Create a functions to add Ring List to q
1110     AddItems = func aList,oList {
1111         for Item in aList
1112             oList.Append(Item)
1113         next
1114     }
1115     # Add Ring Keywords
1116     aKeywords = ["again","and","but",
1117                  "changeringkeyw",
1118                  "def","do","done",
1119                  "func","get","give",
1120                  "loop","new","nex",
1121                  "package","privat",
1122                  "to","try","while"]
1123     call AddItems(aKeywords,oList)
1124     # Add Ring Functions
1125     Call AddItems(cFunctions(),oList)
1126     # Add Ring Classes

```

(5) Output Window

The screenshot shows the Ring Notepad interface with an 'Output Window' tab open. The code in the main window is from 'gettinginput.ring' and contains three 'See' statements: 'See "What is your name?"', 'Give cname', and 'See "Hello " + cname'. In the output window, the message 'What is your name?' is displayed, followed by 'Hello Mahmoud'. An input field at the bottom shows 'Mahmoud'.

```

1 See "What is your name?"
2 Give cname
3 See "Hello " + cname
4

```

(6) Classes List

The screenshot shows the Ring Notepad interface. On the left is a project tree titled "Ring Notepad" with a "Project Files" section containing various application folders like "ring", "applications", "cards", etc. The main area is a code editor titled "Source Code : B:/ring/applications/formdesigner/formdesigner.ring" displaying the following Ring script:

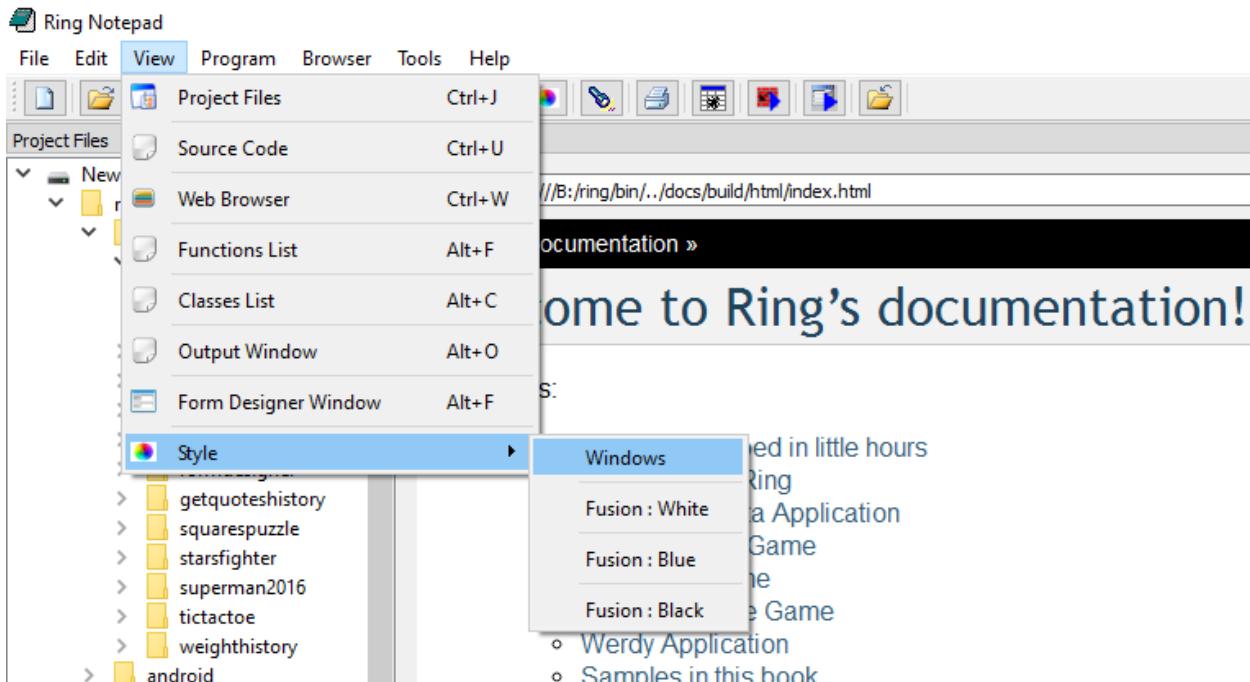
```

34 new qApp {
35   StyleFusion()
36   Open_Window(:FormDesignerController)
37   exec()
38 }
39
40 Class FormDesignerController from WindowsControllerPaser
41
42 oView = new FormDesignerView
43 oModel = new FormDesignerModel
44 oGeneral = new FormDesignerGeneral
45 oFile = new FormDesignerFileSystem
46
47 func Start
48   oView.CreateMainWindow(oModel)
49   AddObjectsToCombo()
50   AddObjectProperties()
51   DisplayObjectProperties()
52   oView.WindowMoveResizeEvents()
53
54

```

To the right of the code editor is a "Classes List" panel containing a scrollable list of class names.

(7) Change the Current Style



93.4 Ring mode for Emacs Editor

Ring 1.3 comes with Ring mode for Emacs Editor

Screen Shot:

```
emacs@MAHMOUD-PC
File Edit Options Buffers Tools Help
func checkwin ogame
    if oGameState.gameresult  return ok
    if oGameState.enemies = 0
        oGameState.gameresult = true
    oGame {
        if oGameState.level < 30
            text {
                point = 400
                size = 30
                file = "fonts/pirulen.ttf"
                text = "Level Completed!"
                nStep = 3
                x = 500 y=10
                state = func ogame,oself {
                    if oself.y >= 400
                        ogame.shutdown = true
                        oGameState.level++
                        oGameState.enemies = oGameState.level
                        oGameState.gameresult = false
                    ok
                }
            }
        else
            text {
                point = 400
                size = 30
                nStep = 3
                file = "fonts/pirulen.ttf"
                text = "You Win !!!"
                x = 500 y=10
            }
    }
-\--- game.ring    77% L304  Git-master (ring)
```

93.5 Better StdLib

The StdLib is updated to include the next functions

- SplitMany()
- JustFilePath()
- JustFileName()

93.6 Better Loop|Exit Command

The Loop|Exit command is updated to accept Expressions after the command (not only numbers).

The syntax:

Loop Exit [Number]

Changed to

Loop Exit [Expression]

Example

```
XLoop = 2      # The outer loop
YLoop = 1      # The first inner loop
for x = 1 to 10
    for y = 1 to 10
        see "x=" + x + " y=" + y + nl
        if x = 3 and y = 5
            exit XLoop
        ok
    next
next
```

93.7 New Functions

- PackageName() function
- Swap() function

Example:

```
aList = [:one,:two,:four,:three]
see aList
see copy("*",50) + nl
swap(aList,3,4)
see aList
```

Output

```
one
two
four
three
*****
one
two
three
four
```

93.8 Return Self by Reference

In this release, using Return Self in class methods will return the object by reference.

Example:

```
mylist = [new mytest() {
    see self
    x = 20
    see self
}]

see mylist

class mytest
    x = 15
```

(continues on next page)

(continued from previous page)

```
func init
    return self      # Return by reference
```

Output

```
x: 15.000000
x: 20.000000
x: 20.000000
```

93.9 Using ‘<’ and ‘:’ operators as ‘from’ keyword

In this release of the Ring language we can use the ‘<’ and ‘:’ operators as the ‘from’ keyword

Syntax (1):

```
class Cat from Animal
```

Syntax (2):

```
class Cat < Animal
```

Syntax (3):

```
class Cat : Animal
```

93.10 Embedding Ring in Ring without sharing the State

From Ring 1.0 we already have functions for embedding Ring in the C language. Also we can execute Ring code inside Ring programs using the eval() function. In this release we provide functions for embedding Ring in Ring programs without sharing the state.

Advantages:

- (1) Quick integration for Ring programs and applications together without conflicts.
- (2) Execute and run Ring code in safe environments that we can trace.

Example:

```
pState = ring_state_init()
ring_state_runcode(pState, "See 'Hello, World!'+nl")
ring_state_runcode(pState, "x = 10")

pState2 = ring_state_init()
ring_state_runcode(pState2, "See 'Hello, World!'+nl")
ring_state_runcode(pState2, "x = 20")

ring_state_runcode(pState, "see x +nl")
ring_state_runcode(pState2, "see x +nl")

v1 = ring_state_findvar(pState, "x")
v2 = ring_state_findvar(pState2, "x")
```

(continues on next page)

(continued from previous page)

```
see v1[3] + nl
see V2[3] + nl

ring_state_delete(pState)
ring_state_delete(pState2)
```

Output:

```
Hello, World!
Hello, World!
10
20
10
20
```

93.11 RingZip Library

Ring 1.3 comes with the RingZip library for creating, modifying and extracting *.zip files.

Example (1): Create myfile.zip contains 4 files

```
load "ziplib.ring"
oZip = zip_openfile("myfile.zip", 'w')
zip_addfile(oZip, "test.c")
zip_addfile(oZip, "zip.c")
zip_addfile(oZip, "zip.h")
zip_addfile(oZip, "miniz.h")
zip_close(oZip)
```

Example (2): Extract myfile.zip to myfolder folder.

```
load "ziplib.ring"
zip_extract_allfiles("myfile.zip", "myfolder")
```

Example (3): Print file names in the myfile.zip

```
load "ziplib.ring"
oZip = zip_openfile("myfile.zip", 'r')
for x=1 to zip_filescount(oZip)
    see zip_getfilenamebyindex(oZip, x) + nl
next
zip_close(oZip)
```

Example (4) : Using Classes instead of Functions

```
load "ziplib.ring"

new Zip {
    SetFileName("myfile.zip")
    Open("w")
    AddFile("test.c")
    AddFile("zip.c")
    AddFile("zip.h")
    AddFile("miniz.h")
```

(continues on next page)

(continued from previous page)

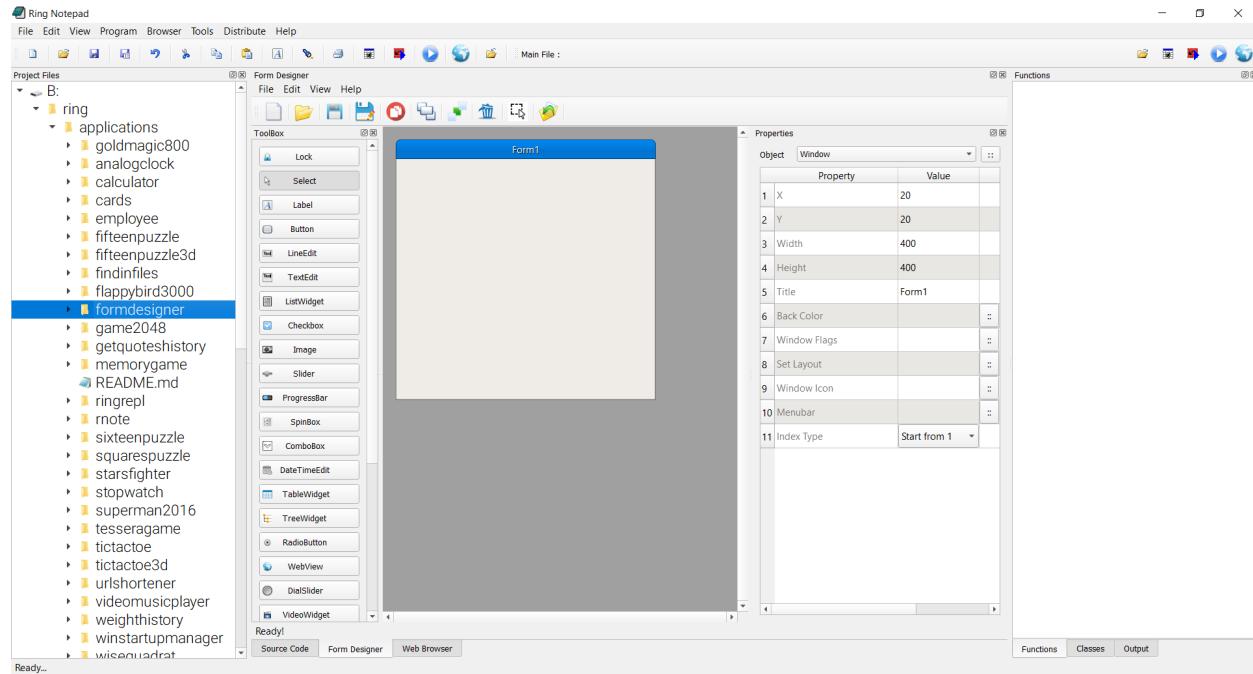
```
        Close()
}
```

93.12 Form Designer

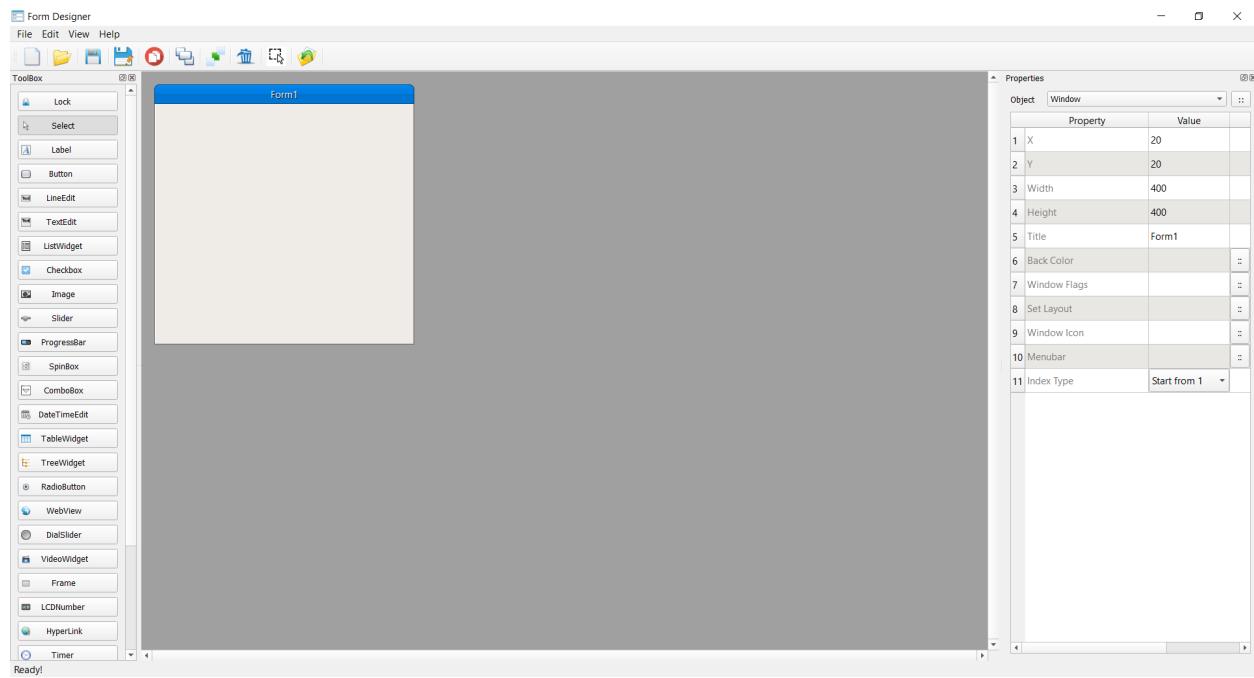
Ring 1.3 comes with the Form Designer to quickly design your GUI application windows/forms and generate the Ring source code.

It's written in Ring (Around 8000 Lines of code) using Object-Oriented Programming and Meta-Programming.

We can run the Form Designer from Ring Notepad



Also we can run the Form Designer in another window.



WHAT IS NEW IN RING 1.4?

In this chapter we will learn about the changes and new features in Ring 1.4 release.

94.1 List of changes and new features

Ring 1.4 comes with many new features

- Change: Basic Extensions are separated from RingVM
- The Natural Library
- New Style is added to Ring Notepad
- RingREPL
- Convert between Numbers and Bytes
- Better StdLib
- Better WebLib
- Better RingQt
- Qt Class Convertor

94.2 Change: Basic Extensions are separated from RingVM

In Ring 1.4 the next libraries are separated from RingVM

- RingODBC
- RingMySQL
- RingSQLite
- RingOpenSSL
- RingInternet

To use these libraries, Use the Load command.

```
load "odbc.lib.ring"
# use ODBC Functions
```

```
load "mysql.lib.ring"
# use MySQL Functions
```

```
load "sqlitelib.ring"
# use SQLite Functions
```

```
load "openssllib.ring"
# use OpenSSL Functions ( Hash and Security functions)
```

```
load "internetlib.ring"
# use Internet Functions ( Download() and SendEmail() )
```

If you will use all of these libraries, You can just use stdlib.ring And the stdlib.ring will load odbc.lib, mysql.lib, sqlitelib.ring, openssllib.ring and internetlib.ring files.

```
load "stdlib.ring"
```

94.3 The Natural Library

Ring 1.4 comes with the Natural Library to quickly define a language that contains a group of commands.

We will write the natural code in a Text file, for example program.txt

File: program.txt

```
Welcome to the Ring programming language!
What you are reading now is not comments, I swear!

After many years of programming I decided to think different about
programming and solve the problems in a better way.

We are writing commands or code and the Ring language is reading
it to understand us! Sure, What you are seeing now is
just ***part of the code - Not the Complete Program***
You have to write little things before and after this
part to be able to run it!

It is the natural part of our code where we can write in English,
Arabic or any Natural Language Then we will tell the computer
through the Ring language what must happens! in a way that we can scale
for large frameworks and programs.

Just imagine what will happens to the world of programming once
we create many powerful frameworks using the Ring language that
uses this way (Natural Programming).

For example When we say Hello to the Machine, It can reply! and when we
say count from 1 to 5 it will understand us, Also if
we said count from 5 to 1 it will
understand us too! You can see the Output window!

This Goal is not new, but the Ring language comes
with an innovative solution to this problem.
```

Output:

```
Hello, Sir!
```

```
The Numbers!
```

```
1  
2  
3  
4  
5
```

```
I will count Again!
```

```
5  
4  
3  
2  
1
```

To execute the natural code, We have start.ring

In start.ring we define the language and the commands.

File: start.ring

```
load "stdlib.ring"
load "naturallib.ring"

New NaturalLanguage {
    SetLanguageName (:MyLanguage)
    SetCommandsPath (CurrentDir () + "/../command")
    SetPackageName ("MyLanguage.Natural")
    UseCommand (:Hello)
    UseCommand (:Count)
    RunFile ("program.txt")
}
```

We defined a language called MyLanguage, We have folder for the language commands.

Each command will define a class that belong to the MyLanguage.Natural package.

We will define two commands, Hello and Count.

So we must have two files for defining the commands in the CurrentDir() + "/..command" folder

File: hello.ring

```
DefineNaturalCommand.SyntaxIsKeyword([
    :Package = "MyLanguage.Natural",
    :Keyword = :hello,
    :Function = func {
```

(continues on next page)

(continued from previous page)

```

        See "Hello, Sir!" + nl + nl
    }
])

```

File: count.ring

```

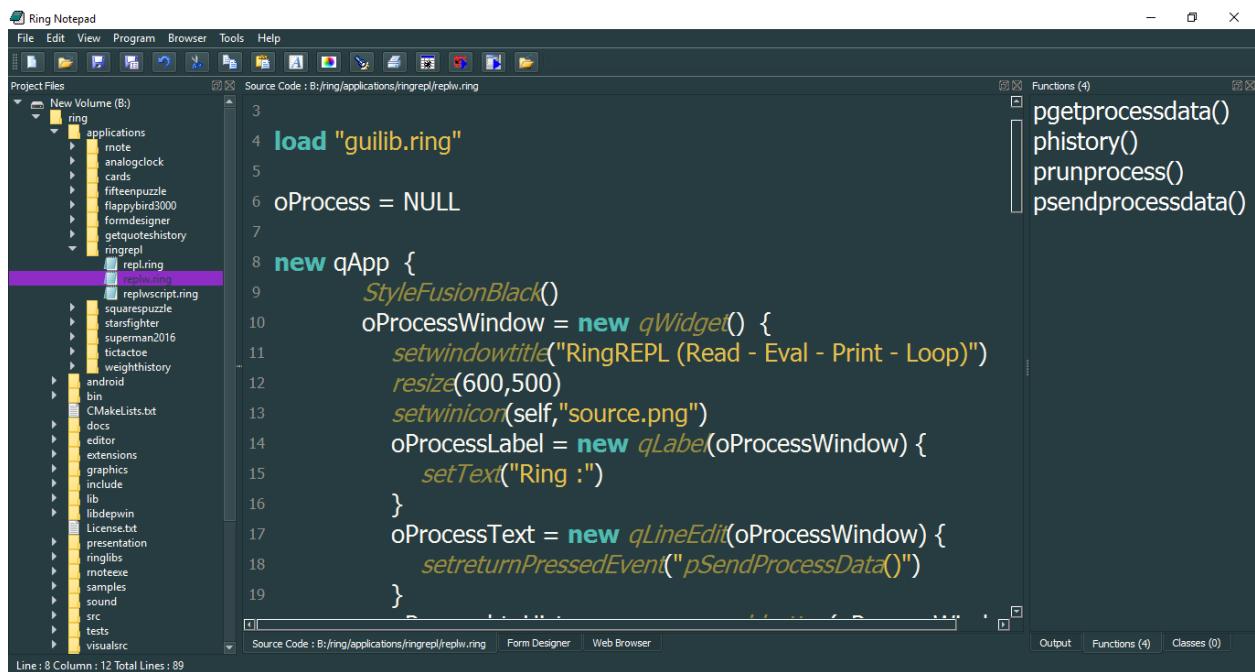
DefineNaturalCommand.SyntaxIsKeywordNumberNumber([
    :Package = "MyLanguage.Natural",
    :Keyword = :count,
    :Function = func {
        if not isattribute(self,:count_times) {
            AddAttribute(self,:count_times)
            Count_Times = 0
        }
        if Expr(1) > Expr(2) {
            nStep = -1
        }
        else
            nStep = 1
        }
        if Count_Times = 0 {
            see nl+"The Numbers!" + nl
            Count_Times++
        }
        else
            see nl + "I will count Again!" +nl
        }
        for x = Expr(1) to Expr(2) step nStep {
            see nl+x+nl
        }
        CommandReturn(fabs(Expr(1)-Expr(2))+1)
    }
])

```

94.4 New Style is added to Ring Notepad

In Ring Notepad - From View - Styles - Select the (Modern) Style

Screen Shot:



The screenshot shows the Ring Notepad interface. The left pane displays a file tree for the 'ring' application folder, which contains various subfolders like 'applications', 'cards', 'fifteenpuzzle', 'flappybird3000', 'formdesigner', 'getquoteshistory', 'ringrepl', and 'replw'. The right pane shows the source code for 'replw.ring'.

```

3
4 load "guilib.ring"
5
6 oProcess = NULL
7
8 new qApp {
9     StyleFusionBlack()
10    oProcessWindow = new QWidget() {
11        setWindowTitle("RingREPL (Read - Eval - Print - Loop)")
12        resize(600,500)
13        setwinicon(self,"source.png")
14    }
15    oProcessLabel = new QLabel(oProcessWindow) {
16        setText("Ring :")
17    }
18    oProcessText = new QLineEdit(oProcessWindow) {
19        setreturnPressedEvent("pSendProcessData()")
}

```

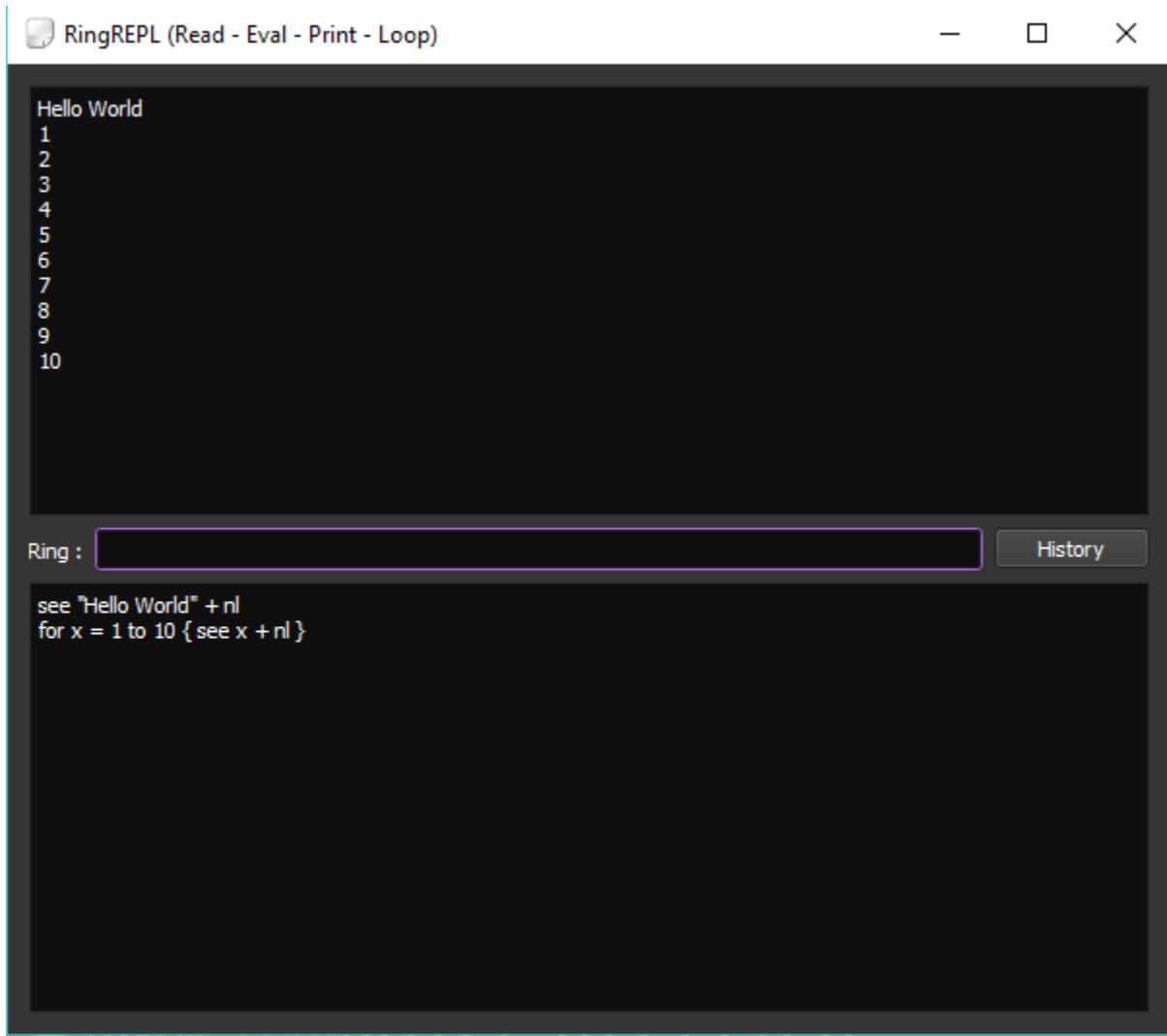
The code implements a Qt application ('qApp') that creates a window titled 'RingREPL (Read - Eval - Print - Loop)'. It includes a label ('QLabel') with the text 'Ring :' and a line edit ('QLineEdit') with a return pressed event handler 'pSendProcessData()'.

94.5 RingREPL

In the application folder, You will find RingREPL (Read-Eval-Print-Loop)

Also you can run it from Ring Notepad (Menubar - Tools)

Screen Shot:



94.6 Convert between Numbers and Bytes

Ring 1.4 comes with the next functions to convert between Numbers and Bytes.

- Int2Bytes()
- Float2Bytes()
- Double2Bytes()
- Bytes2Int()
- Bytes2Float()
- Bytes2Double()

Example:

```
see "Test Int2Bytes() and Bytes2Int() - Value : 77" + nl
r = Int2Bytes(77)
see "Int Size : " + len(r) + nl
```

(continues on next page)

(continued from previous page)

```

see r + nl
see Bytes2Int(r) + nl
see "Test Float2Bytes() and Bytes2Float() - Value 77.12" + nl
r = Float2Bytes(77.12)
see "Float Size : " + len(r) + nl
see r + nl
see Bytes2Float(r) + nl
see "Test Double2Bytes() and Bytes2Double() - Value 9999977.12345" + nl
r = Double2Bytes(9999977.12345)
see "Double Size : " + len(r) + nl
see r + nl
decimals(5)
see Bytes2Double(r) + nl

```

94.7 Better StdLib

The StdLib is updated to include the next functions

- FSize()

The print() function is updated to accept local variables.

```

load "stdlib.ring"

func main
    print("Enter your name : ") ;
    Name = getString() ;
    print( "Hello : #{Name} " ) ;
    return ;

```

94.8 Better WebLib

The web library is updated

- Provide better error message
- (1) Error (WebLib-1) : REQUEST_METHOD is empty ! - Run this script from the browser
 - (2) Error (DataLib-1) : Can't connect to the database server!
- Better Template() function - can accept NULL instead of object as the second parameter.

```
html(template("main.rhtml",NULL))
```

- The Form Class is updated to support the “target” attribute.

```

BootStrapWebPage()
{
    Title = "The Ring Programming Language"
    html(template("main.rhtml",NULL))
    div {
        classname = :container
        div
    }
}

```

(continues on next page)

(continued from previous page)

```

id = "div3"
color = "black"
backgroundcolor = "white"
width = "100%"
form
{
    method = "POST"
    Action = website
    Target = "codeoutput"
    input { type="hidden" name="page" value=1 }
    Table
    {
        style = stylewidth("100%") +
            stylegradient(3)
        TR
        {

            TD { align="center"
                WIDTH="10%"
                text("Code :")
            }
            TD {
                html(`<textarea name = "cCode"
rows="5"
style="width : 100%; ">
See "Hello, World!" + nl
</textarea>`)
            }
        }
    }
    Input { type = "submit"
        classname="btn btn-primary btn-block"
        value = "Execute" }
    Table
    {
        style = stylewidth("100%") +
            stylegradient(34)
        TR
        {

            TD { align="center"
                WIDTH="10%"
                text("Output :")
            }
            TD {
                html(`<iframe name="codeoutput"
width="100%"
style="background-color:white;">
</iframe>`)
            }
        }
    }
}

```

(continues on next page)

(continued from previous page)

```
        }
        html(template("footer.rhtml",NULL))
    }
```

94.9 Better RingQt

The next functions are added to RingQt

- SetDialogIcon(cIconFile)
- MsgInfo(cTitle,cMessage)
- ConfirmMsg(cTitle,cMessage)
- InputBox(cTitle,cMessage)
- InputBoxInt(cTitle,cMessage)
- InputBoxNum(cTitle,cMessage)
- InputBoxPass(cTitle,cMessage)

The next classes are added to RingQt

- QToolButton
- QSerialPort
- QSerialPortInfo

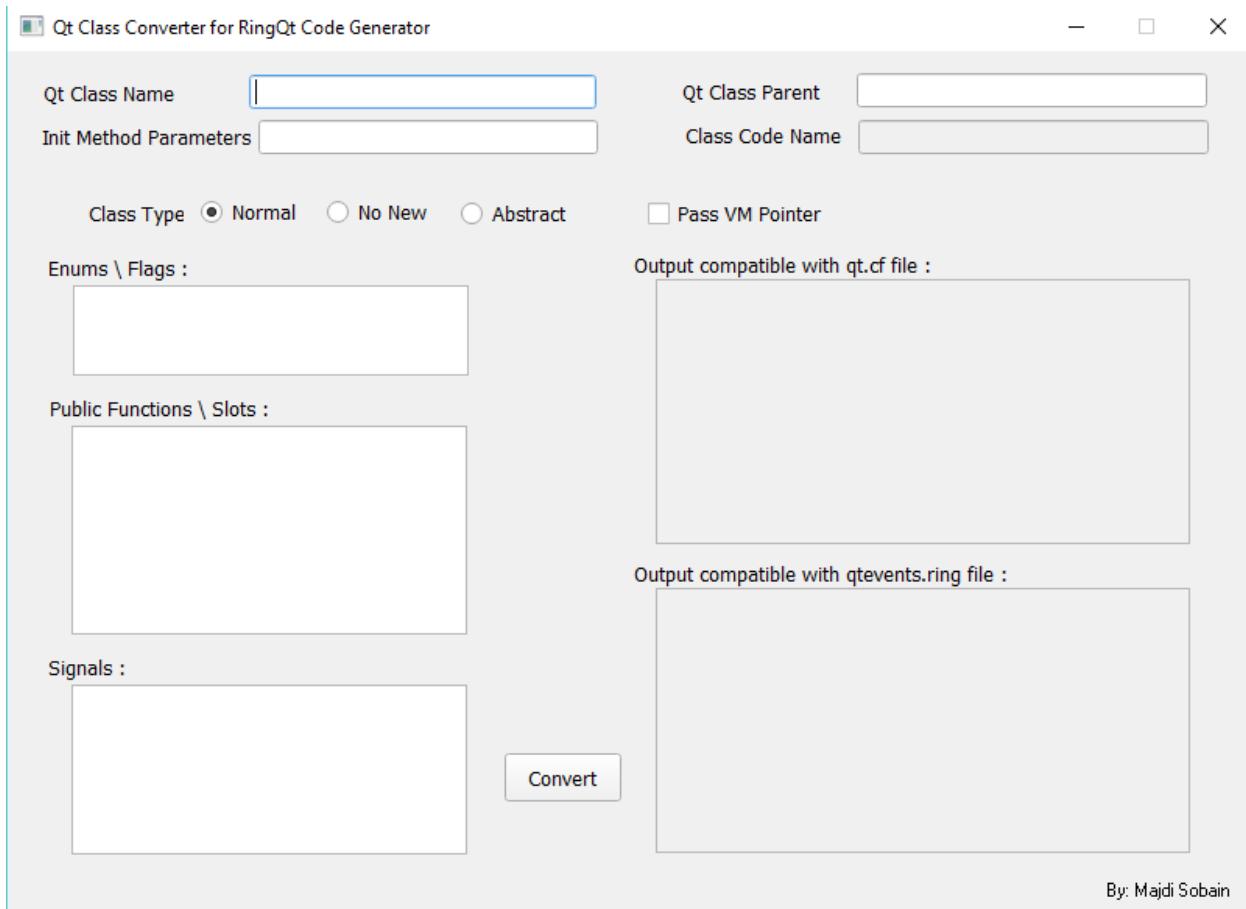
94.10 Qt Class Convertor

Ring 1.4 comes with a simple tool that help in porting Qt classes to RingQt.

You will find it in ring/extensions/ringqt/converter

Online : <https://github.com/ring-lang/ring/tree/master/extensions/ringqt/converter>

Screen Shot:



94.11 What is new in Ring 1.4.1?

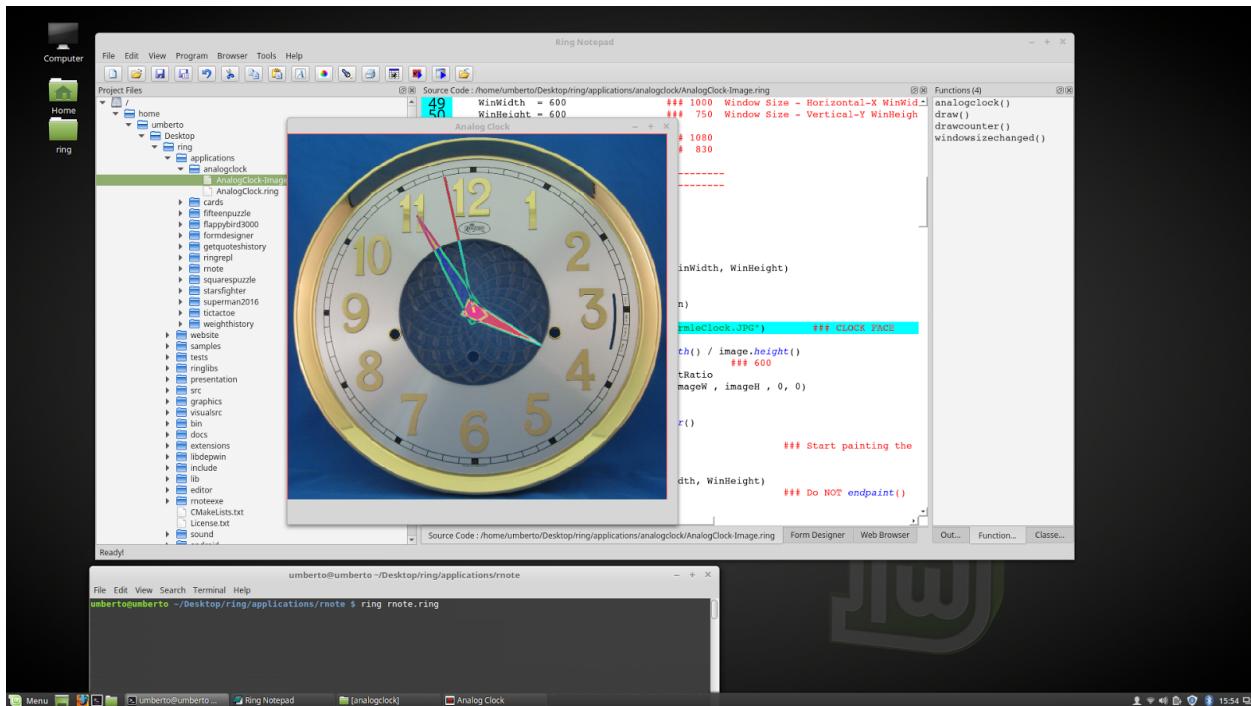
Ring 1.4.1 comes with the next changes

- Better Scripts for Building from Source Code
- Better Colors for the Modern Style in Ring Notepad
- Better StdLib
- Better RingQt
- New Sample : Sixteen Puzzle

The scripts are updated for building from source code.

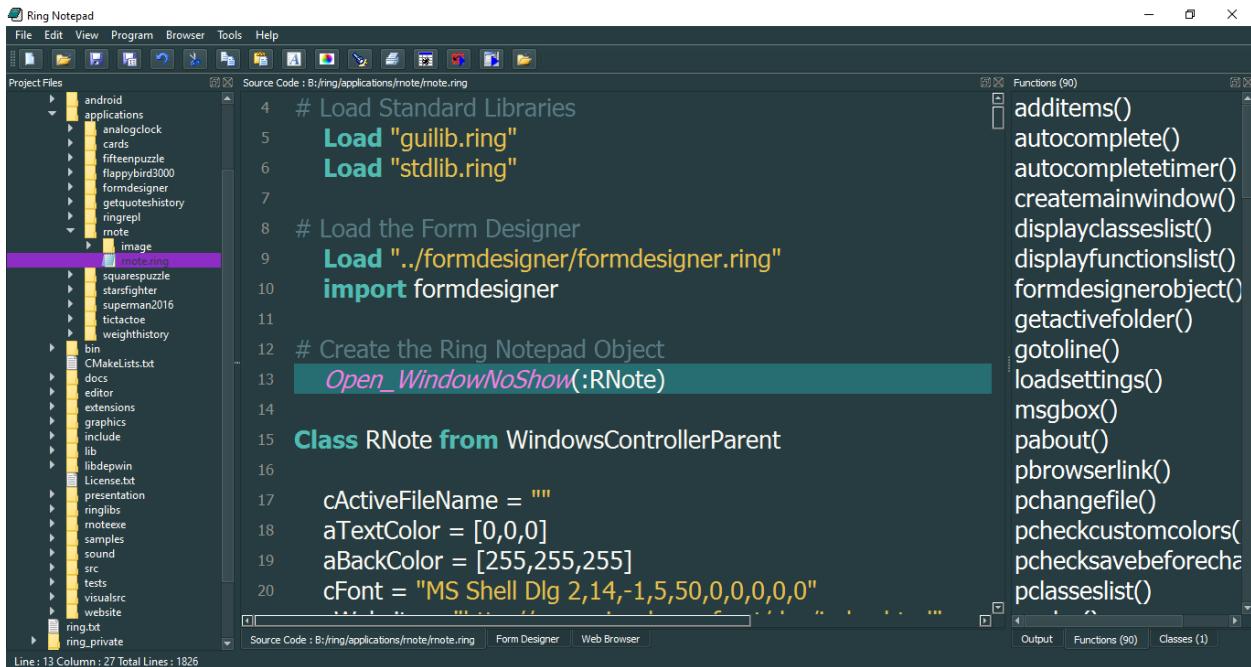
Tested using Windows, Ubuntu Linux, Linux Mint and MacOS X.

Screen Shot:



In Ring Notepad - the (Modern) Style colors are updated

Screen Shot:



The StdLib is updated to include the next functions

- TrimLeft()
- TrimRight()
- TrimAll()
- EpochTime()

The next functions are updated to display the dialogs on the top of other windows.

- SetDialogIcon(cIconFile)
- MsgInfo(cTitle,cMessage)
- ConfirmMsg(cTitle,cMessage)
- InputBox(cTitle,cMessage)
- InputBoxInt(cTitle,cMessage)
- InputBoxNum(cTitle,cMessage)
- InputBoxPass(cTitle,cMessage)

The Sixteen Puzzle is added to the Applications folder.

Screen Shot:



WHAT IS NEW IN RING 1.5?

In this chapter we will learn about the changes and new features in Ring 1.5 release.

95.1 List of changes and new features

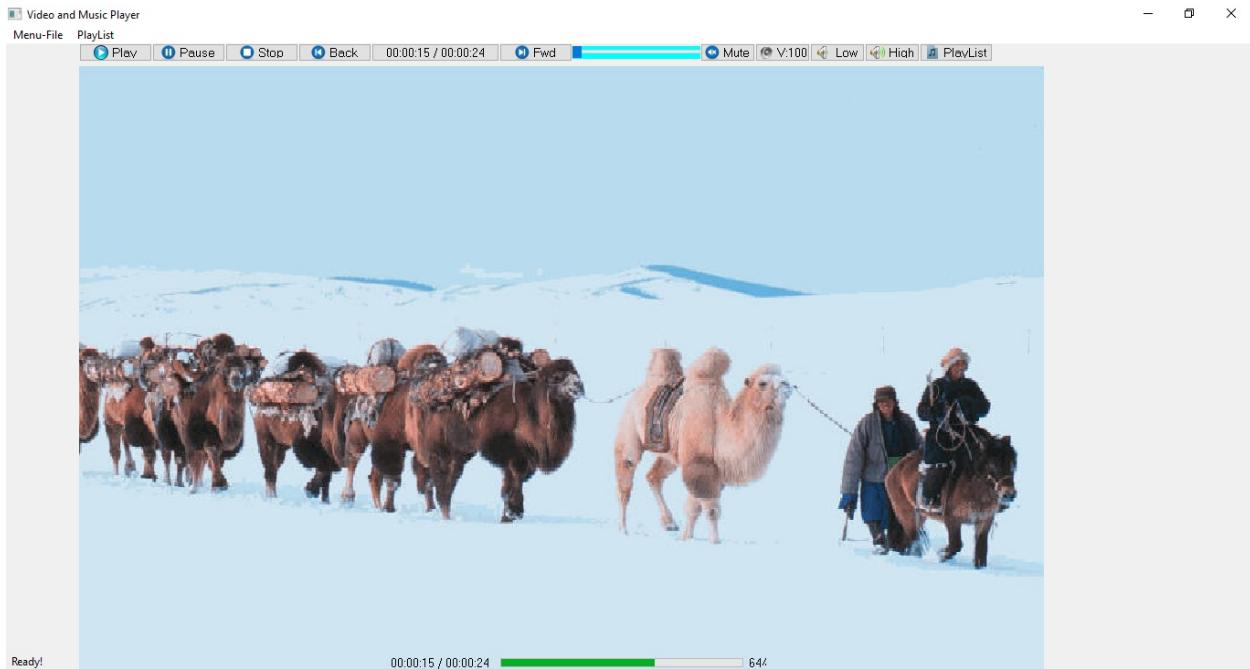
Ring 1.5 comes with many new features!

- Video-Music-Player Application
- Windows StartUp Manager Application
- Calculator Application
- Better Ring Notepad
- Better StdLib
- Better WebLib
- Better RingQt
- Better Objects Library
- RingFreeGLUT Extension
- RingOpenGL Extension
- Better Code Generator for Extensions
- Better Documentation Generator for Extensions
- Ring VM - Tracing Functions
- Trace Library and Interactive Debugger
- More Syntax Flexibility
- Type Hints Library
- Better Quality

95.2 Video-Music-Player Application

The Video-Music-Player application is added to the Applications folder.

Screen Shot:

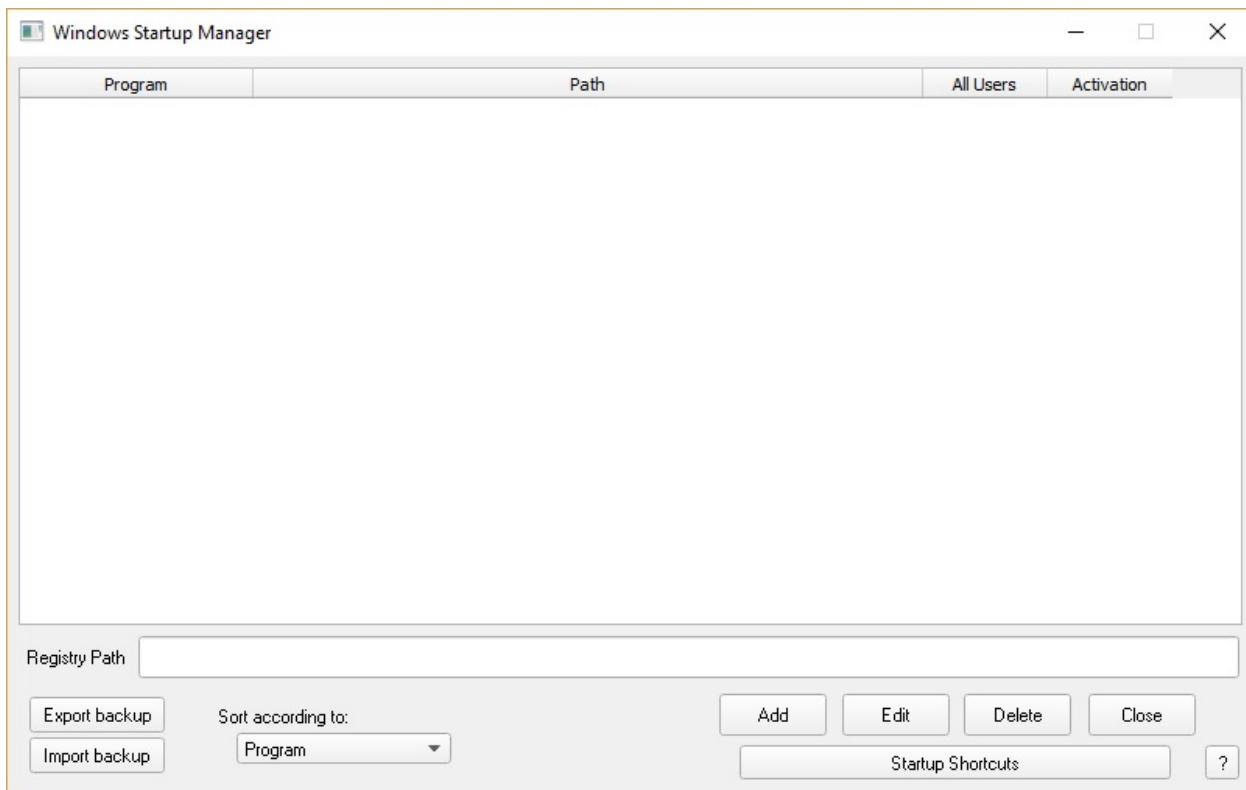


95.3 Windows StartUp Manager Application

The Windows StartUp Manager

URL : <https://github.com/ring-lang/WinStartupManager>

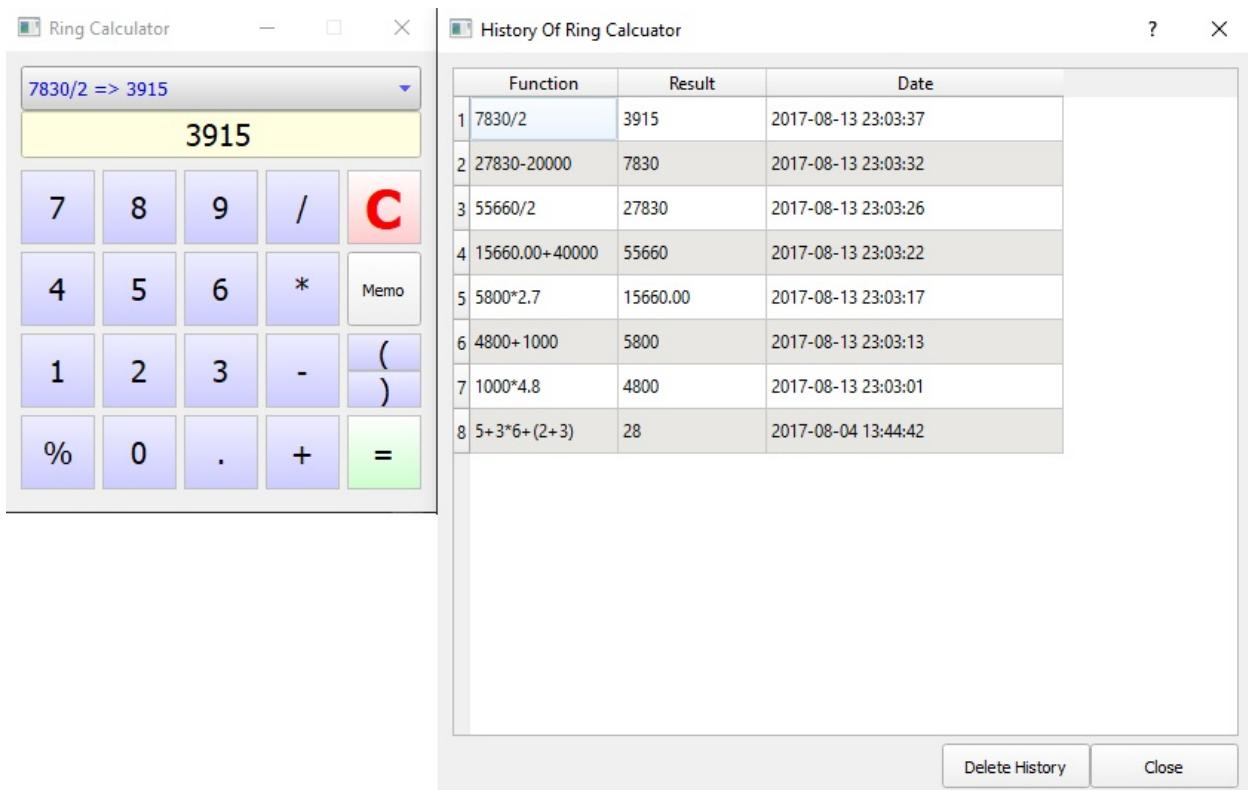
Screen Shot:



95.4 Calculator Application

The Calculator application is added to the Applications folder.

Screen Shot:



95.5 Better Ring Notepad

(1) Ring Notepad is updated to include some new styles and the Main File ToolBar

The idea of the Main File ToolBar is to determine the main file in the project When the project contains many source code files

This way you can run the project (Main File) at any time while opening other files in the project without the need to switch to the Main File to run the project.

To quickly use this feature

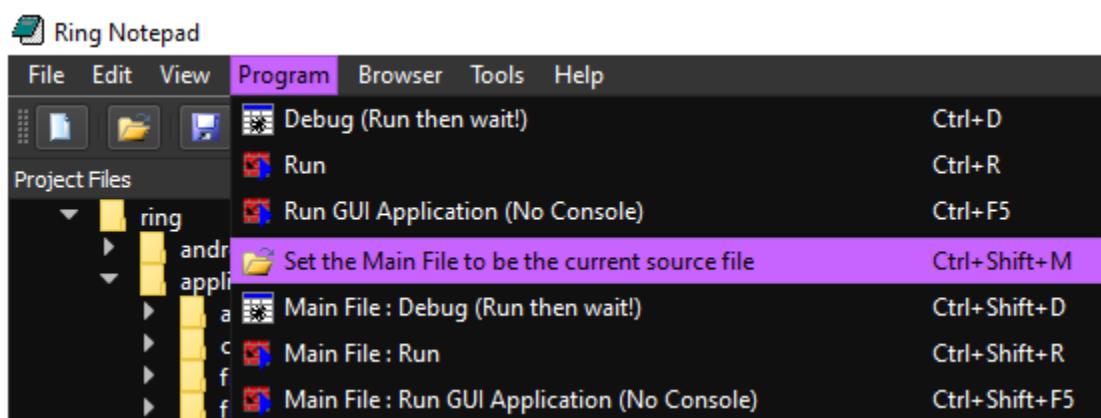
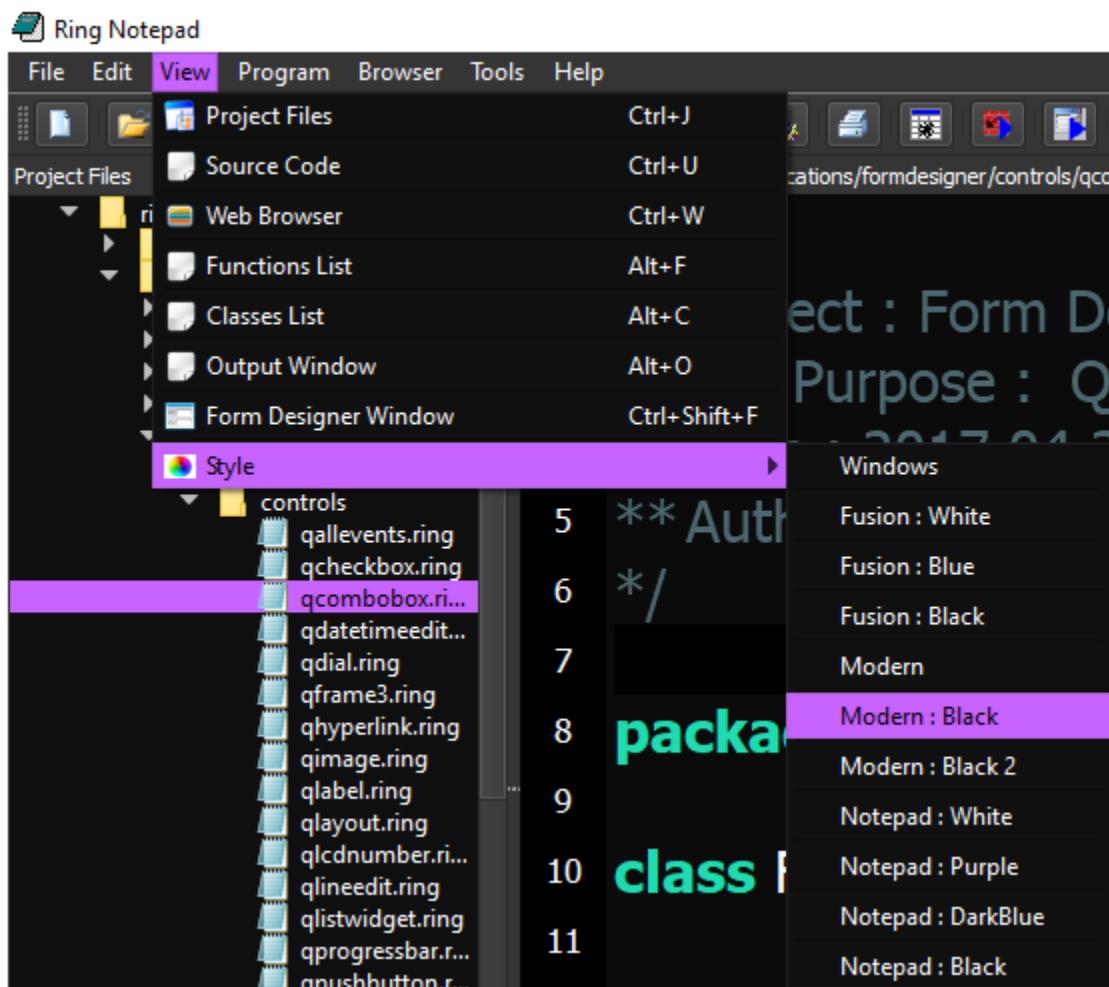
(Open the project main file)

Press Ctrl+Shift+M to set the current source code file as the main file

Open and modify other source code files in the project

To run the project (Main File) at any time press Ctrl+Shift+F5 (GUI) or Ctrl+Shift+D (Console)

Screen Shots:



The screenshot shows the Ring Notepad application window. The menu bar includes File, Edit, View, Program, Browser, Tools, and Help. The toolbar has various icons for file operations. The project tree on the left shows a hierarchy of files and folders under 'ring' and 'common'. The main code editor area contains the following Ring script:

```

1 /*
2 ** Project : Form Designer
3 ** File Purpose : QComboBox Control
4 ** Date : 2017.04.29
5 ** Author : Mahmoud Fayed <msfclipper@yahoo.com>
6 */
7
8 package formdesigner
9
10 class FormDesigner_QComboBox from QComboBox
11
12 CreateCommonAttributes()
13 CreateMoveResizeCornersAttributes()
14
15 cItems = ""
16 ccurrentIndex = ""

```

The status bar at the bottom indicates 'Line : 7 Column : 1 Total Lines : 152'.

(2) The output window is updated to display the new lines correctly and contains the “Clear” button.

Screen Shot:

The screenshot shows the Ring Notepad application window with the 'Output' tab selected. The code editor on the left shows a Ring script:

```

1 see "Date : " + date() + nl +
2 "Time : " + time() + nl

```

The output window on the right displays the results:

```

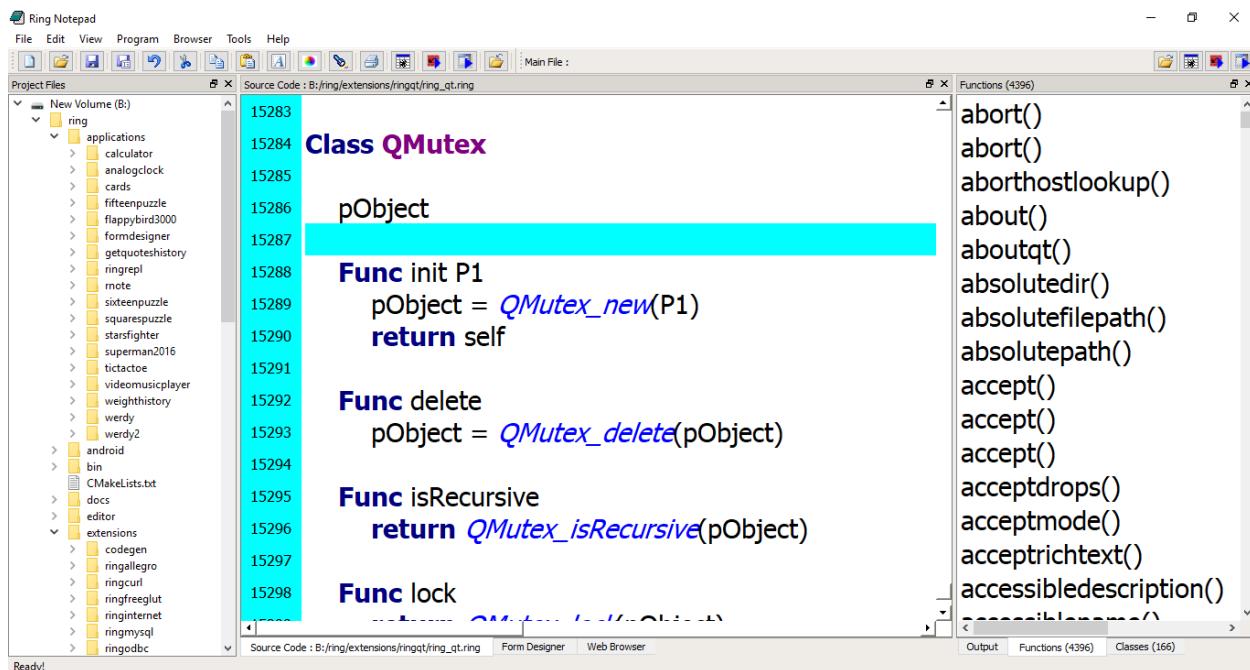
Date : 14/08/2017
Time : 02:22:14

```

The status bar at the bottom indicates 'Input : [] Send Clear'.

(3) The Ring Notepad is updated to quickly open and switch between large files while preparing the functions/classes lists in the background.

Screen Shot:



95.6 Better StdLib

New Functions

- Print2Str()
- ListAllFiles()
- SystemCmd()

(1) The Print2Str() is a new function added to the StdLib

Example:

```
load "stdlib.ring"

world = "World!"
mystring = print2str("Hello, #{world} \nIn Year \n#{2000+17} \n")

see mystring + nl
```

Output:

```
Hello, World!
In Year
2017
```

(2) The ListAllFiles() is a new function added to the StdLib

Using this function we can quickly do a process on a group of files in a folder and it's sub folders.

Example:

```
load "stdlib.ring"
aList = ListAllFiles("c:/ring/ringlibs","ring") # *.ring only
aList = sort(aList)
see aList
```

Example:

```
load "stdlib.ring"
see listallfiles("b:/ring/ringlibs/weblib","","") # All Files
```

(3) The SystemCmd() is a new function added to the StdLib

The function will execute a system command like the System() function but will return the output in a string.

Example:

```
cYou = SystemCmd("whoami")
See "SystemCmd: whoami =====" + nl + cYou +nl
```

Output:

```
SystemCmd: whoami =====
desktop-umberto\umberto
```

95.7 Better WebLib

The WebLib is updated to include the HTMLPage class

Using this class we can create HTML documents without printing the output to the standard output

So instead of using the WebLib in Web Applications only

We can use it in Console/GUI/Mobile Applications too

Example:

```
load "stdlib.ring"
load "weblib.ring"

import System.Web

func main

    mypage = new HtmlPage {
        h1 { text("Customers Report") }
        Table
        {
            style = stylewidth("100%") + stylegradient(4)
            TR
            {
                TD { WIDTH="10%" text("Customers Count : ") }
                TD { text(100) }
            }
        }
        Table
    }
```

(continues on next page)

(continued from previous page)

```

style = stylewidth("100%") + stylegradient(26)
TR
{
    style = stylewidth("100%") + stylegradient(24)
    TD { text("Name" ) }
    TD { text("Age" ) }
    TD { text("Country" ) }
    TD { text("Job" ) }
    TD { text("Company" ) }
}
for x = 1 to 100
    TR
    {
        TD { text("Test" ) }
        TD { text("30" ) }
        TD { text("Egypt" ) }
        TD { text("Sales" ) }
        TD { text("Future" ) }
    }
next
}

write("report.html", mypage.output())

```

Using this feature we can create reports quickly using WebLib & GUIlib together

Example:

```

load "stdlib.ring"
load "weplib.ring"
load "guilib.ring"

import System.Web
import System.GUI

new qApp {
    open_window(:CustomersReportController)
    exec()
}

class CustomersReportController

    oView = new CustomersReportView

    func Start
        CreateReport()

    func CreateReport
        mypage = new HtmlPage {
            h1 { text("Customers Report" ) }
            Table
            {
                style = stylewidth("100%") + stylegradient(4)
                TR
                {

```

(continues on next page)

(continued from previous page)

```

        TD { WIDTH="10%"  

             text("Customers Count : " ) }  

        TD { text (100) }  

    }  

}  

Table  

{  

    style = stylewidth("100%") + stylegradient(26)  

TR  

{  

    style = stylewidth("100%") +  

        stylegradient(24)  

    TD { text("Name" ) }  

    TD { text("Age" ) }  

    TD { text("Country" ) }  

    TD { text("Job" ) }  

    TD { text("Company" ) }  

}  

for x = 1 to 100  

TR  

{  

    TD { text("Test" ) }  

    TD { text("30" ) }  

    TD { text("Egypt" ) }  

    TD { text("Sales" ) }  

    TD { text("Future" ) }  

}  

next  

}  

}  

write("report.html",mypage.output())  

func PrintEvent  

    printer1 = new qPrinter(0) {  

        setoutputformat(1)  

        setoutputfilename("report.pdf")  

}  

    oView {  

        web.print(printer1)  

        web.show()  

}  

    system ("report.pdf")  

class CustomersReportView  

    win = new window() {  

        setwindowtitle("Report Window")  

        setgeometry(100,100,500,500)  

        web = new webview(win) {  

            setgeometry(100,100,1000,500)  

            loadpage(new qurl("file:///"+  

                currentdir() + "/report.html"))  

        }  

        new pushbutton(win) {  

            setGeometry(100,20,100,30)  

            settext("Print")  

            setclickevent(Method(:PrintEvent))  

        }  

    }  

}

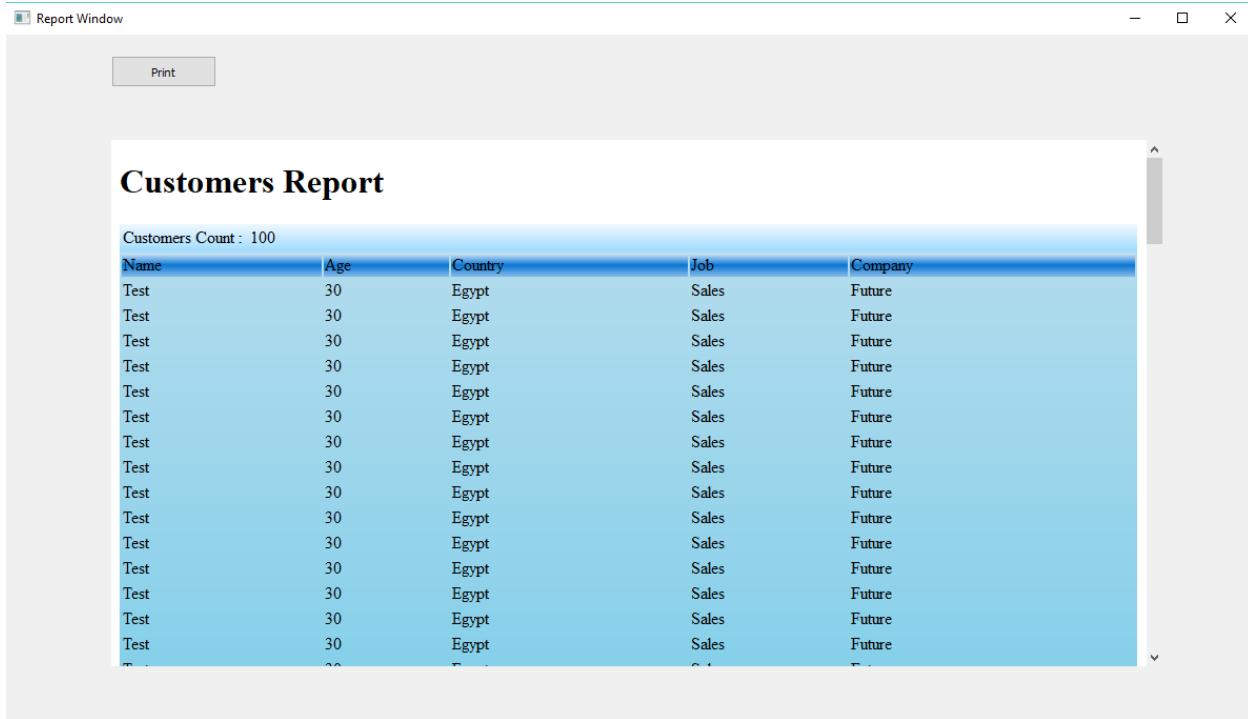
```

(continues on next page)

(continued from previous page)

```
        }  
    showMaximized()  
}
```

Screen Shot:



95.8 Better RingQt

New classes added to RingQt :

- `QStringRef`
 - `QMutex`
 - `QMutexLocker`
 - `QBuffer`
 - `QBluetoothAddress`
 - `QBluetoothDeviceDiscoveryAgent`
 - `QBluetoothDeviceInfo`
 - `QBluetoothHostInfo`
 - `QBluetoothLocalDevice`
 - `QBluetoothServer`
 - `QBluetoothServiceDiscoveryAgent`
 - `QBluetoothServiceInfo`
 - `QBluetoothSocket`

- QBluetoothTransferManager
- QBluetoothTransferReply
- QBluetoothTransferRequest
- QBluetoothUuid

Example:

```
### Submits your car VIN - Vehicle Id Number - to the Web Site - vpic.nhtsa.dot.gov -
### Parses XML data returned
### Prints out the car info result

load "libcurl.ring"
load "guilib.ring"
load "stdlib.ring"

curl = curl_easy_init()

# request = "3G1JC5248YS251015?format=xml"    ### VIN - Chevrolet
request = "3GYFK62847G247323?format=xml"    ### VIN - Cadillac

call_type    = "decodevinvalues/"
url         = "https://vpic.nhtsa.dot.gov/api/vehicles/"
url_request = url + call_type + request

See "URL Request: "+ url_request +nl

curl_easy_setopt(curl, curlopt_url, url_request)
response = curl_easy_perform(curl);

See nl +"Response Raw: "+ response +nl +nl

curl_easy_cleanup(curl)

xml = new QDomStreamReader()
xml.addData_2(response)

x = new QStringRef()
while not xml.atEnd()
    if xml.error()
        see xml.errorString() see nl
        exit loop
    ok

    x = xml.text()
    if not x.length() = 0
        see "Length: " see x.length() +" --- "
        see "Value: " see x.toString() see nl
    ok

    xml.readNext()
end

get x

#####
### Results
```

(continues on next page)

(continued from previous page)

```

#
# ==>Value: 115
# ==>Value: Results returned successfully
# ==>Value: VIN(s): 3G1JC5248YS251015
# ==>Value: 3G1JC5248YS251015
# ==>Value: Sedan/Saloon
# ==>Value: 4
# ==>Value: 2200.0
# ==>Value: 134.25223700841
# ==>Value: 2.2
# ==>Value: 4
# ==>Value: LN2
# ==>Value: CHEVROLET
# ==>Value: GENERAL MOTORS LLC
# ==>Value: Cavalier
# ==>Value: 2000
# ==>Value: Ramos Arzipe
# ==>Value: PASSENGER CAR
# ==>Value: 4
# ==>Value: In-Line
# ==>Value: 1st Row (Driver & Passenger)
# ==>Value: Sequential Fuel Injection (SFI)
# ==>Value: Mexico
# ==>Value: NA
# ==>Value: Manual
# ==>Value: Body Type: Sedan, 4-6 Window, Notchback (GM codes: 19, 69)
# ==>Value: Name Plate: Chevrolet, Pontiac
# ==>Value: 0 - VIN decoded clean. Check Digit (9th position) is correct
# ==>Value: LAN
# ==>Value: 984
#
##-----
```

95.9 Better Objects Library

The function Open_WindowInPackages() is added to the Objects library.

The Open_WindowInPackages() function is the same as Open_Window() but takes an extra list that determine the packages to import before opening the window.

Syntax:

```
Open_WindowInPackages(cClassName, aPackagesList)
```

Example:

The next example from the Form Designer source code, Open the Window Flags window using the open_windowInPackages() function.

We determine the class name “WindowFlagsController” and the packages name.

The Window Flags window uses the FormDesigner and System.GUI packages.

```
open_windowInPackages(:WindowFlagsController, [
    "formdesigner",
```

(continues on next page)

(continued from previous page)

```
"System.GUI"
])
```

95.10 RingFreeGLUT Extension

Ring 1.5 comes with RingFreeGLUT extension to support the FreeGLUT library

Example:

```
/*
   This sample is based on C Tutorials
   from : http://www.lighthouse3d.com/tutorials/glut-tutorial/
*/

load "freeglut.ring"
load "opengl21lib.ring"

// angle of rotation for the camera direction
angle = 0.0

// actual vector representing the camera's direction
lx=0.0 lz=-1.0

// XZ position of the camera
x=0.0 z=5.0

// the key states. These variables will be zero
//when no key is being presses
deltaAngle = 0.0
deltaMove = 0
xOrigin = -1

// Constant definitions for Menus
C_RED = 1
C_GREEN = 2
C_BLUE = 3
C_ORANGE = 4

C_FILL = 5
C_LINE = 6

// Pop up menu identifiers
fillMenu=NULL
fontMenu=NULL
mainMenu=NULL
colorMenu=NULL

// color for the nose
red = 1.0
blue=0.5
green=0.5

// scale of snowman
```

(continues on next page)

(continued from previous page)

```

scale = 1.0

// menu status
menuFlag = 0

// default font
font = GLUT_BITMAP_TIMES_ROMAN_24

C_INT_GLUT_BITMAP_8_BY_13 = 7
C_INT_GLUT_BITMAP_9_BY_15 = 8
C_INT_GLUT_BITMAP_TIMES_ROMAN_10 = 9
C_INT_GLUT_BITMAP_TIMES_ROMAN_24 = 10
C_INT_GLUT_BITMAP_HELVETICA_10 = 11
C_INT_GLUT_BITMAP_HELVETICA_12 = 12
C_INT_GLUT_BITMAP_HELVETICA_18 = 13

// width and height of the window
h = 0
w = 0

// variables to compute frames per second
frame=0
time=0
timebase=0
s = ""

func changeSize
    w = glutEventWidth()
    h = glutEventHeight()

    // Prevent a divide by zero, when window is too short
    // (you cant make a window of zero width).
    if h = 0
        h = 1
    ok

    ratio = w * 1.0 / h

    // Use the Projection Matrix
    glMatrixMode(GL_PROJECTION)

    // Reset Matrix
    glLoadIdentity()

    // Set the viewport to be the entire window
    glViewport(0, 0, w, h)

    // Set the correct perspective.
    gluPerspective(45.0, ratio, 0.1, 100.0)

    // Get Back to the Modelview
    glMatrixMode(GL_MODELVIEW)

func drawSnowMan

    glScalef(scale, scale, scale)
    glColor3f(1.0, 1.0, 1.0)

```

(continues on next page)

(continued from previous page)

```

// Draw Body
    glTranslatef(0.0 ,0.75, 0.0)
    glutSolidSphere(0.75,20,20)

// Draw Head
    glTranslatef(0.0, 1.0, 0.0)
    glutSolidSphere(0.25,20,20)

// Draw Eyes
    glPushMatrix()
    glColor3f(0.0,0.0,0.0)
    glTranslatef(0.05, 0.10, 0.18)
    glutSolidSphere(0.05,10,10)
    glTranslatef(-0.1, 0.0, 0.0)
    glutSolidSphere(0.05,10,10)
    glPopMatrix()

// Draw Nose
    glColor3f(red, green, blue)
    glRotatef(0.0,1.0, 0.0, 0.0)
    glutSolidCone(0.08,0.5,10,2)

    glColor3f(1.0, 1.0, 1.0)

func renderBitmapString x,y,z,font,string
    glRasterPos3f(x, y,z)
    for c in string
        glutBitmapCharacter(font,ascii(c))
    next

func renderStrokeFontString x,y,z,font,string
    glPushMatrix()
    glTranslatef(x, y,z)
    glScalef(0.002, 0.002, 0.002)
    for c in string
        glutStrokeCharacter(font, Ascii(c));
    next
    glPopMatrix()

func restorePerspectiveProjection

    glMatrixMode(GL_PROJECTION)
    // restore previous projection matrix
    glPopMatrix()

    // get back to modelview mode
    glMatrixMode(GL_MODELVIEW)

func setOrthographicProjection

    // switch to projection mode
    glMatrixMode(GL_PROJECTION)

    // save previous matrix which contains the

```

(continues on next page)

(continued from previous page)

```

//settings for the perspective projection
glPushMatrix()

// reset matrix
glLoadIdentity()

// set a 2D orthographic projection
gluOrtho2D(0, w, h, 0)

// switch back to modelview mode
glMatrixMode(GL_MODELVIEW)

func computePos deltaMove

    x += deltaMove * lx * 0.1
    z += deltaMove * lz * 0.1

func renderScene

    if deltaMove
        computePos(deltaMove)
    ok

    // Clear Color and Depth Buffers
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)

    // Reset transformations
    glLoadIdentity()

    // Set the camera
    gluLookAt(      x, 1.0, z,
                    x+lx, 1.0, z+lz,
                    0.0, 1.0, 0.0)

    // Draw ground

    glColor3f(0.9, 0.9, 0.9)
    glBegin(GL_QUADS)
        glVertex3f(-100.0, 0.0, -100.0)
        glVertex3f(-100.0, 0.0, 100.0)
        glVertex3f( 100.0, 0.0, 100.0)
        glVertex3f( 100.0, 0.0, -100.0)
    glEnd()

    // Draw 9 SnowMen
    for i = -3 to -1
        for j = -3 to -1
            glPushMatrix()
            glTranslatef(i*10.0, 0.0, j * 10.0)
            drawSnowMan()
            number = (i+3)*3+(j+3)
            renderBitmapString(0.0, 0.5, 0.0, font , ""+number)
            glPopMatrix()
        next

```

(continues on next page)

(continued from previous page)

```

next

// Code to compute frames per second
frame++

time=glutGet(GLUT_ELAPSED_TIME)
if time - timebase > 1000
    s = "RingFreeGLUT - FPS: " + (frame*1000.0/(time-timebase))
    timebase = time
    frame = 0
ok

// Code to display a string (fps) with bitmap fonts
setOrthographicProjection()

glPushMatrix()
glLoadIdentity()
renderBitmapString(5, 30, 0, GLUT_BITMAP_HELVETICA_18, s)
glPopMatrix()

restorePerspectiveProjection()

glutSwapBuffers()

// -----
//          KEYBOARD
// -----


func processNormalKeys
    key = glutEventKey()
    xx = glutEventX()
    yy = glutEventY()

    switch key
        on 27
            glutDestroyMenu(mainMenu)
            glutDestroyMenu(fillMenu)
            glutDestroyMenu(colorMenu)
            glutDestroyMenu(fontMenu)
            Shutdown()
        off

func pressKey

    key = glutEventKey()
    xx = glutEventX()
    yy = glutEventY()

    switch key
        on GLUT_KEY_UP
            deltaMove = 0.5
        on GLUT_KEY_DOWN
            deltaMove = -0.5
    off

```

(continues on next page)

(continued from previous page)

```

func releaseKey

    key = glutEventKey()

    switch key
        on GLUT_KEY_UP
            deltaMove = 0
        on GLUT_KEY_DOWN
            deltaMove = 0
    off

// -----
//          MOUSE
// -----


func mouseMove
    xx = glutEventX()
    yy = glutEventY()

    // this will only be true when the left button is down
    if xOrigin >= 0

        // update deltaAngle
        deltaAngle = (xx - xOrigin) * 0.001

        // update camera's direction
        lx = sin(angle + deltaAngle)
        lz = -cos(angle + deltaAngle)
    ok

func mouseButton

    button = glutEventButton()
    state = glutEventState()
    xx = glutEventX()
    yy = glutEventY()

    // only start motion if the left button is pressed
    if button = GLUT_LEFT_BUTTON
        // when the button is released
        if state = GLUT_UP
            angle += deltaAngle
            xOrigin = -1
        else
            // state = GLUT_DOWN
            xOrigin = xx
        ok
    ok

// -----
//          MENUS
// -----

```

(continues on next page)

(continued from previous page)

```

func processMenuStatus

    status = glutEventStatus()

    if status = GLUT_MENU_IN_USE
        menuFlag = 1
    else
        menuFlag = 0
    ok

func processMainMenu

    // nothing to do in here
    // all actions are for submenus

func processFillMenu

    option = glutEventValue()

    switch option

        on C_FILL
            glPolygonMode(GL_FRONT, GL_FILL)
        on C_LINE
            glPolygonMode(GL_FRONT, GL_LINE)
    off

func processFontMenu

    option = glutEventValue()

    switch (option) {
        on C_INT GLUT_BITMAP_8_BY_13
            font = GLUT_BITMAP_8_BY_13
        on C_INT GLUT_BITMAP_9_BY_15
            font = GLUT_BITMAP_9_BY_15
        on C_INT GLUT_BITMAP_TIMES_ROMAN_10
            font = GLUT_BITMAP_TIMES_ROMAN_10
        on C_INT GLUT_BITMAP_TIMES_ROMAN_24
            font = GLUT_BITMAP_TIMES_ROMAN_24
        on C_INT GLUT_BITMAP_HELVETICA_10
            font = GLUT_BITMAP_HELVETICA_10
        on C_INT GLUT_BITMAP_HELVETICA_12
            font = GLUT_BITMAP_HELVETICA_12
        on C_INT GLUT_BITMAP_HELVETICA_18
            font = GLUT_BITMAP_HELVETICA_18
    off

func processColorMenu

    option = glutEventValue()

    switch option
        on C_RED

```

(continues on next page)

(continued from previous page)

```

        red = 1.0
        green = 0.0
        blue = 0.0
    on C_GREEN
        red = 0.0
        green = 1.0
        blue = 0.0
    on C_BLUE
        red = 0.0
        green = 0.0
        blue = 1.0
    on C_ORANGE
        red = 1.0
        green = 0.5
        blue = 0.5
off

func createPopupMenus

fontMenu = glutCreateMenu(:processFontMenu)

glutAddMenuEntry("BITMAP_8_BY_13 ",C_INT_GLUT_BITMAP_8_BY_13 )
glutAddMenuEntry("BITMAP_9_BY_15",C_INT_GLUT_BITMAP_9_BY_15 )
glutAddMenuEntry("BITMAP_TIMES_ROMAN_10 ",C_INT_GLUT_BITMAP_TIMES_ROMAN_10 )
glutAddMenuEntry("BITMAP_TIMES_ROMAN_24",C_INT_GLUT_BITMAP_TIMES_ROMAN_24 )
glutAddMenuEntry("BITMAP_HELVETICA_10 ",C_INT_GLUT_BITMAP_HELVETICA_10 )
glutAddMenuEntry("BITMAP_HELVETICA_12",C_INT_GLUT_BITMAP_HELVETICA_12 )
glutAddMenuEntry("BITMAP_HELVETICA_18",C_INT_GLUT_BITMAP_HELVETICA_18 )

fillMenu = glutCreateMenu(:processFillMenu)

glutAddMenuEntry("Fill",C_FILL)
glutAddMenuEntry("Line",C_LINE)

colorMenu = glutCreateMenu(:processColorMenu)
glutAddMenuEntry("Red",C_RED);
glutAddMenuEntry("Blue",C_BLUE);
glutAddMenuEntry("Green",C_GREEN);
glutAddMenuEntry("Orange",C_ORANGE);

mainMenu = glutCreateMenu(:processMainMenu)

glutAddSubMenu("Polygon Mode", fillMenu)
glutAddSubMenu("Color", colorMenu)
glutAddSubMenu("Font", fontMenu)
// attach the menu to the right button
glutAttachMenu(GLUT_RIGHT_BUTTON)

// this will allow us to know if the menu is active
glutMenuStatusFunc(:processMenuStatus)

// -----
//          MAIN
// -----

```

(continues on next page)

(continued from previous page)

```

func main

    // init GLUT and create window
    glutInit()
    glutInitDisplayMode(GLUT_DEPTH | GLUT_DOUBLE | GLUT_RGBA)
    glutInitWindowPosition(100,100)
    glutInitWindowSize(320,320)
    glutCreateWindow("RingFreeGLUT - Test - 9 SnowMan")

    // register callbacks
    glutDisplayFunc(:renderScene)
    glutReshapeFunc(:changeSize)
    glutIdleFunc(:renderScene)

    glutIgnoreKeyRepeat(1)
    glutKeyboardFunc(:processNormalKeys)
    glutSpecialFunc(:pressKey)
    glutSpecialUpFunc(:releaseKey)

    // here are the two new functions
    glutMouseFunc(:mouseButton)
    glutMotionFunc(:mouseMove)

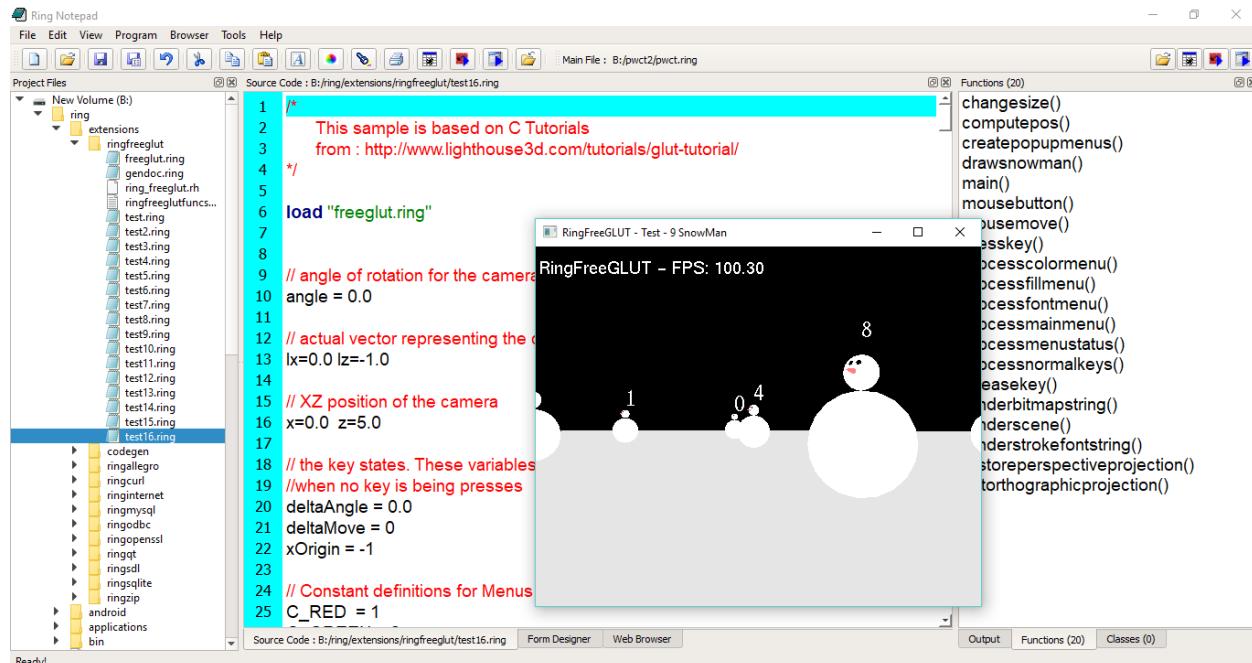
    // OpenGL init
    glEnable(GL_DEPTH_TEST)
    glEnable(GL_CULL_FACE)

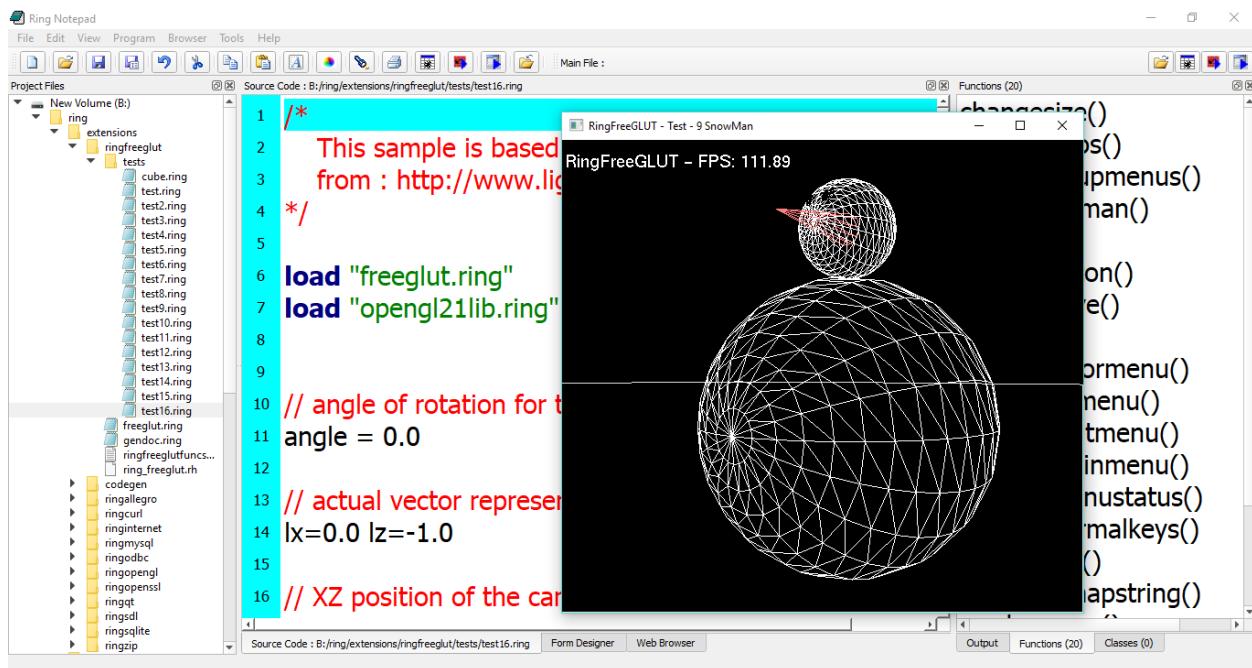
    // init Menus
    createPopupMenu()

    // enter GLUT event processing cycle
    glutMainLoop()

```

Screen Shots:





95.11 RingOpenGL Extension

Ring 1.5 comes with RingOpenGL and support for the next versions

- OpenGL 1.1
- OpenGL 1.2
- OpenGL 1.3
- OpenGL 1.4
- OpenGL 1.5
- OpenGL 2.0
- OpenGL 2.1
- OpenGL 3.0
- OpenGL 3.2
- OpenGL 3.3
- OpenGL 4.0
- OpenGL 4.1
- OpenGL 4.2
- OpenGL 4.3
- OpenGL 4.4
- OpenGL 4.5
- OpenGL 4.6

Example:

```

/*
    This sample is based on C Tutorials
    from :
        http://www.wikihow.com/Make-a-Cube-in-OpenGL
*/

load "freeglut.ring"
load "opengl21lib.ring"

// -----
// Global Variables
// -----
rotate_y=0
rotate_x=0

// -----
// display() Callback function
// -----
func display

    // Clear screen and Z-buffer
    glClear(GL_COLOR_BUFFER_BIT|GL_DEPTH_BUFFER_BIT)

    // Reset transformations
    glLoadIdentity()

    // Rotate when user changes rotate_x and rotate_y
    glRotatef( rotate_x, 1.0, 0.0, 0.0 )
    glRotatef( rotate_y, 0.0, 1.0, 0.0 )

    //Multi-colored side - FRONT
    glBegin(GL_POLYGON)

    glColor3f( 1.0, 0.0, 0.0 )      glVertex3f( 0.5, -0.5, -0.5 )      # P1 is red
    glColor3f( 0.0, 1.0, 0.0 )      glVertex3f( 0.5, 0.5, -0.5 )      # P2 is green
    glColor3f( 0.0, 0.0, 1.0 )      glVertex3f( -0.5, 0.5, -0.5 )     # P3 is blue
    glColor3f( 1.0, 0.0, 1.0 )      glVertex3f( -0.5, -0.5, -0.5 )    # P4 is purple

    glEnd()

    // White side - BACK
    glBegin(GL_POLYGON)
    glColor3f( 1.0, 1.0, 1.0 )
    glVertex3f( 0.5, -0.5, 0.5 )
    glVertex3f( 0.5, 0.5, 0.5 )
    glVertex3f( -0.5, 0.5, 0.5 )
    glVertex3f( -0.5, -0.5, 0.5 )
    glEnd()

    // Purple side - RIGHT
    glBegin(GL_POLYGON)
    glColor3f( 1.0, 0.0, 1.0 )
    glVertex3f( 0.5, -0.5, -0.5 )
    glVertex3f( 0.5, 0.5, -0.5 )
    glVertex3f( 0.5, 0.5, 0.5 )
    glVertex3f( 0.5, -0.5, 0.5 )
    glEnd()

```

(continues on next page)

(continued from previous page)

```

// Green side - LEFT
glBegin(GL_POLYGON)
glColor3f( 0.0, 1.0, 0.0 )
glVertex3f( -0.5, -0.5, 0.5 )
glVertex3f( -0.5, 0.5, 0.5 )
glVertex3f( -0.5, 0.5, -0.5 )
glVertex3f( -0.5, -0.5, -0.5 )
glEnd()

// Blue side - TOP
glBegin(GL_POLYGON)
glColor3f( 0.0, 0.0, 1.0 )
glVertex3f( 0.5, 0.5, 0.5 )
glVertex3f( 0.5, 0.5, -0.5 )
glVertex3f( -0.5, 0.5, -0.5 )
glVertex3f( -0.5, 0.5, 0.5 )
glEnd()

// Red side - BOTTOM
glBegin(GL_POLYGON)
glColor3f( 1.0, 0.0, 0.0 )
glVertex3f( 0.5, -0.5, -0.5 )
glVertex3f( 0.5, -0.5, 0.5 )
glVertex3f( -0.5, -0.5, 0.5 )
glVertex3f( -0.5, -0.5, -0.5 )
glEnd()

glFlush()
glutSwapBuffers()

// -----
// specialKeys() Callback Function
// -----
func specialKeys

    key = glutEventKey()

    // Right arrow - increase rotation by 5 degree
    switch Key

        on GLUT_KEY_RIGHT
            rotate_y += 5

        // Left arrow - decrease rotation by 5 degree
        on GLUT_KEY_LEFT
            rotate_y -= 5

        on GLUT_KEY_UP
            rotate_x += 5

        on GLUT_KEY_DOWN
            rotate_x -= 5

    off

```

(continues on next page)

(continued from previous page)

```

// Request display update
glutPostRedisplay()

// -----
// main() function
// -----
func main

    // Initialize GLUT and process user parameters
    glutInit()

    // Request double buffered true color window with Z-buffer
    glutInitDisplayMode(GLUT_DOUBLE | GLUT_RGB | GLUT_DEPTH)

    // Create window
    glutCreateWindow("Awesome Cube")

    // Enable Z-buffer depth test
    glEnable(GL_DEPTH_TEST)

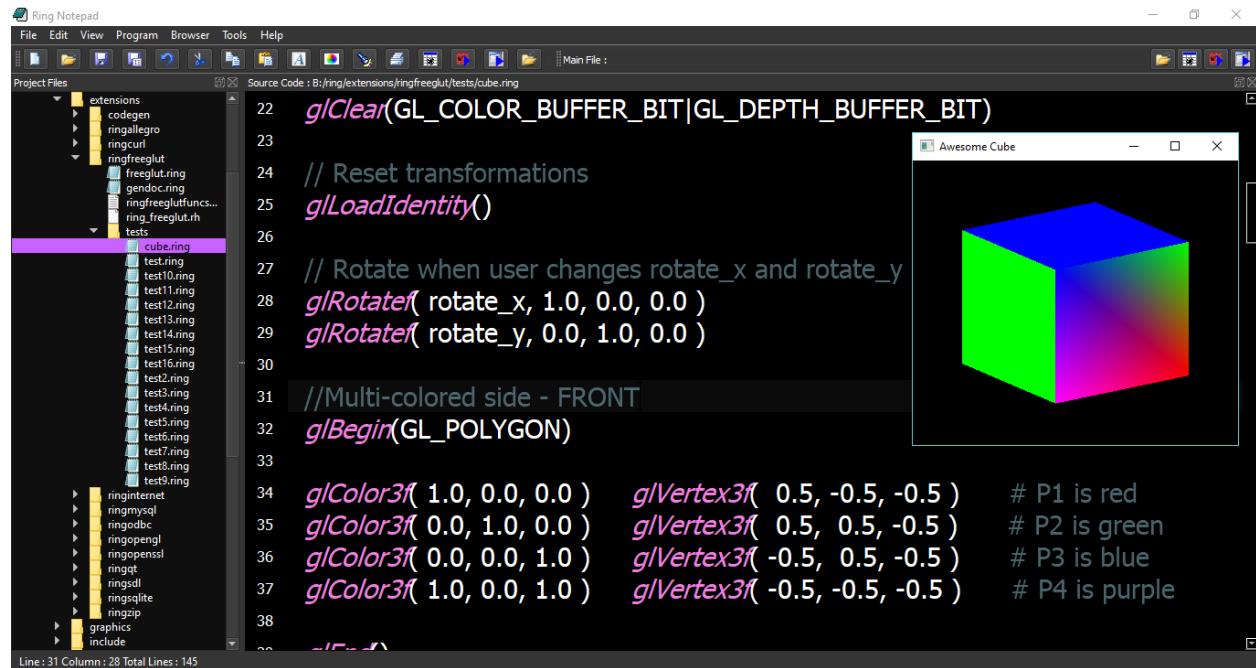
    // Callback functions
    glutDisplayFunc(:display)
    glutSpecialFunc(:specialKeys)

    // Pass control to GLUT for events
    glutMainLoop()

    // Return to OS

```

Screen Shot:



95.12 Better Code Generator for Extensions

The Code Generator is updated to support <constant> type, So we can have constants other than numbers, for example : Strings and Pointers.

When we have pointers we can determine the pointer type. To use this feature, before <constant> and </constant> we can use

```
$nDefaultConstantType = C_CONSTANT_TYPE_POINTER
$cDefaultConstantPointerType = "void *
```

The next example from the RingFreeGLUT extension

```
<runcode>
    $nDefaultConstantType = C_CONSTANT_TYPE_POINTER
    $cDefaultConstantPointerType = "void"
</runcode>
<constant>
    GLUT_STROKE_ROMAN
    GLUT_STROKE_MONO_ROMAN
    GLUT_BITMAP_9_BY_15
    GLUT_BITMAP_8_BY_13
    GLUT_BITMAP_TIMES_ROMAN_10
    GLUT_BITMAP_TIMES_ROMAN_24
    GLUT_BITMAP_HELVETICA_10
    GLUT_BITMAP_HELVETICA_12
    GLUT_BITMAP_HELVETICA_18
</constant>
```

95.13 Better Documentation Generator for Extensions

The documentation generator for extensions is updated to generate a list of constants in the generated documentation

The previous versions provides the functions prototype only, Now we have the list of constants too.

95.14 Ring VM - Tracing Functions

In Ring 1.5 the next functions are added to Ring VM

- RingVM_SetTrace(cCode)
- RingVM_TraceData() -> aDataList
- RingVM_TraceEvent() -> nTraceEvent
- RingVM_TraceFunc() -> cCode
- RingVM_ScopesCount() -> nScopes
- RingVM_EvalInScope(nScope,cCode)
- RingVM_PassError()
- RingVM_HideErrorMsg(lStatus)
- RingVM_CallFunc(cFuncName)

Example:

```

load "tracelib.ring"

ringvm_settrace("mytrace()")

see "Hello, world!" + nl
see "Welcome" + nl
see "How are you?" +nl
mytest()
new myclass { mymethod() }

func mytest
    see "Message from mytest" + nl

func mytrace
    see "===== The Trace function is Active =====" + nl +
        "Trace Function Name : " + ringvm_TraceFunc() + nl +
        "Trace Event : "
    switch ringvm_TraceEvent()
        on TRACEEVENT_NEWLINE          see "New Line"
        on TRACEEVENT_NEWFUNC          see "New Function"
        on TRACEEVENT_RETURN           see "Return"
        on TRACEEVENT_ERROR            see "Error"
        on TRACEEVENT_BEFOREFUNC      see "Before C Function"
        on TRACEEVENT_AFTERFUNC       see "After C Function"
    off
    see nl +
        "Line Number : " + ringvm_tracedata() [TRACEDATA_LINENUMBER] + nl +
        "File Name   : " + ringvm_tracedata() [TRACEDATA_FILENAME] + nl +
        "Function Name : " + ringvm_tracedata() [TRACEDATA_FUNCNAME] + nl +
        "Method or Function : "
        if ringvm_tracedata() [TRACEDATA_METHODORFUNC] =
            TRACEDATA_METHODORFUNC_METHOD
            see "Method"
        else
            if ringvm_tracedata() [TRACEDATA_FUNCNAME] = NULL
                see "Command"
            else
                see "Function"
            ok
        ok
    see nl + Copy("=", 42) + nl

class myclass
    func mymethod
        see "Message from mymethod" + nl

```

Output:

```

===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : After C Function
Line Number : 3
File Name   : test1.ring
Function Name : ringvm_settrace
Method or Function : Function
=====
```

(continues on next page)

(continued from previous page)

```
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 5
File Name   : test1.ring
Function Name :
Method or Function : Command
=====
Hello, world!
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 6
File Name   : test1.ring
Function Name :
Method or Function : Command
=====
Welcome
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 7
File Name   : test1.ring
Function Name :
Method or Function : Command
=====
How are you?
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 8
File Name   : test1.ring
Function Name :
Method or Function : Command
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Function
Line Number : 8
File Name   : test1.ring
Function Name : mytest
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 12
File Name   : test1.ring
Function Name : mytest
Method or Function : Function
=====
Message from mytest
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 14
File Name   : test1.ring
```

(continues on next page)

(continued from previous page)

```

Function Name : mytest
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : Return
Line Number : 8
File Name   : test1.ring
Function Name :
Method or Function : Command
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 9
File Name   : test1.ring
Function Name :
Method or Function : Command
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 43
File Name   : test1.ring
Function Name :
Method or Function : Command
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : Before C Function
Line Number : 9
File Name   : test1.ring
Function Name : ismethod
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : After C Function
Line Number : 9
File Name   : test1.ring
Function Name : ismethod
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Function
Line Number : 9
File Name   : test1.ring
Function Name : mymethod
Method or Function : Method
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 44
File Name   : test1.ring
Function Name : mymethod

```

(continues on next page)

(continued from previous page)

```
Method or Function : Method
=====
Message from mymethod
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : Return
Line Number : 9
File Name   : test1.ring
Function Name :
Method or Function : Command
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : Before C Function
Line Number : 9
File Name   : test1.ring
Function Name : ismethod
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : After C Function
Line Number : 9
File Name   : test1.ring
Function Name : ismethod
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : Before C Function
Line Number : 9
File Name   : test1.ring
Function Name : ismethod
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : After C Function
Line Number : 9
File Name   : test1.ring
Function Name : ismethod
Method or Function : Function
=====
===== The Trace function is Active =====
Trace Function Name : mytrace()
Trace Event : New Line
Line Number : 11
File Name   : test1.ring
Function Name :
Method or Function : Command
=====
```

95.15 Trace Library and Interactive Debugger

Ring 1.5 comes with the Trace Library and the Interactive Debugger

Using this library we can trace events, execute programs line by line, open the Interactive Debugger when an error happens or at breakpoints.

Example:

The next example uses a Breakpoint to open the Interactive Debugger!

```
load "tracelib.ring"

test1()

func test1
    x = 10
    see :test1 + nl
    t = 12
    BreakPoint()
    see "After breakpoint!" +nl
    see "t = " + t + nl
    see "End of program!" + nl
```

Screen Shots:

We have the Interactive Debugger at the Breakpoint!

```
5 # BreakPoint
6
7 load "tracelib.ring"
8
9 test1()
10
11 func test1
12     x = 10
13     see :test1 + nl
14     t = 12
15     BreakPoint()
16     see "After breakpoint!" +nl
17     see "t = " + t + nl
18     see "End of program!" + nl
19
20
```

C:\WINDOWS\system32\cmd.exe - B:\ring\applications\note\batch\rn "B:/ring/ringlibs/tracelib/samples/sample6.ring"

```
test1
=====
Interactive Debugger
=====
Command (Exit)      : End Program
Command (Cont)       : Continue Execution
Command (Locals)     : Print local variables names
Command (LocalsData) : Print local variables data
Command (Globals)    : Print global variables names
Command (CallStack)  : Print call stack
We can execute Ring code
=====

code:> ■
```

We can print the variables values

The screenshot shows a Ring Notepad window. On the left, a script named 'sample6.ring' is displayed:

```

6 load "tracelib.ring"
7
8
9 test1()
10
11 func test1
12     x = 10
13     see :test1 + nl
14     t = 12
15     BreakPoint()
16     see "After breakpoint!" +nl
17     see "t = " + t + nl
18     see "End of program!" + nl
19
20

```

To the right, the command-line interface shows the execution of the script:

```

=====
Command (Exit)      : End Program
Command (Cont)      : Continue Execution
Command (Locals)    : Print local variables names
Command (LocalsData) : Print local variables data
Command (Globals)   : Print global variables names
Command (CallStack) : Print call stack
We can execute Ring code
=====
code:> localsdata

Variable : x      Type : NUMBER          Value : 10
Variable : t      Type : NUMBER          Value : 12

code:> -

```

We can change the variables values then continue execution

The screenshot shows a Ring Notepad window. On the left, the same script 'sample6.ring' is displayed, but with changes made to the variable values:

```

5 # BreakPoint
6
7 load "tracelib.ring"
8
9 test1()
10
11 func test1
12     x = 10
13     see :test1 + nl
14     t = 12
15     BreakPoint()
16     see "After breakpoint!" +nl
17     see "t = " + t + nl
18     see "End of program!" + nl
19
20

```

To the right, the command-line interface shows the execution of the modified script:

```

=====
code:> localsdata

Variable : x      Type : NUMBER          Value : 10
Variable : t      Type : NUMBER          Value : 12

code:> x = 100
code:> t = 200
code:> cont
After breakpoint!
t = 200
End of program!

```

We can run the Interactive Debugger in the Output Window

The screenshot shows a Ring Notepad window with the 'Interactive Debugger' feature running in the Output window. The project tree on the left shows the 'samples' directory containing various Ring files. The 'sample6.ring' file is selected. The 'Output' window on the right displays the debugger's commands and responses:

```

=====
Interactive Debugger
=====
Command (Exit)      : End Program
Command (Cont)      : Continue Execution
Command (Locals)    : Print local variables names
Command (LocalsData) : Print local variables data
Command (Globals)   : Print global variables names
Command (CallStack) : Print call stack
We can execute Ring code
=====

code:> localsdata

Variable : x      Type : NUMBER          Value : 10
Variable : t      Type : NUMBER          Value : 12

code:> t = 100
code:> cont
After breakpoint!
t = 100
End of program!

```

95.16 More Syntax Flexibility

- Using braces { } in Packages/Classes/Functions

Example:

```
load "stdlib.ring"

import mypackage

new myclass {
    myfunc()
}

package mypackage
{
    class myclass
    {
        func myfunc
        {
            print("Hello, World!\n")
        }
    }
}
```

- Using ‘end’ keyword after Packages/Classes/Functions

Example:

```
import mypackage

new myclass {
    myfunc()
}

package mypackage
    class myclass
        def myfunc
            put "Hello, World!"
        end
    end
end
```

- Using ‘endpackage’/‘endclass’/‘endfunc’ keywords after Packages/Classes/Functions

Example:

```
import mypackage

new myclass { myfunc() }

package mypackage
    class myclass
        func myfunc
            see "welcome" + nl
        endfunc
    endclass
endpackage
```

95.17 Type Hints Library

Ring 1.5 comes with the Type Hints library

Using this library we can add the type information to the source code which will be very useful for tools like

- Code Editors
- Static-Analysis

Example:

```
load "typehints.ring"

see sum(3,4) + nl ;
see sayHello("Mahmoud");

int func sum(int x,int y) {
    return x+y ;
}

string func sayHello(string name) {
    return "Hello " + name ;
}
```

The library is very powerful and support the User types (Classes) automatically!

Example:

```
load "typehints.ring"

import mypackage

test() { main([:one,:two,:three]) }

myclass func test() {
    see "Testing User Types!" + nl
    return new myclass
}

package mypackage {
    public class myclass {
        public static void func main(list args) {
            see "welcome" + nl
            see args
        }
    }
}
```

Also You can use the types inside the code (not only the function prototype)

Example:

```
load "typehints.ring"

int      sum = sum(3,4)
string   msg = sayHello("Mahmoud")

see "Sum = " + sum + nl + msg + nl
```

(continues on next page)

(continued from previous page)

```

int func sum(int x,int y) {
    return x+y ;
}

string func sayHello(string name) {
    return "Hello " + name ;
}

```

Rules:

- To use the types in the function prototype, You must use ‘(‘ and ‘)’ around parameters
- To use the types in the function code, You must set the variable value (Assignment).

Note: Ring is a dynamic language, No type checking will be done by the compiler.

95.18 Better Quality

Based on Ring usage every day in practical projects

Ring 1.5 is more stable and more productive!

We are adding features based on clear vision and practical needs.

Also the documentation is better.

95.19 What is new in Ring 1.5.1?

- Better Documentation
- StdLib - Factorial() function update
- RingVM - Better code for clearing the stack in the Class Region.
- Sample : 3D Cube (OpenGL) + Texture Image using GameLib (RingAllegro)

Source Code:

```

load "gamelib.ring"
load "opengl21lib.ring"

func main

    new GraphicsApp {
        start()
    }

class GraphicsApp from GraphicsAppBase

    TITLE = "Ring Cube"

```

(continues on next page)

(continued from previous page)

```

bitmap texture

xrot = 0.0
yrot = 0.0
zrot = 0.0

func loadresources

    bitmap = al_load_bitmap("ring.bmp")
    texture = al_get_opengl_texture(bitmap)

func destroyResources

    al_destroy_bitmap(bitmap)

func drawScene

    w = 800 h = 600
    ratio = w / h

    glViewport(0, 0, w, h)
    glMatrixMode(GL_PROJECTION)
    glLoadIdentity()

    gluPerspective(45,ratio,1,100)
    glMatrixMode(GL_MODELVIEW)
    glLoadIdentity()

    glEnable(GL_TEXTURE_2D)
    glShadeModel(GL_SMOOTH)
    glClearColor(0.0, 0.0, 0.0, 0.5)
    glClearDepth(1.0)
    glEnable(GL_DEPTH_TEST)
    glEnable(GL_CULL_FACE)
    glDepthFunc(GL_LEQUAL)
    glHint(GL_PERSPECTIVE_CORRECTION_HINT, GL_NICEST)

    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)
    glLoadIdentity();
    glTranslatef(0.0,0.0,-5.0);

    glRotatef(xrot,1.0,0.0,0.0);
    glRotatef(yrot,0.0,1.0,0.0);
    glRotatef(zrot,0.0,0.0,1.0);

    glBindTexture(GL_TEXTURE_2D, texture)

    glBegin(GL_QUADS)
        // Front Face
        glTexCoord2f(0.0, 0.0) glVertex3f(-1.0, -1.0, 1.0)
        glTexCoord2f(1.0, 0.0) glVertex3f( 1.0, -1.0, 1.0)
        glTexCoord2f(1.0, 1.0) glVertex3f( 1.0, 1.0, 1.0)
        glTexCoord2f(0.0, 1.0) glVertex3f(-1.0, 1.0, 1.0)
        // Back Face
        glTexCoord2f(1.0, 0.0) glVertex3f(-1.0, -1.0, -1.0)
        glTexCoord2f(1.0, 1.0) glVertex3f(-1.0, 1.0, -1.0)
        glTexCoord2f(0.0, 1.0) glVertex3f( 1.0, 1.0, -1.0)

```

(continues on next page)

(continued from previous page)

```

glTexCoord2f(0.0, 0.0) glVertex3f( 1.0, -1.0, -1.0)
// Top Face
glTexCoord2f(0.0, 1.0) glVertex3f(-1.0, 1.0, -1.0)
glTexCoord2f(0.0, 0.0) glVertex3f(-1.0, 1.0, 1.0)
glTexCoord2f(1.0, 0.0) glVertex3f( 1.0, 1.0, 1.0)
glTexCoord2f(1.0, 1.0) glVertex3f( 1.0, 1.0, -1.0)
// Bottom Face
glTexCoord2f(1.0, 1.0) glVertex3f(-1.0, -1.0, -1.0)
glTexCoord2f(0.0, 1.0) glVertex3f( 1.0, -1.0, -1.0)
glTexCoord2f(0.0, 0.0) glVertex3f( 1.0, -1.0, 1.0)
glTexCoord2f(1.0, 0.0) glVertex3f(-1.0, -1.0, 1.0)
// Right face
glTexCoord2f(1.0, 0.0) glVertex3f( 1.0, -1.0, -1.0)
glTexCoord2f(1.0, 1.0) glVertex3f( 1.0, 1.0, -1.0)
glTexCoord2f(0.0, 1.0) glVertex3f( 1.0, 1.0, 1.0)
glTexCoord2f(0.0, 0.0) glVertex3f( 1.0, -1.0, 1.0)
// Left Face
glTexCoord2f(0.0, 0.0) glVertex3f(-1.0, -1.0, -1.0)
glTexCoord2f(1.0, 0.0) glVertex3f(-1.0, -1.0, 1.0)
glTexCoord2f(1.0, 1.0) glVertex3f(-1.0, 1.0, 1.0)
glTexCoord2f(0.0, 1.0) glVertex3f(-1.0, 1.0, -1.0)
glEnd()

xrot += 0.3
yrot += 0.2
zrot += 0.4

class GraphicsAppBase

    display event_queue ev timeout
    timer redraw = true

    FPS = 60

    SCREEN_W = 800
    SCREEN_H = 600

    KEY_UP = 1
    KEY_DOWN = 2
    KEY_LEFT = 3
    KEY_RIGHT = 4

    Key = [false, false, false, false]

    TITLE = "Graphics Application"

    func start

        SetUp()
        loadResources()
        eventsLoop()
        destroy()

    func setup

        al_init()

```

(continues on next page)

(continued from previous page)

```

al_init_image_addon()
al_set_new_display_flags(ALLEGRO_OPENGL)
display = al_create_display(SCREEN_W, SCREEN_H)
al_set_Window_title(display, TITLE)
al_clear_to_color(al_map_rgb(0, 0, 0))
event_queue = al_create_event_queue()
al_register_event_source(event_queue,
    al_get_display_event_source(display))
ev = al_new_allegro_event()
timeout = al_new_allegro_timeout()
al_init_timeout(timeout, 0.06)
timer = al_create_timer(1.0 / FPS)
al_register_event_source(event_queue,
    al_get_timer_event_source(timer))
al_start_timer(timer)
al_install_mouse()
al_register_event_source(event_queue,
    al_get_mouse_event_source())
al_install_keyboard()
al_register_event_source(event_queue,
    al_get_keyboard_event_source())

func eventsLoop

while true
    al_wait_for_event_until(event_queue, ev, timeout)
    switch al_get_allegro_event_type(ev)
    on ALLEGRO_EVENT_DISPLAY_CLOSE
        exit
    on ALLEGRO_EVENT_TIMER
        redraw = true
    on ALLEGRO_EVENT_MOUSE_AXES
        mouse_x = al_get_allegro_event_mouse_x(ev)
        mouse_y = al_get_allegro_event_mouse_y(ev)
    on ALLEGRO_EVENT_MOUSE_ENTER_DISPLAY
        mouse_x = al_get_allegro_event_mouse_x(ev)
        mouse_y = al_get_allegro_event_mouse_y(ev)
    on ALLEGRO_EVENT_MOUSE_BUTTON_UP
        exit
    on ALLEGRO_EVENT_KEY_DOWN
        switch al_get_allegro_event_keyboard_keycode(ev)
        on ALLEGRO_KEY_UP
            key[KEY_UP] = true
        on ALLEGRO_KEY_DOWN
            key[KEY_DOWN] = true
        on ALLEGRO_KEY_LEFT
            key[KEY_LEFT] = true
        on ALLEGRO_KEY_RIGHT
            key[KEY_RIGHT] = true
    off
    on ALLEGRO_EVENT_KEY_UP
        switch al_get_allegro_event_keyboard_keycode(ev)
        on ALLEGRO_KEY_UP
            key[KEY_UP] = false
        on ALLEGRO_KEY_DOWN
            key[KEY_DOWN] = false
        on ALLEGRO_KEY_LEFT

```

(continues on next page)

(continued from previous page)

```

key[KEY_LEFT] = false
on ALLEGRO_KEY_RIGHT
    key[KEY_RIGHT] = false
on ALLEGRO_KEY_ESCAPE
    exit
off
off
if redraw and al_is_event_queue_empty(event_queue)
    redraw = false
    drawScene()
    al_flip_display()
ok
    callgc()
end

func destroy

    destroyResources()
    al_destroy_timer(timer)
    al_destroy_allegro_event(ev)
    al_destroy_allegro_timeout(timeout)
    al_destroy_event_queue(event_queue)
    al_destroy_display(display)

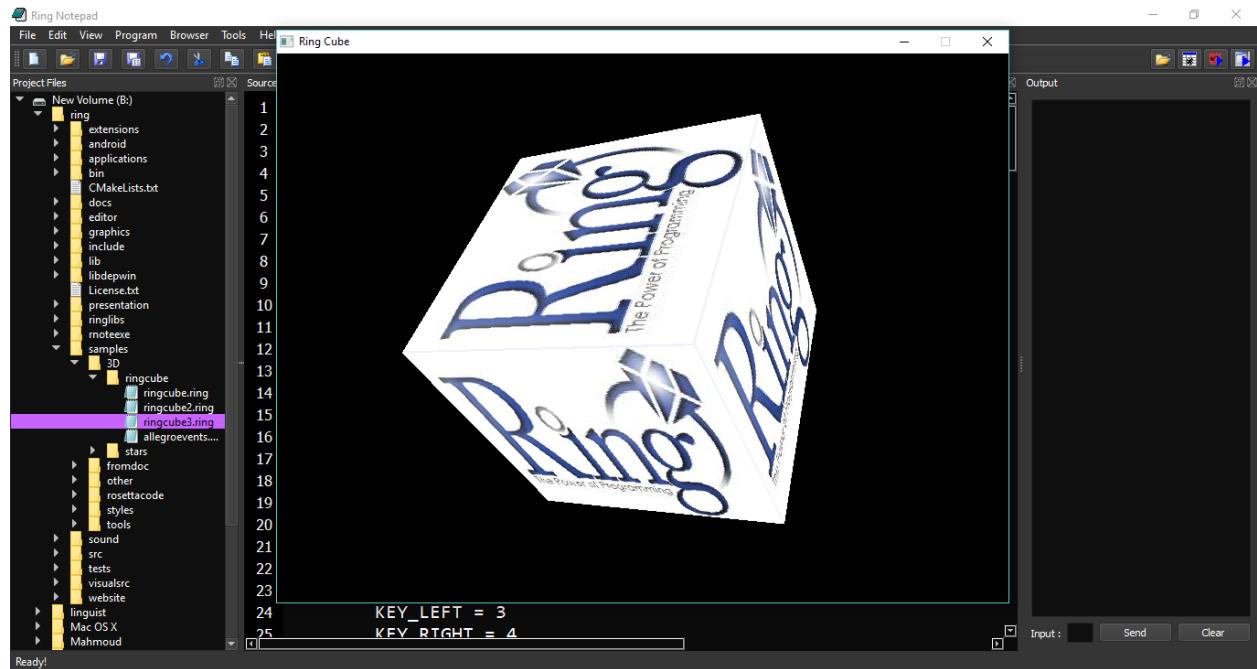
func loadresources

func drawScene

func destroyResources

```

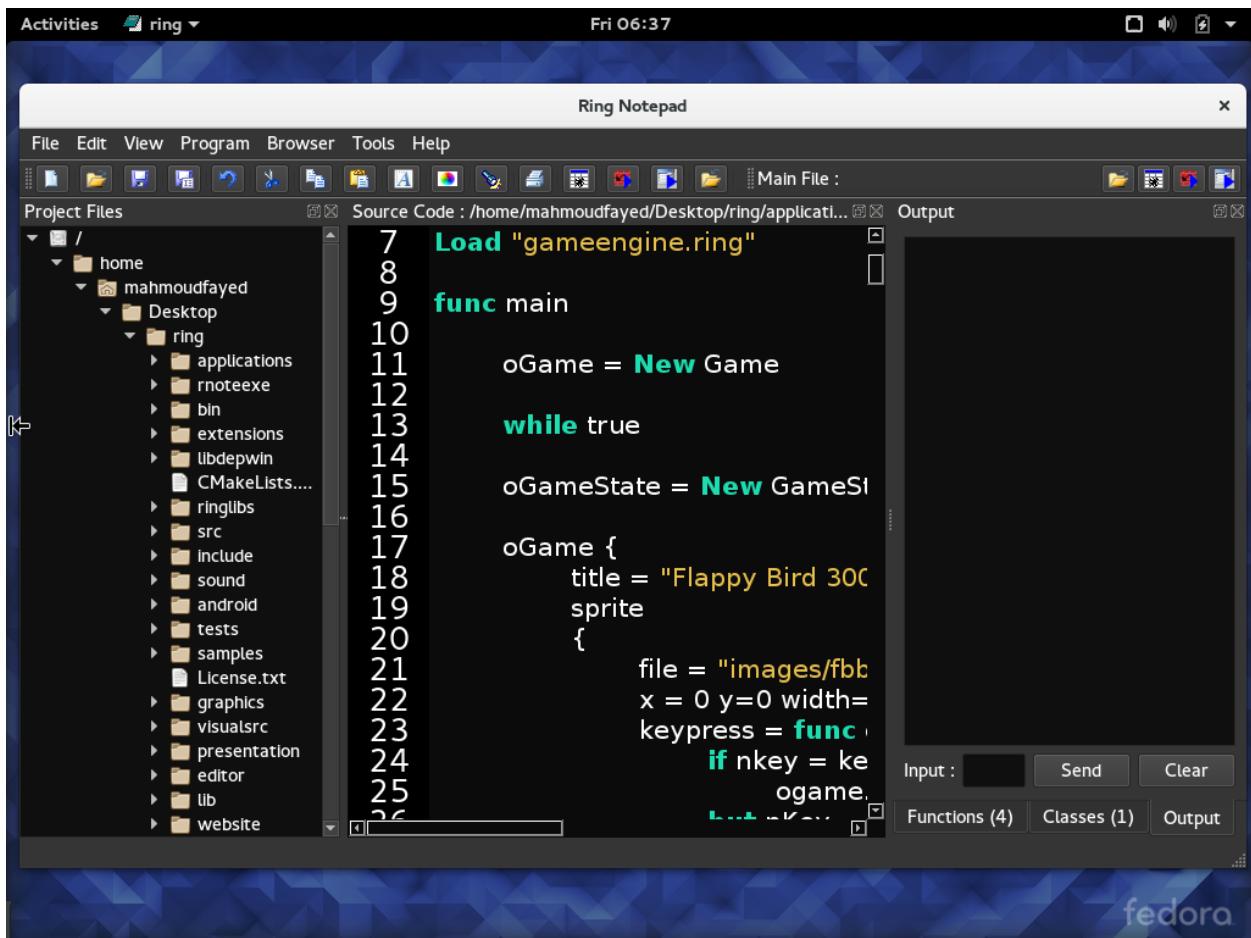
Screen Shot:



95.20 What is new in Ring 1.5.2?

- Documentation - Chapter “Applications developed in little hours” is updated
 - Ring Notepad - Display programs output in the output window on all platforms
 - Form Designer - Help Menu - Open CHM/PDF files without displaying the console window
 - Form Designer - Better response to Resize/Move Events when moving the Mouse quickly
 - Form Designer - New/Open/Save As, will open the Controller class in Ring Notepad
 - Form Designer - Added “Close Form” option to the file menu
 - Ring Notepad - Run, will save the current file (Also the opened Form) automatically
 - GetQuotesHistory Application - Updated to work on MacOS X and Qt 5.2
 - Calculator Application - Updated to include more features!
 - RingVM - Classification for Environment Errors (Check Chapter : Language Reference)
 - RingQt - New methods added to QAllEvents for faster Events execution
 - RingQt - Fusion Black Style - Better colors for disabled controls
 - Scripts - For building Ring on Fedora Linux (Check Chapter : Building From Source Code)

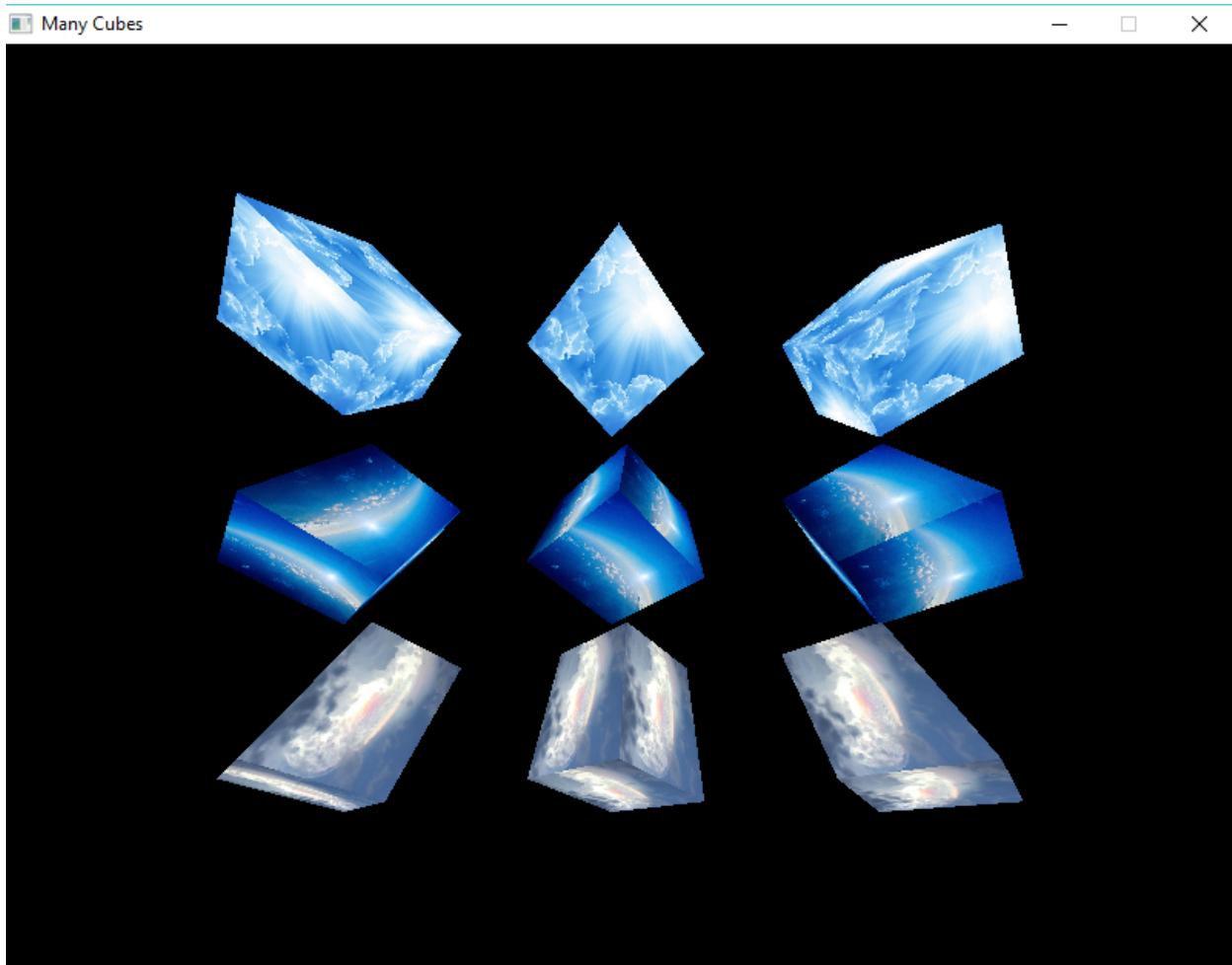
Screen Shot:



95.21 What is new in Ring 1.5.3?

- Form Designer : Close Action will notify Ring Notepad to be able to open the Form again
- Form Designer : Save Action will open the controller class in Ring Notepad
- Form Designer : Keep current control selected when selecting many controls using CTRL Key
- Form Designer : Nice form back color when used in Ring Notepad (Style: Modern Black)
- RingOpenSSL : Updated to support newer versions like OpenSSL 1.1
- Building Scripts : Updated to work on Fedora 26 (64bit)
- OpenGL : New Sample - Many Cubes (samples/3D/manycubes)

Screen Shot:



- RingQt : Add QDateTime Class
- RingQt : New methods added to QMenu and QCursor Classes

Example:

```
load "guilib.ring"
```

```
new qApp {
```

(continues on next page)

(continued from previous page)

```

win = new QWidget() {
    setWindowTitle("Context Menu")
    resize(400,400)
    myfilter = new QAllEvents(win) {
        setContextMenuEvent("mymenu()")
    }
    installEventFilter(myfilter)
    show()
}
exec()
}

func mymenu

new QMenu(win) {
    oAction = new QAction(win) {
        setText("new")
        SetCLickevent("See :New")
    }
    addAction(oAction)
    oAction = new QAction(win) {
        setText("open")
        SetCLickevent("See :Open")
    }
    addAction(oAction)
    oAction = new QAction(win) {
        setText("save")
        SetCLickevent("See :Save")
    }
    addAction(oAction)
    oAction = new QAction(win) {
        setText("close")
        SetCLickevent("See :Close")
    }
    addAction(oAction)
    oCursor = new QCursor()
    exec(oCursor.pos())
}

```

- Compiler : Support using _ in numbers

Example:

```
x = 1_000_000
see type(x)+nl
see x+1+nl
```

Output:

```
NUMBER
100000001
```

- Compiler : Support using f after numbers

Example:

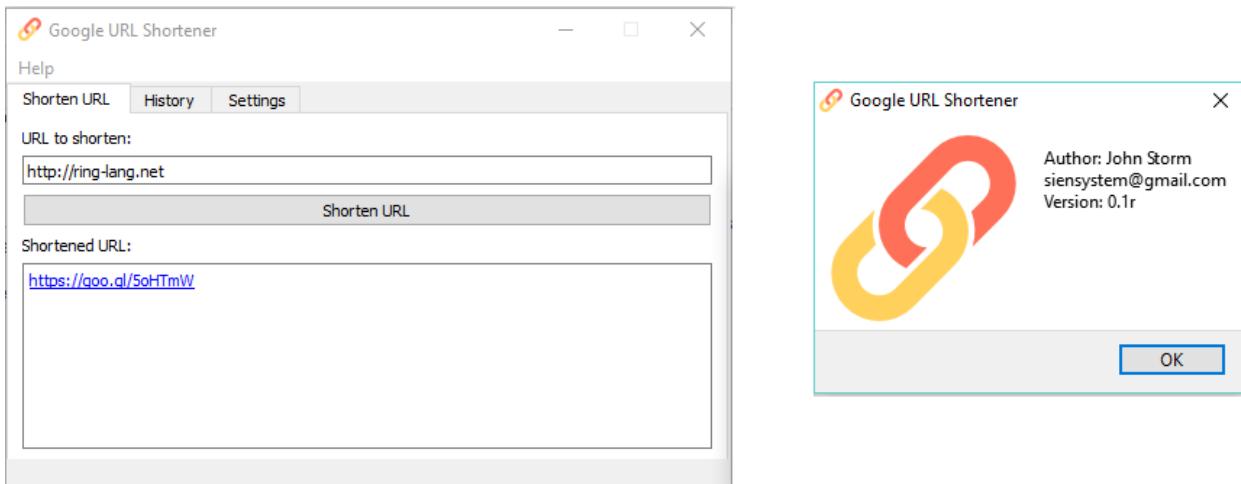
```
x = 19.99f  
see type(x) + nl
```

Output:

```
NUMBER
```

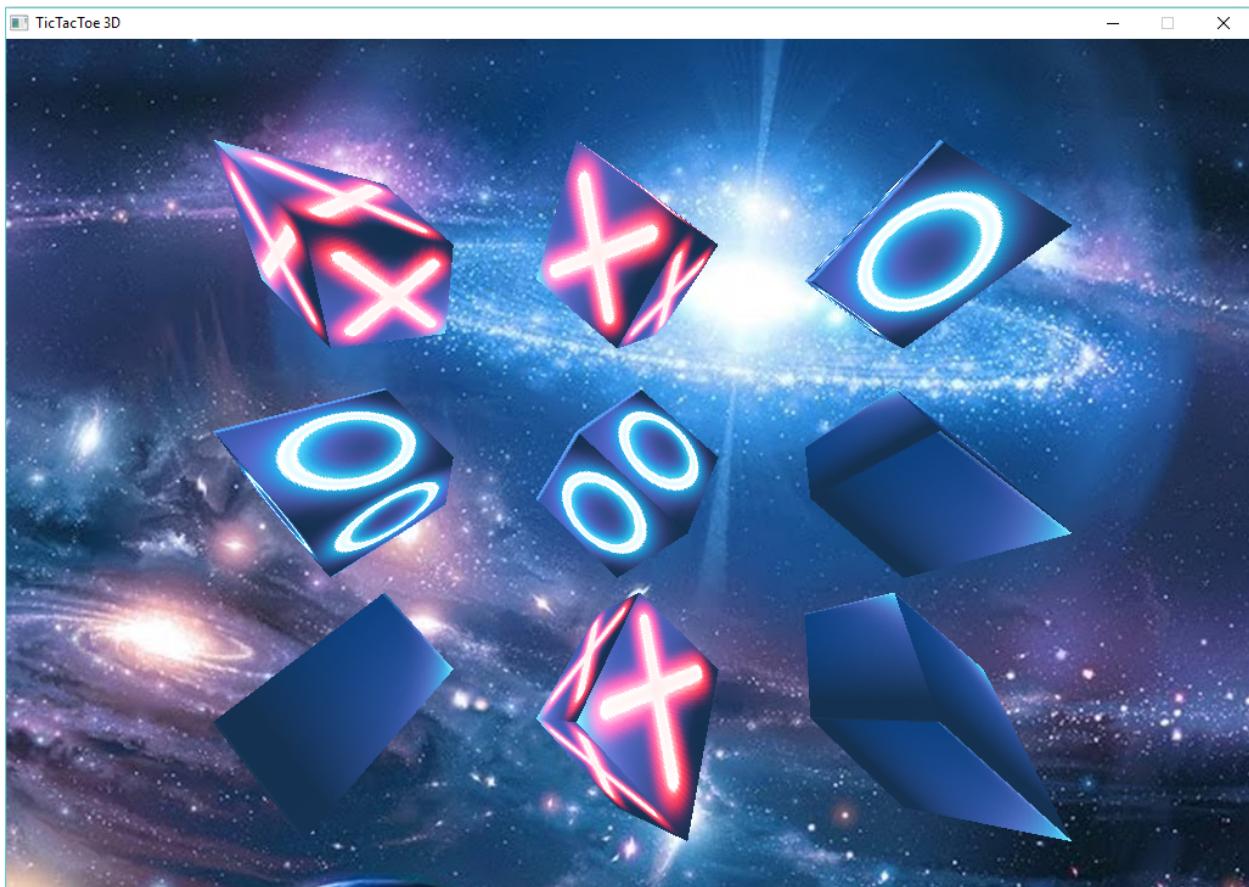
- Google API Shortener Application

Screen Shots:



- TicTacToe 3D Game

Screen Shot:



95.22 What is new in Ring 1.5.4?

- CalmoSoft Fifteen Puzzle Game 3D
- Ring Notepad - New Styles
- Ring Notepad - Better Toolbar Style
- Ring Notepad - View Modes
- Ring Notepad - QPlainTextEdit - don't set back color for the scroll bars
- Ring Notepad - Style Fusion (White) - use Silver color for comments
- Ring Notepad - Tab and Shift-Tab - Indent multiple lines
- Form Designer - Better Toolbar Style
- Form Designer - Nice backcolor for Window Flags and Menubar Designer
- Form Designer - Default back color for controls
- RingQt - Added grab() and windowHandle() methods to QWidget class
- RingQt - Added new methods to QPixmap Class
- **RingQt - Added Classes :-**
 - QScreen

- QWindow
- QGuiApplication
- QTextBrowser
- Code Generator for Extensions - None Option - Support Parent Class
- Ring VM - Internal Implementation - Pass state to Strings and Lists objects
- Ring VM - Garbage Collector - Memory Pool for Small Objects
- Ring VM - Better code for Saving/Restoring the State

WHAT IS NEW IN RING 1.6?

In this chapter we will learn about the changes and new features in Ring 1.6 release.

96.1 List of changes and new features

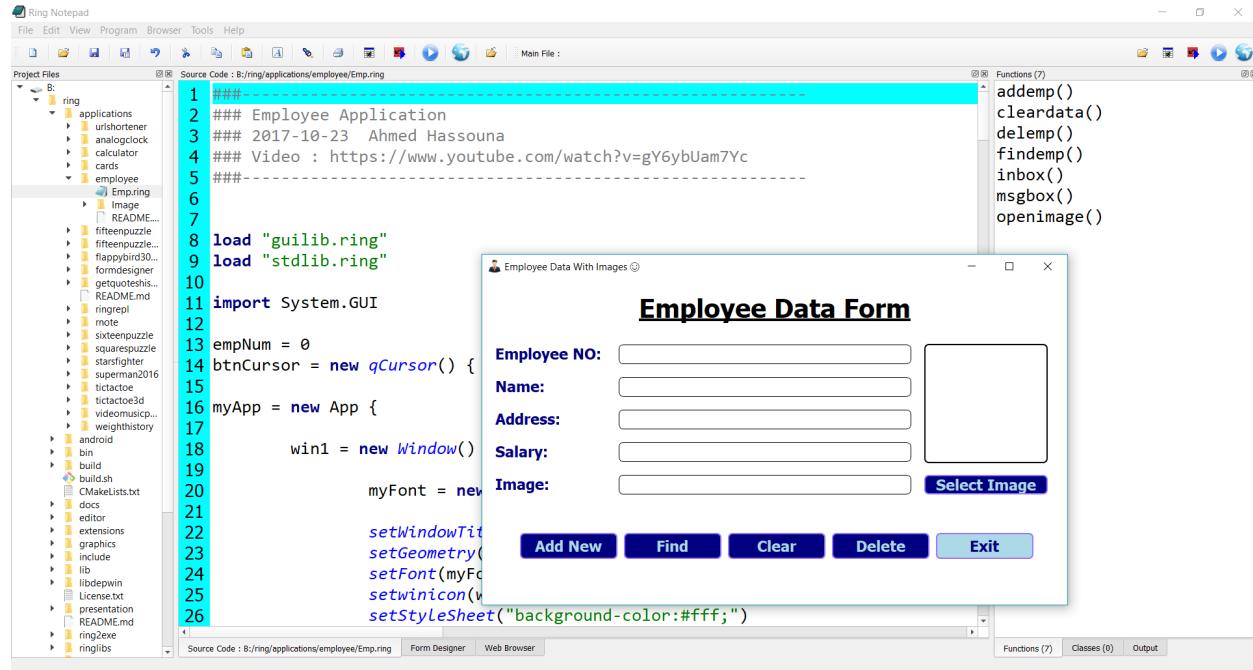
Ring 1.6 comes with many new features!

- Employee Application
- New Tool: Ring2EXE
- Better Ring For Android
- New Tool : Folder2qrc
- Better Scripts for building Ring
- RingConsoleColors Extension
- RingMurmurHash Extension
- Better Ring Notepad
- Better RingQt
- Better StdLib
- Better RingVM
- Better RingREPL
- Using Tab instead of char(9)
- Using CR as Carriage return
- Using the ! operator as not
- Using && and || operators
- Using ? to print expression then new line

96.2 Employee Application

The Employee application is added to ring/applications

Developer: Ahmed Hassouna



96.3 New Tool: Ring2EXE

In Ring 1.6 we have a nice tool called Ring2EXE (Written in Ring itself)

Using Ring2EXE we can distribute applications quickly for Windows, Linux, macOS and Mobile devices

Read the chapter “Distributing Ring Applications using Ring2EXE” for more information!

96.4 Better Ring For Android

Ring For Android (using RingQt) is updated to use the Ring Object File (*.ringo) instead of using many source code files (*.ring)

The next screen shot is an example of building the cards game for Android

We are using cards.ringo instead of cards.ring

If you have large project (many *.ring files) it will use only one *.ringo file.

The screenshot shows the Qt Creator IDE interface. The left sidebar contains icons for Welcome, Edit, Design, Debug, Projects, Analyze, and Help. The Projects section shows a tree view of the 'project [master]' directory, which includes 'project.pro', 'Headers', 'Sources', 'Resources' (containing 'project.qrc'), and a folder named '/' containing 'cards.jpg' and 'cards.ringo'. The main window has a tab bar with 'main.cpp' selected. The code editor displays the following C++ code:

```
67 }
68
69 int main(int argc, char *argv[])
70 {
71     QApplication a(argc,argv);
72
73     QString path ;
74     path = QStandardPaths::writableLocation(QStandardPaths::GenericDataLocation) ;
75     QDir::setCurrent(path);
76
77     // Delete the application files
78     ringapp_delete_file(path,"cards.ringo");
79
80     // Copy Ring Object File (cards.ringo) from Resources to Temp Folder
81     QString path2 ;
82     path2 = path+"/cards.ringo";
83     QFile::copy(":/cards.ringo",path2);
84
85     // Call Ring and run the Application
86     RingState *pRingState;
87     pRingState = ring_state_new();
88     ring_vm_funcregister("loadlib",ring_loadlib);
89     ring_vm_funcregister("ismobileqt",ring_ismobileqt);
90     ring_state_runobjectfile(pRingState,"cards.ringo");
91     ring_state_delete(pRingState);
92
93     return 0;
94
95 }
```

A blue box highlights the line 'QFile::copy(":/cards.ringo",path2);'. A blue arrow points from the bottom right towards this highlighted line.

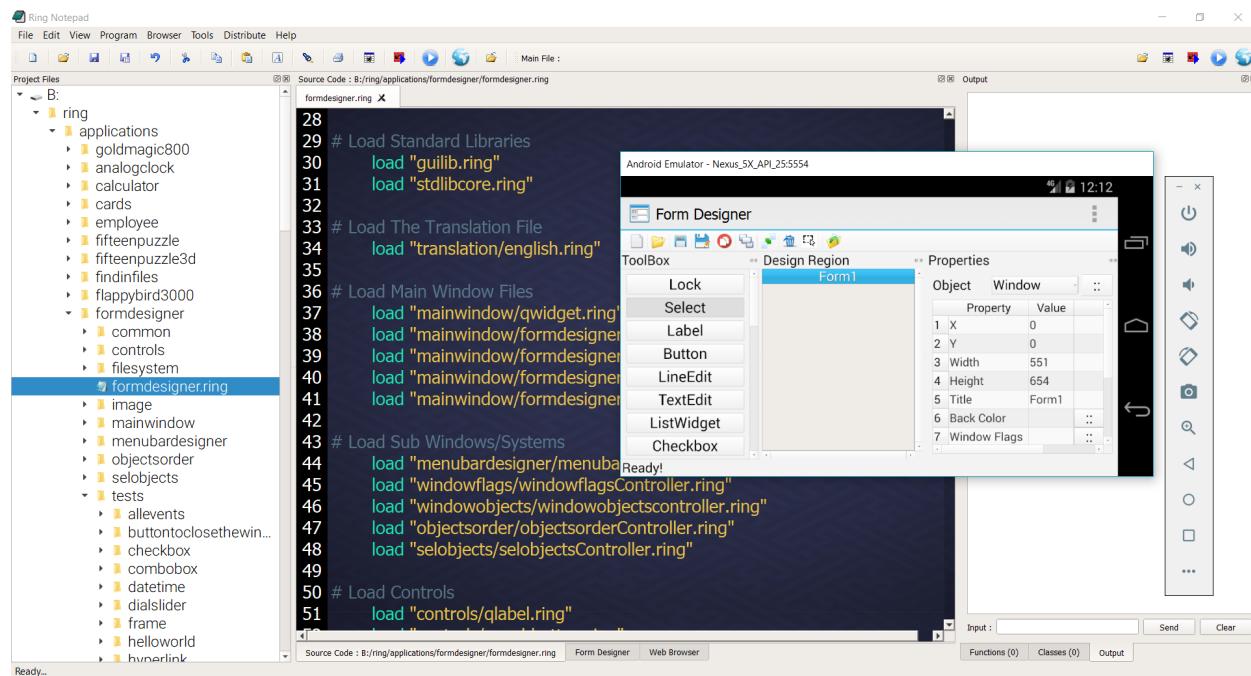
To prepare Qt project to distribute RingQt application for Mobile use Ring2EXE

Example

```
ring2exe cards.ring -dist -mobileqt
```

Example (2)

```
ring2exe formdesigner.ring -dist -mobileqt
```



96.5 New Tool: Folder2qrc

When we have large RingQt project that contains a lot of images and files, We need to add these files to the resource file (*.qrc) when distributing applications for Mobile devices.

Instead of adding these files one by one, Ring 1.6 comes with a simple tool that save our time, It's called Folder2qrc.

Example:

```
folder2qrc formdesigner.ring
```

We determine the main source file while we are in the application folder, and Folder2qrc will check all of the files in the current folder and sub folders, Then add them to the resource file after the mainfile.ringo (In our example this will be formdesigner.ringo)

The output file will be : project.qrc

You can open it and remove the files that you don't need in the resources!

96.6 Better Scripts for building Ring

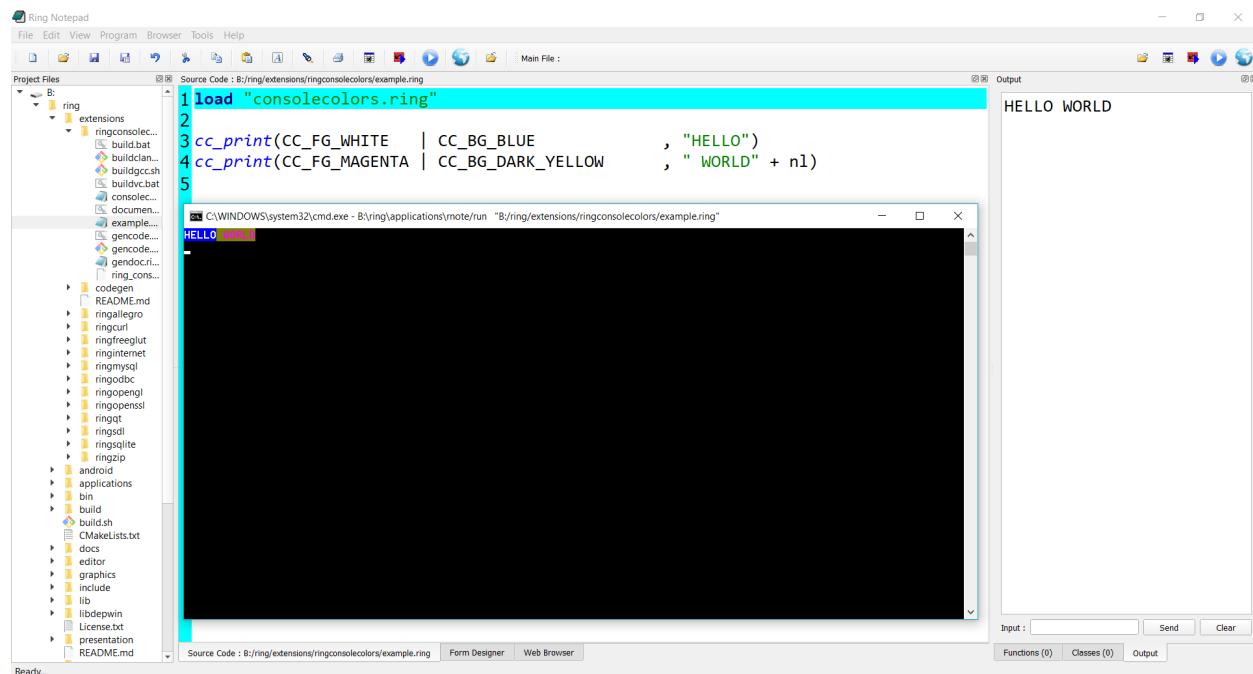
Ring 1.6 comes with better scripts for building Ring from source code.

The updates are tested on 32bit and 64bit systems on Windows, Linux (Ubuntu,Fedora) and macOS.

The scripts for Windows are updated to find the Visual C/C++ compiler based on your Visual Studio version.

96.7 RingConsoleColors Extension

Using the RingConsoleColors extension we can easily change the colors used in our console applications



For more information check the RingConsoleColors chapter in the documentation.

96.8 RingMurmurHash Extension

Ring 1.6 comes with the RingMurmurHash extension!

Developer: Hassan Ahmed

Example:

```
load "murmurhashlib.ring"

key = "Ring Language"

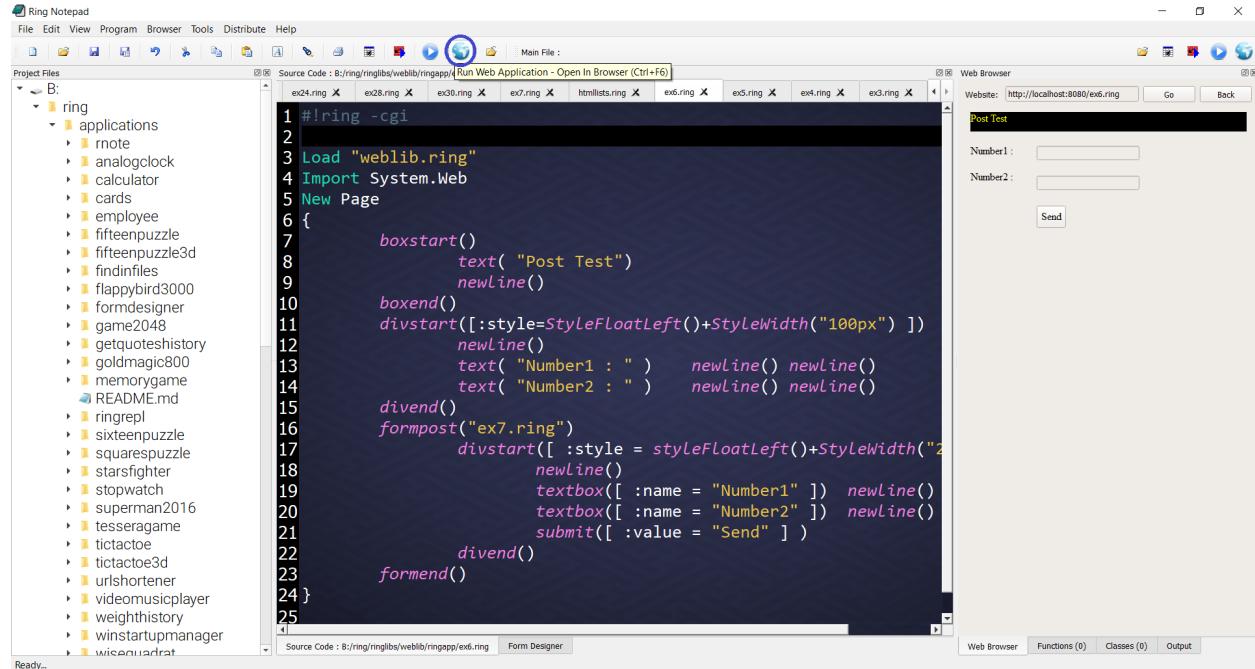
see murmurhash3_x86_32(key, 0, 0) + nl // Output: 1894444853
see murmurhash3_x86_32(key, 0, 1) + nl // Output: 70eaef35
```

For more information check the RingMurmurHash chapter in the documentation.

96.9 Better Ring Notepad

Ring Notepad comes with the next updates

- (1) Automatic setting for the Main File when we Run the application (using the Main file buttons).
- (2) Main File - Automatic save before running.
- (3) When we run GUI application - don't change the focus to the text box used for the input in the Output Window.
- (4) A button and option to run web applications



For Windows users, Ring 1.6 comes with Apache Web server!

We can run any web application from any folder directly without doing any configuration.

The screenshot shows the Ring Notepad interface. On the left, the source code for a Ring script named 'mytest.ring' is displayed:

```

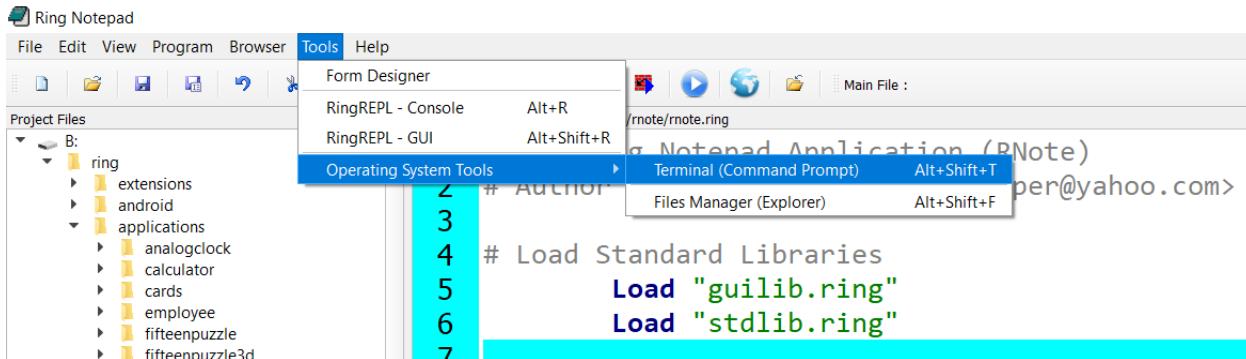
1 #!ring -cgi
2
3 Load "weblib.ring"
4
5 Import System.Web
6
7 func main
8     New Page
9     {
10         Text("Hello, World!") newline()
11         Text("Welcome to web development using Ring!")
12         newline()
13         for x = 1 to 5 {
14             TEXT("Number: " + x) newline()
15         }
16         text("Enjoy!")
17     }
18
19

```

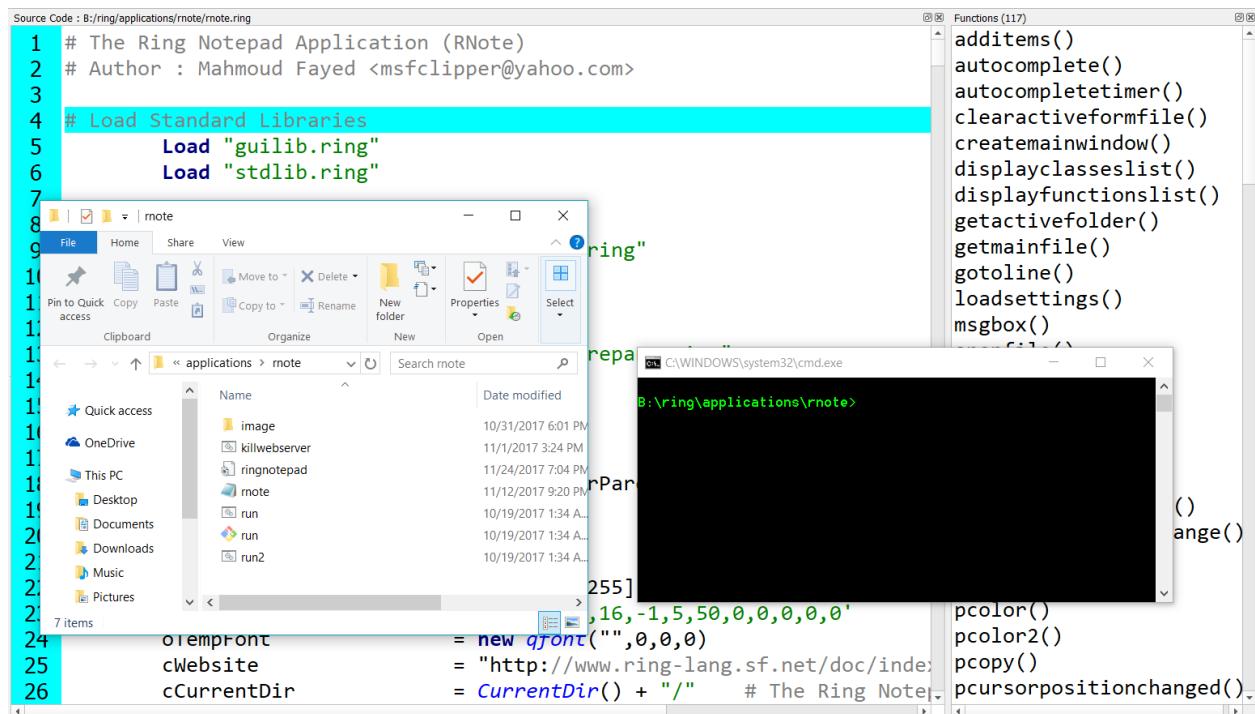
On the right, a browser window titled 'Test' is shown with the URL 'localhost:8080/mytest.ring'. The page content is:

Hello, World!
Welcome to web development using Ring!
Number: 1
Number: 2
Number: 3
Number: 4
Number: 5
Enjoy!

(5) Tools - Operating System - Terminal (Command Prompt) & Files Manager (Explorer).

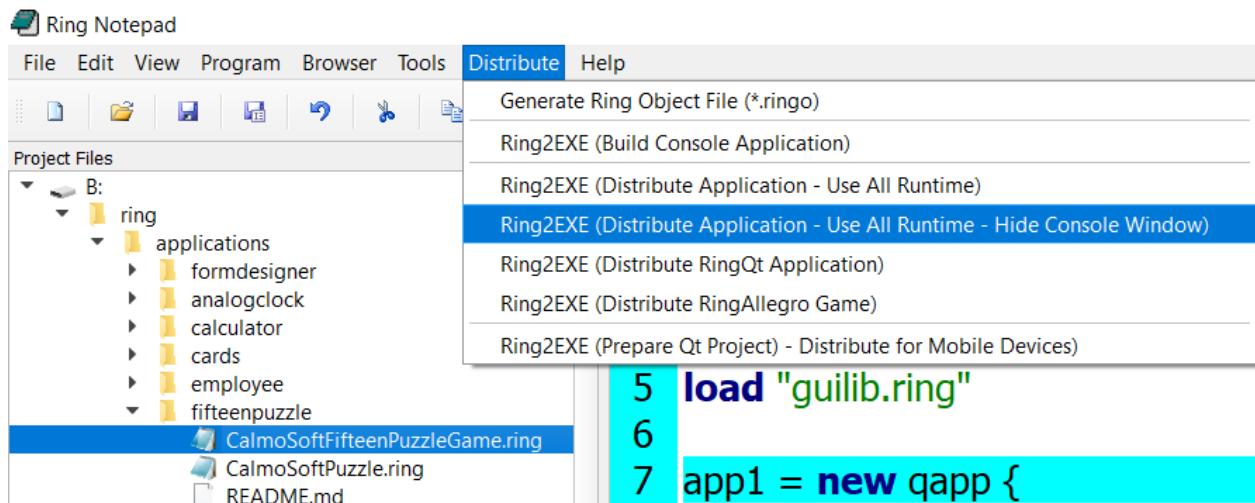


So we can quickly open the Command Prompt or the Explorer at the application folder.



- (6) Support *.sh & *.bat extensions.

- ## (7) New Menu: Distribute



96.10 Better RingQt

RingQt comes with the next updates

- (1) QAllEvents - getkeytext() Method
 - (2) QSqlQuery - exec_2() Method
 - (3) QDockWidget Events
 - (4) AppFile() Function

- (5) IsMobile() Function
- (6) QRegion Class
- (7) QCoreApplication class

96.11 Better StdLib

StdLib comes with the next updates

- (1) Factors() function is updated (Return the output instead of printing it)
- (2) Palindrome() function is updated (Return the output instead of printing it)
- (3) Using stdlibcore.ring we can use the StdLib functions (Without Classes)

Also this is useful when developing standalone console applications

Because using stdlib.ring (functions & classes) will load libraries like RingLibCurl, RingOpenSSL, etc.

(4) New Functions

- SystemSilent(cCommand) Function : Execute system commands without displaying the output.
- OSCreateOpenFolder(cFolder) : Create folder then change the current folder to this new folder
- OSCopyFolder(cParentFolder,cFolderNameToCopy) : Copy folder to the current directory
- OSDeleteFolder(cFolder) : Delete Folder
- OSCopyFile(cFileName) : Copy File to the current directory
- OSDeleteFile(cFileName) : Delete File
- OSRenameFile(cOldFileName,cNewFileName) : Rename file

96.12 Better RingVM

RingVM comes with the next updates

- (1) Support using many getter methods in Expressions
- (2) Support using this & self in setter/getter/normal methods without calling setter/getter methods.
- (3) TempName() function is updated (Better Code)
- (4) ExeFileName() function is updated (Better Code)
- (5) Private Attributes - Support re-usage in the class region (After the keyword private)
- (6) Ring API : ring_scanner_runobjstring()
- (7) ring_state_setvar() function

96.13 Better RingREPL

RingREPL comes with the next updates

- (1) RingREPL will get command line parameters to determine the style.
- (2) Setting RingREPL Style based on Ring Notepad Style.

96.14 Using Tab instead of char(9)

The variable Tab is defined to be used instead of char(9)

Example (1):

```
see :one + nl + tab + :two + nl + tab + tab + :three
```

Output:

```
one
    two
        three
```

You can change the variable to another value

Example (2):

```
tab = " "
see :one + nl + tab + :two + nl + tab + tab + :three
```

Output:

```
one
    two
        three
```

96.15 Using CR as Carriage return

The next example count from 1 to 10 in the same line during 10 seconds

```
load "stdlibcore.ring"
for x = 1 to 10 see x sleep(1) see cr next
```

96.16 Using the ! operator as not

We have = and != in the Ring language

But for the logical operators we have and, or & not

Now we can use the ! operator as not

Example:

```
if ! false
    see "True!" + nl
ok
```

Output

```
True!
```

96.17 Using && and || operators

In Ring we have the next keywords for the logical operations

- and
- or
- not

Now we have also the next operators

- &&
- ||
- !

Example:

```
if one() and two()
    see "Test1 - Fail" + nl
else
    see "Test1 - Pass" + nl
ok

if two() or one()
    see "Test2 - Pass" + nl
else
    see "Test2 - Fail" + nl
ok

if one() && two()
    see "Test3 - Fail" + nl
else
    see "Test3 - Pass" + nl
ok

if two() || one()
    see "Test4 - Pass" + nl
else
    see "Test4 - Fail" + nl
ok

func one return True
func two return False
```

Output:

```
Test1 - Pass
Test2 - Pass
Test3 - Pass
Test4 - Pass
```

96.18 Using ? to print expression then new line

It's common to print new line after printing an expression, We can use the ? operator to do that!

Example:

```
? "Hello, World!"
for x = 1 to 10
    ? x
next
```

Output:

```
Hello, World!
1
2
3
4
5
6
7
8
9
10
```

WHAT IS NEW IN RING 1.7?

In this chapter we will learn about the changes and new features in Ring 1.7 release.

97.1 List of changes and new features

Ring 1.7 comes with many new features!

- New Command: Load Package
- ringvm_see() and ringvm_give() functions
- ring_state_new() and ring_state_mainfile() functions
- Better Trace Library
- Better Ring Notepad
- Better RingQt
- Better Ring2EXE
- Better RingZip
- Better Documentation
- Better Ring VM
- RingLibuv Extension

97.2 New Command: Load Package

Using the ‘load’ command we can use many ring source files in the same project

But all of these files will share the same global scope

Now we have the “Load Package” command too

Using “Load Package” we can load a library (*.ring file) in new global scope

This is very useful to create libraries that avoid conflicts in global variables

Example:

File: loadpackage.ring

```
x = 100
? "Hello, World!"
load package "testloadpackage.ring"

? x
test()
```

File: testloadpackage.ring

```
? "Hello from testloadpackage.ring"

x = 1000

test()

func test
    ? x
```

Output:

```
Hello, World!
Hello from testloadpackage.ring
1000
100
1000
```

97.3 ringvm_see() and ringvm_give() functions

Using the ringvm_see() function we can redefine the behavior of the See command

Also we can use ring_see() to have the original behavior

Example:

```
see "Hello world" + nl
see 123 + nl
see ["one", "two", "three"]
see new point {x=10 y=20 z=30}

func ringvm_see t
    ring_see("We want to print: ")
    ring_See(t)

class point x y z
```

Output:

```
We want to print: Hello world
We want to print: 123
We want to print: one
two
three
We want to print: x: 10.000000
y: 20.000000
z: 30.000000
```

Using the ringvm_give() function we can redefine the behavior of the Give command

Also we can use ring_give() to have the original behavior

Example:

```
see "Name: " give name
see "Hello " + name

func ringvm_give
    see "Mahmoud" + nl
    return "Mahmoud"
```

Output:

```
Name: Mahmoud
Hello Mahmoud
```

97.4 ring_state_new() and ring_state_mainfile() functions

Using ring_state_new() and ring_state_mainfile() we can run Ring programs from Ring programs

But unlike ring_state_main(), Here we can control when to delete the Ring state!

This is important when we run GUI programs from GUI programs

Because they will share the GUI Library (RingQt), And In this case the caller will call

qApp.Exec()

So the sub program, will not stop and will return to the Main program

Here deleting the State of the sub programs will lead to a problem when we run the sub program events

So keeping the state is important for sub GUI programs hosted in GUI programs.

97.5 Better Trace Library

The Trace library is updated, In the Debugger at break points we have now the “callstack” command

This command will print the functions call stack.

Example:

```
load "tracelib.ring"

func main
    ? "Hello from main!"
    test1()

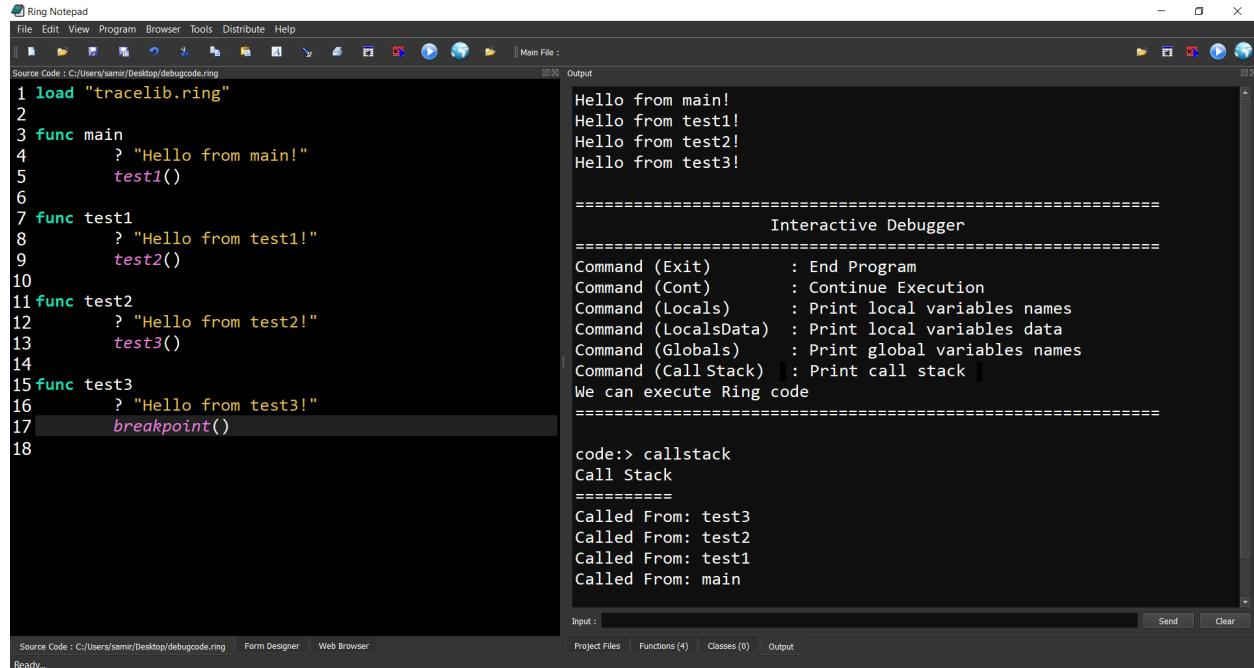
func test1
    ? "Hello from test1!"
    test2()

func test2
    ? "Hello from test2!"
    test3()
```

(continues on next page)

(continued from previous page)

```
func test3
    ? "Hello from test3!"
    breakpoint()
```



97.6 Better Ring Notepad

Ring Notepad comes with the next updates

- (1) Support *.cf extension
- (2) Using Hash function (SHA256) for better “Save Changes?” message
- (3) Ring Notepad - X Button - Ask for saving changes?

97.7 Better RingQt

The next classes are added to RingQt

- (1) QStackedWidget
- (2) QCalendarWidget
- (3) QOpenGLFunctions
- (4) QOpenGLContext
- (5) QSurfaceFormat
- (6) QOpenGLWidget
- (7) QOpenGLVersionProfile

-
- (8) QOpenGLFunctions_3_2_Core
 - (9) QVector2D
 - (10) QVector3D
 - (11) QVector4D
 - (12) QQuaternion
 - (13) QMatrix4x4
 - (14) QOpenGLPaintDevice
 - (15) QPaintDevice
 - (16) QOpenGLTimerQuery
 - (17) QOpenGLDebugLogger
 - (18) QOpenGLFramebufferObject
 - (19) QOpenGLVertexArrayObject
 - (20) QOpenGLBuffer
 - (21) QOpenGLShaderProgram
 - (22) QOpenGLShader
 - (23) QOpenGLTexture

97.8 Better Ring2EXE

Ring2EXE is updated to works as expected when we don't have a C/C++ compiler
Where we can distribute applications and get (exe file and ringo file) in this case.

97.9 Better RingZip

The library is updated to support extracting files contains sub folders!

97.10 Better Documentation

- (1) RingQt Classes Chapter - The classes are sorted.

97.11 Better Ring VM

- (1) Better Error Message
- (2) List2Str() function support lists contains numbers
- (3) Correct support for numbers contains _ as separator
- (4) Creating lists without variables (statement -> Expression -> List)
- (5) IsNULL() - Not case sensitive - treat Null and null like NULL

- (6) Support adding the Self object to an attribute in this object
- (7) Using ‘:’ operator then keyword will create lower case literal
- (8) Printing objects - respect decimals() function
- (9) When literal is not closed - determine the start of the literal
- (10) Better message when printing objects contains lists
- (11) VarPtr() - Support getting a pointer to variables in the local scope
- (12) replace performance instructions with normal instructions when creating new threads

97.12 RingLibuv Extension

Ring 1.7 comes with the RingLibuv extension

Libuv is a multi-platform support library with a focus on asynchronous I/O.

Example (Events Loop):

```
load "libuv.ring"

counter = 0
idler = NULL

func main
    idler = new_uv_idle_t()
    uv_idle_init(uv_default_loop(), idler)
    uv_idle_start(idler, "wait()")
    ? "Idling..."
    uv_run(uv_default_loop(), UV_RUN_DEFAULT);
    uv_loop_close(uv_default_loop());
    destroy_uv_idle_t(idler)

func wait
    counter++
    if counter >= 100000
        uv_idle_stop(idler)
    ok
```

Output:

```
Idling...
```

Example (Server):

```
load "libuv.ring"
load "objectslib.ring"

? "Testing RingLibuv - Server Side - Using Classes"

open_object(:MyServer)

class MyServer from ObjectControllerParent

    DEFAULT_PORT      = 13370
    DEFAULT_BACKLOG  = 1024
```

(continues on next page)

(continued from previous page)

```

addr      = new_sockaddr_in()
server   = NULL
client   = NULL
myloop   = NULL

func start
    myloop = uv_default_loop()
    server = new_uv_tcp_t()
    uv_tcp_init(myloop, server)
    uv_ip4_addr("127.0.0.1", DEFAULT_PORT, addr)
    uv_tcp_bind(server, addr, 0)
    r = uv_listen(server, DEFAULT_BACKLOG, Method(:newconnection) )
    if r
        ? "Listen error " + uv_strerror(r)
        return 1
    ok
    uv_run(myloop, UV_RUN_DEFAULT)
    destroy_uv_tcp_t(server)
    destroy_uv_sockaddr_in(addr)

func newconnection
    ? "New Connection"
    aPara   = uv_Eventpara(server,:connect)
    nStatus = aPara[2]
    if nStatus < 0
        ? "New connection error : " + nStatus
        return
    ok
    client = new_uv_tcp_t()
    uv_tcp_init(myloop, client)
    if uv_accept(server, client) = 0
        uv_read_start(client, uv_myalloccallback(),
                      Method(:echo_read))
    ok

func echo_read
    aPara = uv_Eventpara(client,:read)
    nRead = aPara[2]
    buf   = aPara[3]
    if nRead > 0
        req = new_uv_write_t()
        wrbuf = uv_buf_init(get_uv_buf_t_base(buf), nread)
        uv_write(req, client, wrbuf, 1, Method(:echo_write))
        ? uv_buf2str(wrbuf)
        message = "message from the server to the client"
        buf = new_uv_buf_t()
        set_uv_buf_t_len(buf, len(message))
        set_uv_buf_t_base(buf, varptr("message","char *"))
        uv_write(req, client, buf, 1, Method(:echo_write))
    ok

func echo_write
    aPara = uv_Eventpara(client,:read)
    req   = aPara[1]

```

Output:

When we run the client, We will see the message “New Connection”

Then the message “hello from the client”

```
Testing RingLibuv - Server Side - Using Classes
New Connection
hello from the client
```

Example (Using Threads):

```
load "libuv.ring"
load "objectslib.ring"

? "Testing RingLibuv - Threads - Using Classes"

open_object (:MyThreads)

class MyThreads from ObjectControllerParent

    func Start
        one_id = new_uv_thread_t()
        two_id = new_uv_thread_t()
        uv_thread_create(one_id, Method(:One))
        uv_thread_create(two_id, Method(:Two))
        uv_thread_join(one_id)
        uv_thread_join(two_id)
        destroy_uv_thread_t(one_id)
        destroy_uv_thread_t(two_id)

    func one
        ? "Message from the First Thread!"

    func Two
        ? "Message from the Second Thread!"
```

Output:

```
Testing RingLibuv - Threads - Using Classes
Message from the First Thread!
Message from the Second Thread!
```

For more information about this extension (RingLibuv) check the chapter: Using RingLibuv

CHAPTER
NINETYEIGHT

WHAT IS NEW IN RING 1.8?

In this chapter we will learn about the changes and new features in Ring 1.8 release.

98.1 List of changes and new features

Ring 1.8 comes with the next features!

- Better Performance
- Find in files Application
- String2Constant Application
- StopWatch Application
- More 3D Samples
- Compiling on Manjaro Linux
- Using This in the class region as Self
- Default value for object attributes is NULL
- The For Loops uses the local scope
- Merge binary characters
- FoxRing Library
- Better Form Designer
- Better Cards Game
- Better RingQt
- Better Code Generator For Extensions
- Better Ring Compiler and VM
- Notes to extensions creators

98.2 Better Performance

Ring 1.8 is faster than Ring 1.7

The performance gain is between 10% and 100% based on the application.

Check the 3D samples in this release to get an idea about the current performance.

For more information check the Performance Tips chapter.

98.3 Find in files Application

Ring 1.8 comes with Find in files application

	File	Line	Text
1	B:\ring\applications\findinfiles\findinfilesController.ring	1	# Application : Find in files
2	B:\ring\applications\findinfiles\findinfilesController.ring	5	load "findinfilesView.ring"
3	B:\ring\applications\findinfiles\findinfilesController.ring	11	open_window(:findinfilesController)
4	B:\ring\applications\findinfiles\findinfilesController.ring	16	class findinfilesController from WindowsControllerParent
5	B:\ring\applications\findinfiles\findinfilesController.ring	18	oView = new findinfilesView
6	B:\ring\applications\findinfiles\findinfilesController.ring	32	cText = txtFind.text()
7	B:\ring\applications\findinfiles\findinfilesController.ring	121	parent().FindInFilesSelect(cFile,nRow)
8	B:\ring\applications\findinfiles\findinfilesView.ring	14	new findinfilesView { win.show() }
9	B:\ring\applications\findinfiles\findinfilesView.ring	19	class findinfilesView from WindowsViewParent
10	B:\ring\applications\findinfiles\findinfilesView.ring	23	setWindowTitle("Find in files")
11	B:\ring\applications\findinfiles\findinfilesView.ring	27	lblfind = new label(win) {
12	B:\ring\applications\findinfiles\findinfilesView.ring	35	setText("Find")
13	B:\ring\applications\findinfiles\findinfilesView.ring	49	txtFind = new lineedit(win) {

Output

17 matches across 2 files

Close

98.4 String2Constant Application

Ring 1.8 comes with String2Constant application

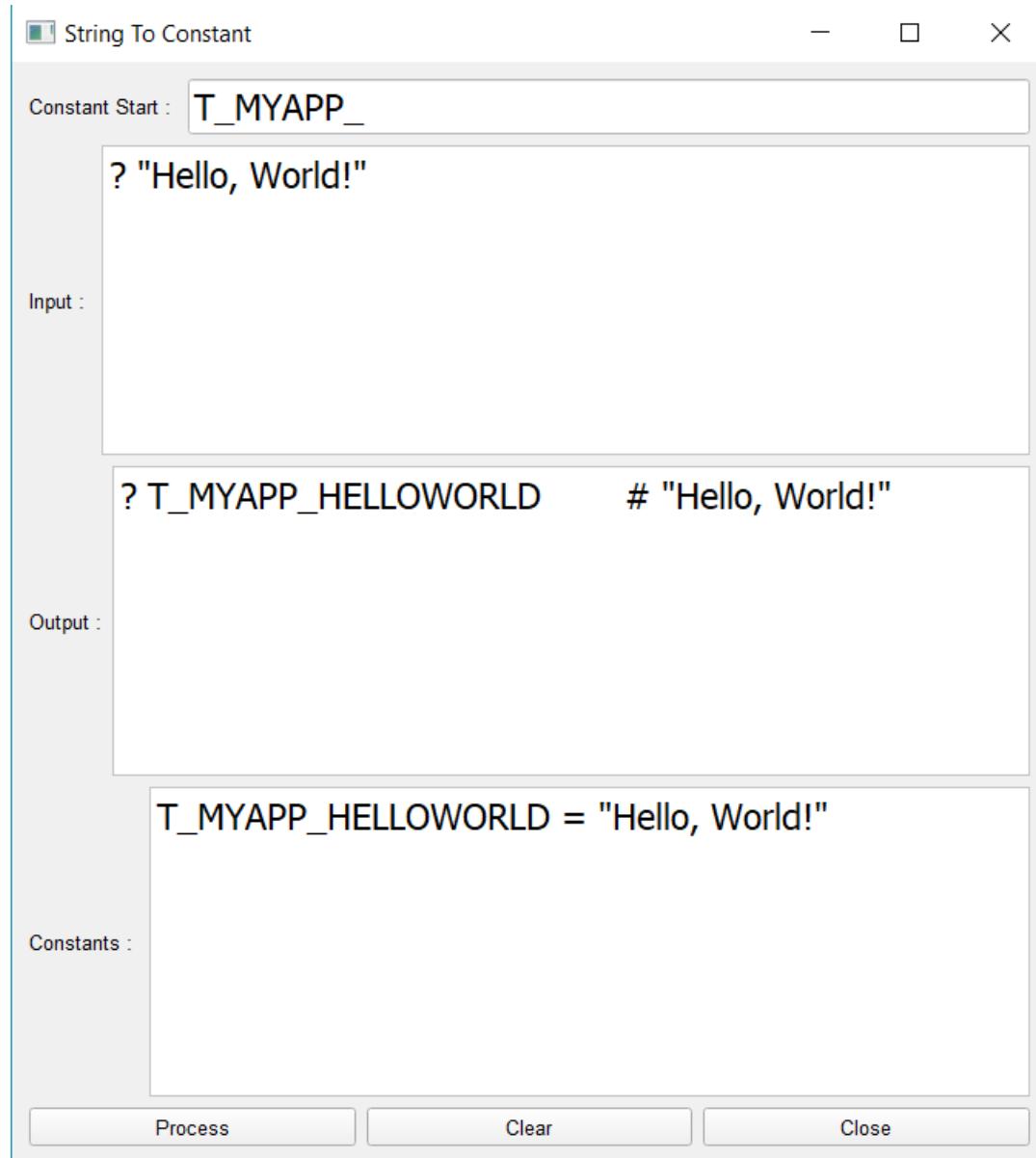
Using this tool we can convert the source code to be based on constants instead of string literals

Then we can store constants in separate source code files that we can translate to different languages

Where we can have special file for each language, like (English.ring, Arabic.ring and so on)

Using this simple tool, the Form Designer is translated to the Arabic language.

For more information check the Multi-language Applications chapter.



98.5 StopWatch Application

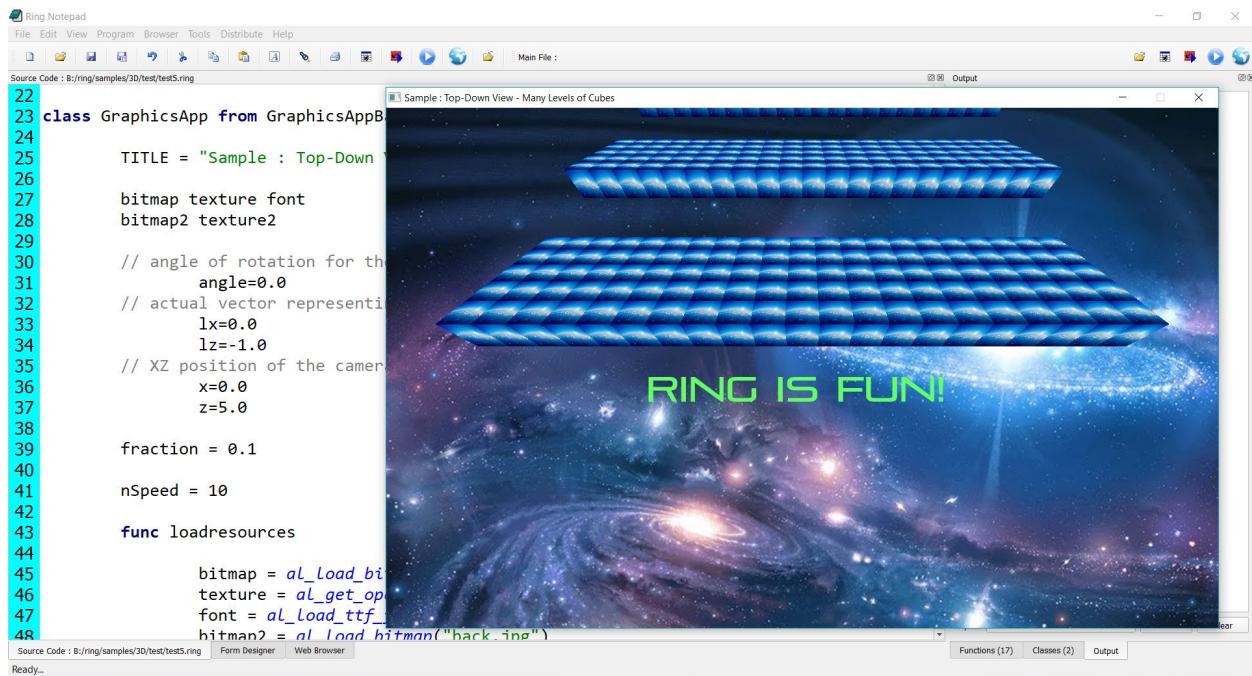
Ring 1.8 comes with StopWatch application



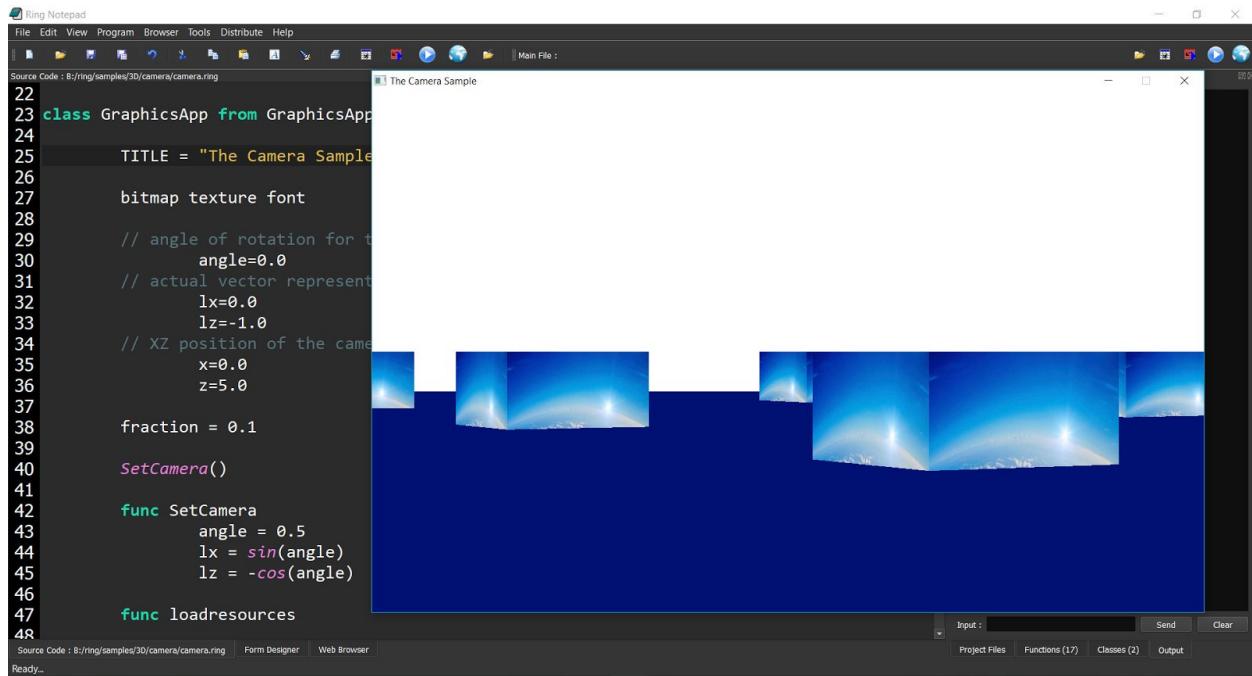
98.6 More 3D Samples

Ring 1.8 comes with more 3D Samples

The next screen shot for the Top-Down view - Many levels of cubes sample

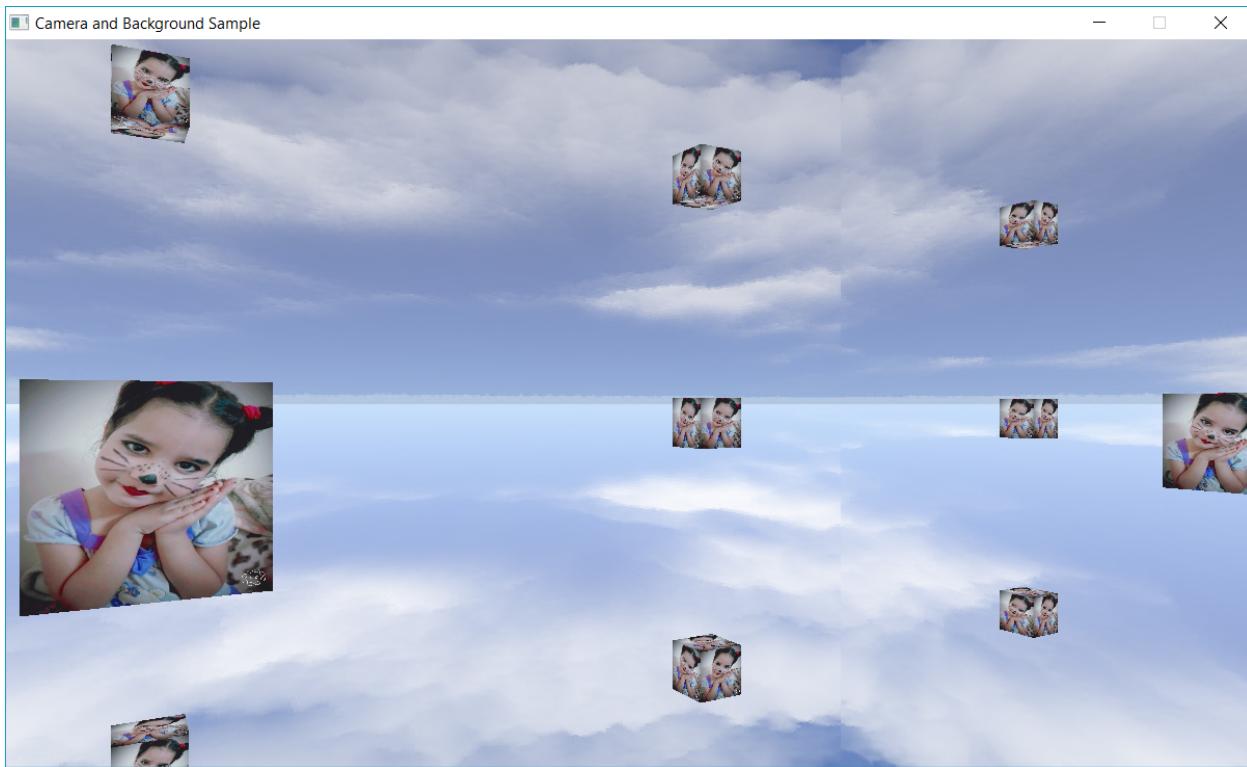


The next screen shot for the Camera Sample



The next screen shot for the Camera and background sample

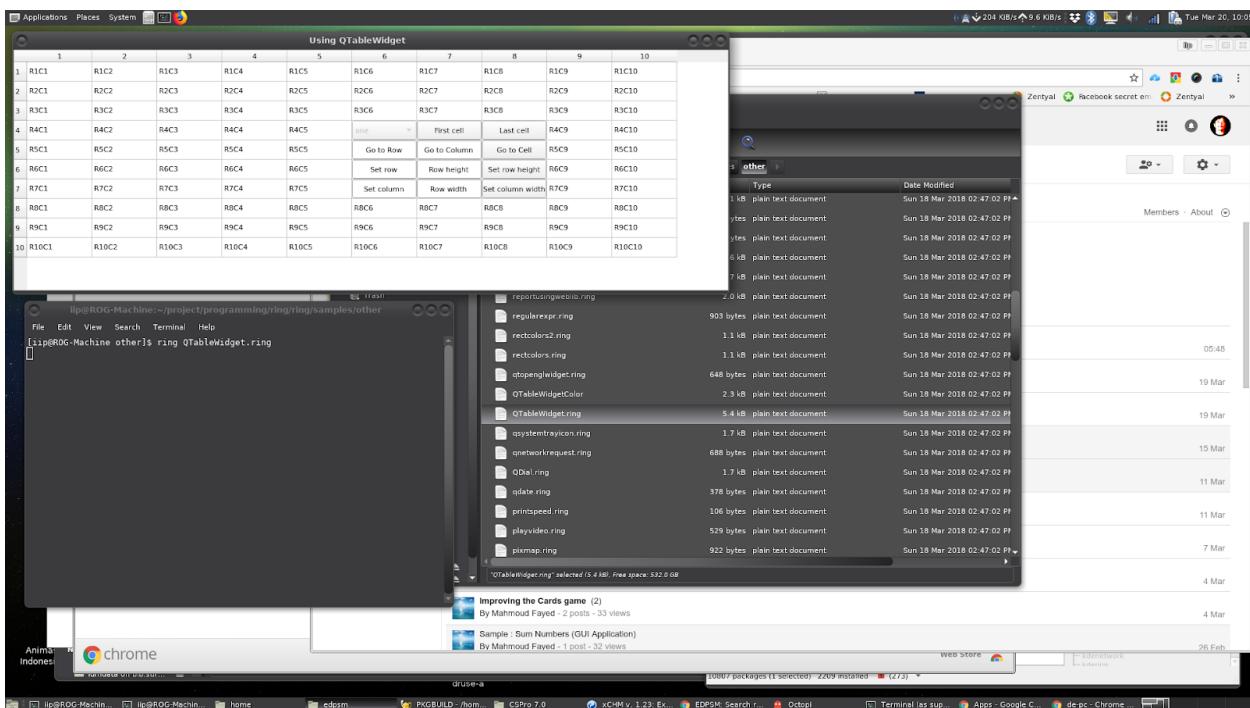
Developer : Azzeddine Remmal



98.7 Compiling on Manjaro Linux

Ring 1.8 is tested on Manjaro Linux too

Tests by : Iip Rifai



98.8 Using This in the class region as Self

The class region is the region that comes after the class name and before any method.

Now we can use This in the class region as Self.

Example:

```
func main

    o1 = new program {
        test()
    }

    ? o1

class program

    this.name = "My Application"
    this.version = "1.0"
    ? name ? version

    func test
        ? "Name      = " + name
        ? "Version = " + version
```

Output

```
My Application
1.0
Name      = My Application
Version = 1.0
name: My Application
version: 1.0
```

Note: When we use braces to change the current active object, Using This we can still point to the class.

Tip: The difference between This and Self is that Self point to the current active object that we can change using braces.

Remember that in most cases we don't need to use This or Self in the class region

We can write

```
class program name version
```

Or

```
class program name="My Application" version="1.0"
```

Note: We use This or Self in the class region just to avoid conflict with global variables that are defined with the same name.

98.9 Default value for object attributes is NULL

Starting from Ring 1.8 the default value for object attributes is NULL

In Ring, the NULL value is just an empty string or a string that contains “NULL”

We can check for NULL values using the isNULL() function

Example:

```
oProgram = new Program
? oProgram.name
? oProgram.version
? isNULL(oProgram.name)
? isNULL(oProgram.version)
oProgram { name="My Application" version="1.0" }
? isNULL(oProgram.name)
? isNULL(oProgram.version)
? oProgram

class program
    name
    version
```

Output:

```
NULL
NULL
1
1
0
0
name: My Application
version: 1.0
```

In previous versions of Ring, trying to access the object attribute before assigning a value to it

Will lead to runtime error and you can't check it using isnull()

The only way was assigning a value or using try/catch/end

We changed this behavior so we can have full control in seamless way.

98.10 The For Loops uses the local scope

In Ring 1.8, when the For Loop defines new identifier (variable) it will define it in the local scope.

Example:

```
x = 10
? x          # Print 10
test1()
? x          # Print 10
test2()
? x          # Print 10

func test1
```

(continues on next page)

(continued from previous page)

```

for x = 1 to 5
next
? x      # Print 6

func test2
    list = 1:5
    for x in list
    next
    ? x      # Print NULL (The "For In" loop will kill the reference after the
→loop)

```

Output:

```

10
6
10
NULL
10

```

98.11 Merge binary characters

From Ring 1.0 we can create binary strings and do operations on these strings.

Now in Ring 1.8, we can get individual characters from these strings and merge them together using the '+' operator.

Example:

```

cStr = "Welcome"
? cstr[1] + cstr[2] + cStr[5]
v = cstr[1] + cstr[2] + cStr[5]
? v
? len(v)
c1 = cStr[1]
? c1
aList = [1,2,3]
cStr = ""
for item in aList
    cStr += int2bytes(item)
next
? "All String"
? len(cStr)
? "First Part"
n1 = cStr[1] + cStr[2] + cStr[3] + cStr[4]
? len(n1)
? "Second Part"
n2 = cStr[5] + cStr[6] + cStr[7] + cStr[8]
? len(n2)
? "Third Part"
n3 = cStr[9] + cStr[10] + cStr[11] + cStr[12]
? len(n3)
? "All String"
cString = cStr[1] + cStr[2] + cStr[3] + cStr[4] +
    cStr[5] + cStr[6] + cStr[7] + cStr[8] +
    cStr[9] + cStr[10] + cStr[11] + cStr[12]
? len(cString)

```

(continues on next page)

(continued from previous page)

```
? ascii(cStr[1])
? len(cStr[2])
```

Output:

```
Weo
Weo
3
W
All String
12
First Part
4
Second Part
4      }
Third Part
4
All String
12
1
1
```

98.12 FoxRing Library

Developer: Jose Rosado

A class with some of the functions I used in FoxPro

Example:

```
Load "foxring.ring"

mf = new frFunctions
? mf.frAbs(-45)
? mf.frAbs(10-30)
? mf.frAbs(30-10)

? mf.frTransform("    Ring is a good language    ",
                 "@! !!!!!!!!!!!!!!!!!!!!!!!")
? mf.frAllTrim("    Ring is a good language    ", Null)
```

Output:

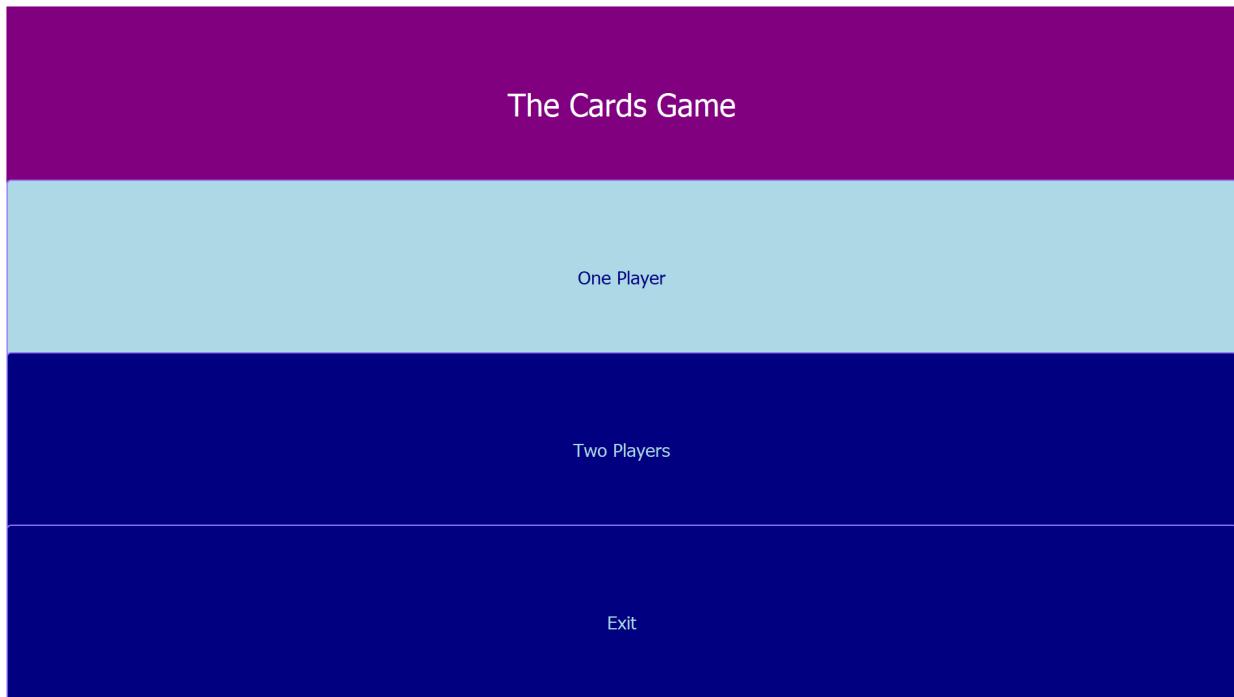
```
45
20
20
      RING IS A GOOD LANGUAGE
Ring is a good language
```

98.13 Better Form Designer

- (1) Layout Control - Display the control name when loading forms.
- (2) Button Control - Display the button images written using relative path.
- (3) Table Control - Display the control name when loading forms.
- (4) Better behavior in “Bring to front” and “Send to back” operations.
- (5) New buttons are added to the toolbar (Duplicate, Bring to front, Send to back, Delete).
- (6) Using layouts in (Menubar designer, Window Flags window, Selecting Objects window).
- (7) Better behavior for displaying the properties window when changing the selected objects.
- (8) New buttons are added to move and resize multiple selection of objects.
- (9) Window Properties - Add button to select the layout.
- (10) Opening forms and switching between files is faster.
- (11) Objects Order window.
- (12) Select Objects window.
- (13) When we change the control name, the name will be updated in layout objects.

98.14 Better Cards Game

The Cards game is updated and we can play with the Computer



98.15 Better RingQt

- The next classes are added to RingQt
 - (1) QTabBar
 - (2) QFile
 - (3) QFileDevice
 - (4) QStandardPaths
 - (5) QDir
 - (6) QQuickWidget
 - (7) QQmlError
 - (8) QScrollBar
- RingQt for Android is updated to support modern versions of Qt

Tested using

- (1) Qt 5.5.1
 - (2) Qt 5.9.5
 - (3) Qt 5.11.0
- In RingQt for Android, The Ring Object File (ringo) will be executed directly from resources.

98.16 Better Code Generator For Extensions

New Option: StaticMethods

Starting from Ring 1.8 the code generator support the staticmethods option.

So the code generator can know that the class doesn't need an object to call the methods.

Example:

```
<class>
name: QStandardPaths
para: void
nonew
staticmethods
</class>

QString displayName(QStandardPaths::StandardLocation type)
QString findExecutable(QString executableName, QStringList paths))
```

98.17 Better Ring Compiler and VM

- (1) Better loading for files in relative paths
- (2) Code Optimization for eval() function
- (3) Better Memory Pool
- (4) When embedding Ring in Ring, the error in the hosted environment will not close the host

Example:

```
? "Start the test!"

pState = ring_state_init()

ring_state_runcode(pState, " ? 'Let us try having an error' ? x")

ring_state_delete(pState)

? ""
? "End of test!"
```

Output:

```
Start the test!
Let us try having an error

Line 1 Error (R24) : Using uninitialized variable : x
in file Ring_EMBEDDEDCode
End of test!
```

- (5) The compiler will ignore new lines after keywords that expect tokens after it

Example:

```
see
"
    Hello, World!
"
test()

func
#=====
    Test
#=====

?

"
Hello from the Test function
"
```

Output:

```
Hello, World!
```

(continues on next page)

(continued from previous page)

Hello from the Test function

- (6) Better code (faster) for the main loop, special loop for eval() function.
- (7) Better code (faster) for tracking C pointers to avoid using NULL pointers.
- (8) Better code (faster) for getting the self object using braces.

98.18 Notes to extensions creators

If you have created new extensions for Ring in the C/C++ languages.

You have to rebuild your extension (Generate the DLL file again using Ring 1.8 header files) before usage with Ring 1.8

Because we changed the internal structure of the VM, but no changes to the code are required. just rebuild.

WHAT IS NEW IN RING 1.9?

In this chapter we will learn about the changes and new features in Ring 1.9 release.

99.1 List of changes and new features

Ring 1.9 comes with the next features!

- New Game : Gold Magic 800
- More Games
- Better Ring Notepad
- Better StdLib
- BigNumber Library
- RingPostgreSQL Extension
- Deploying Web applications in the Cloud
- Better RingQt
- Better Memory Management
- Better Code Generator for Extensions
- More Improvements

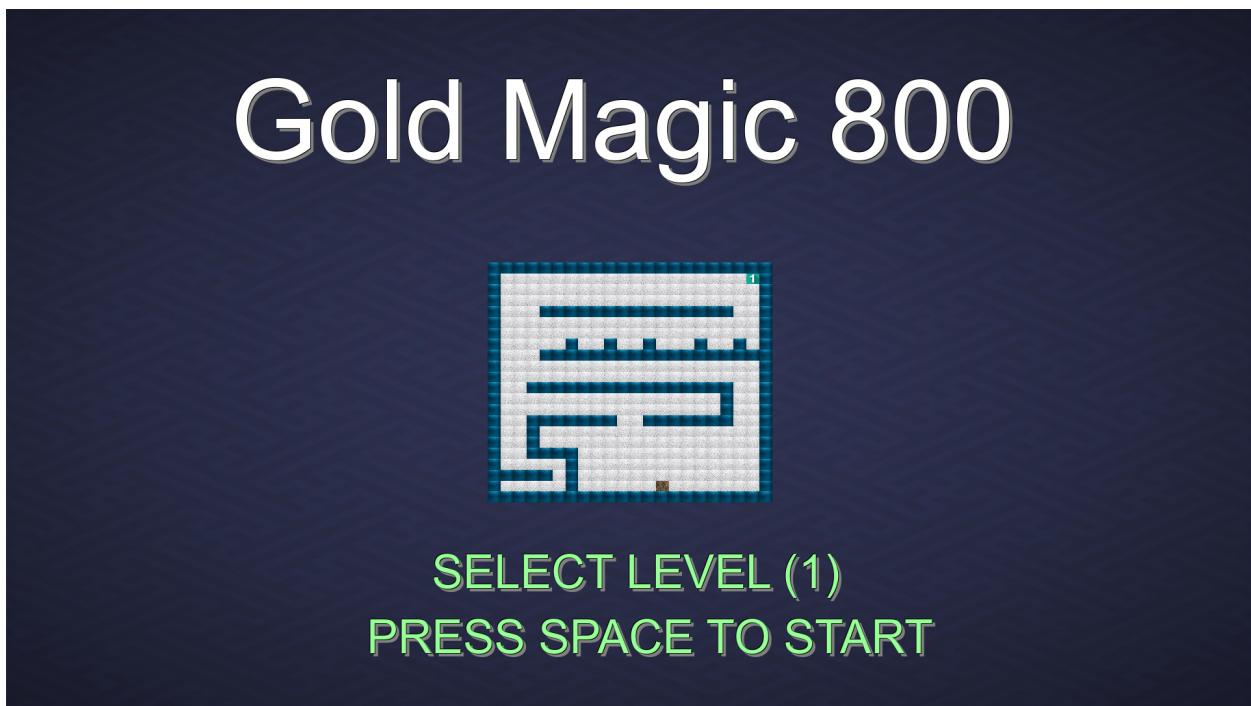
99.2 New Game : Gold Magic 800

The Gold Magic 800 is a new puzzle game.

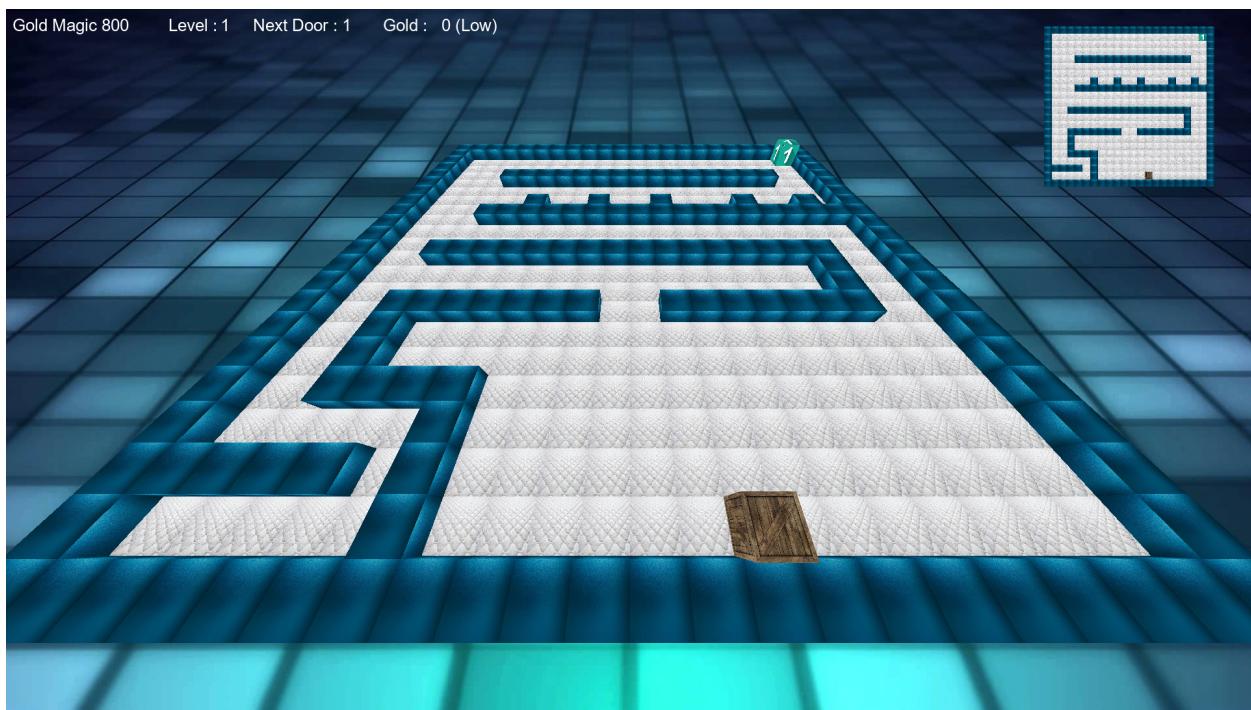
Ring 1.9 comes with the Demo Version (18 Levels) and the game source code.

Steam Page (44 Levels) : https://store.steampowered.com/app/939200/Gold_Magic_800/

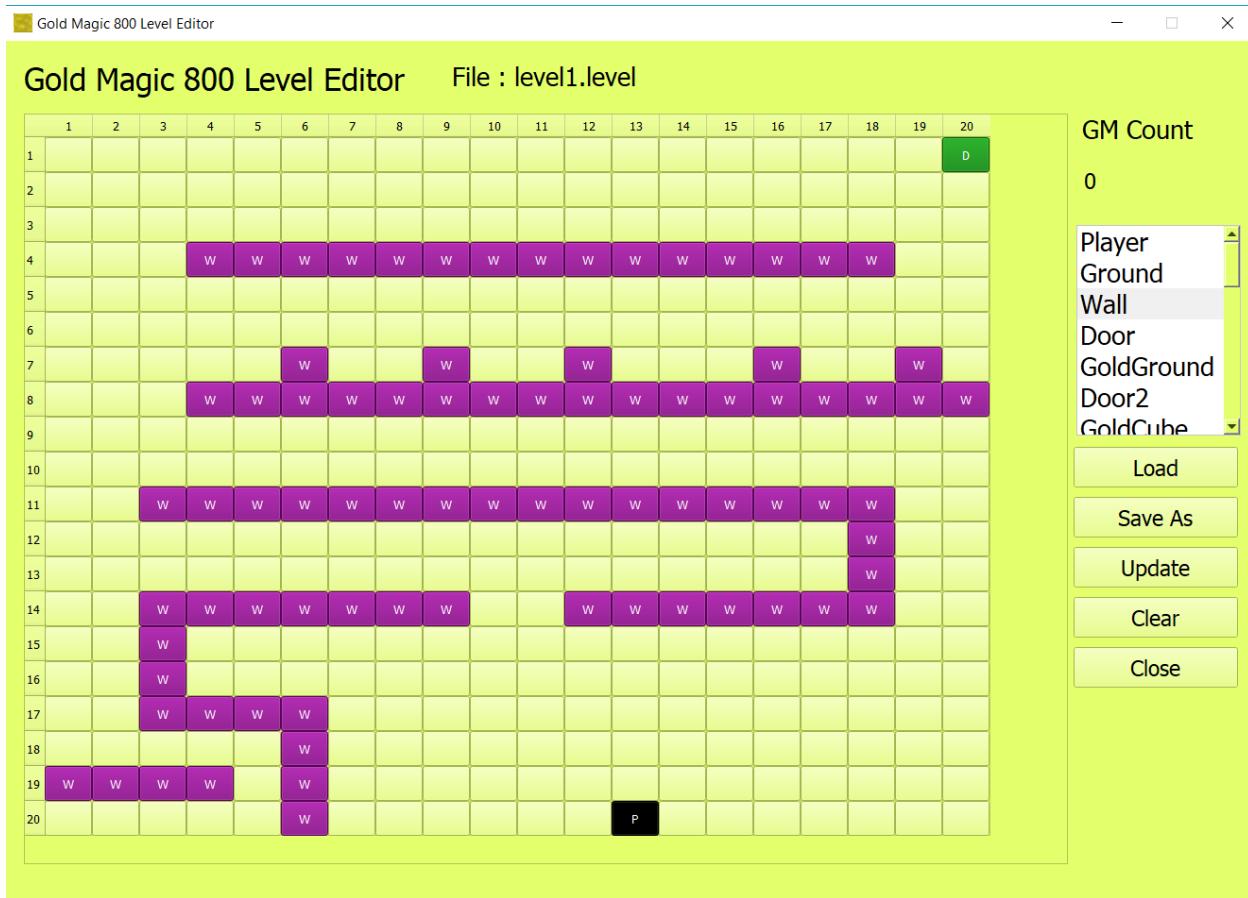
We can select the level



The next screen shot for level (1)



The Gold Magic 800 Level Editor

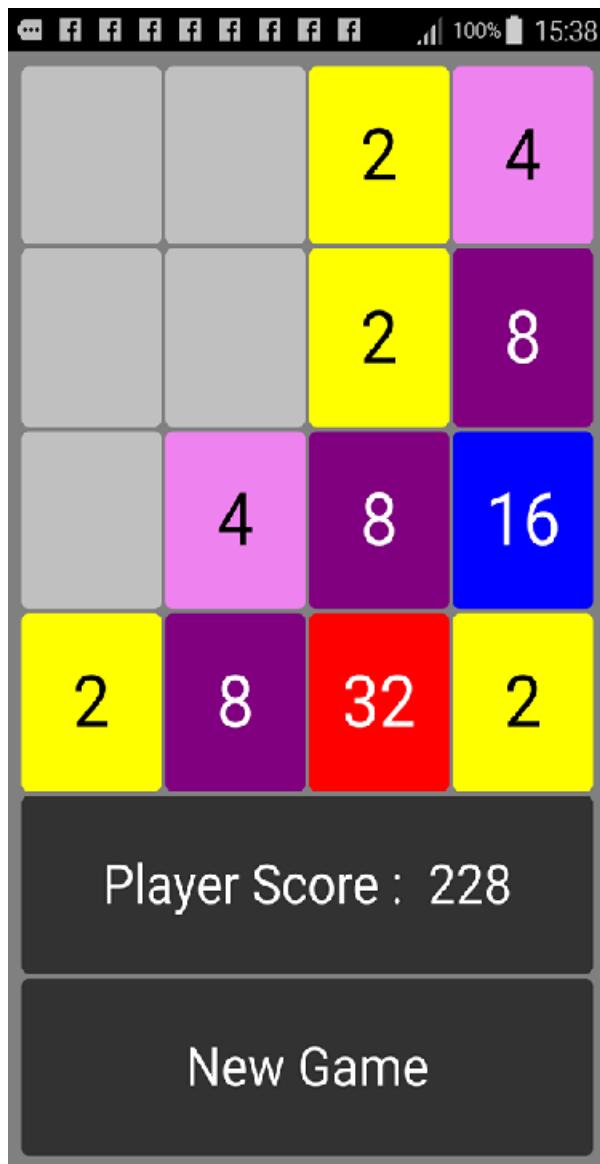


99.3 More Games

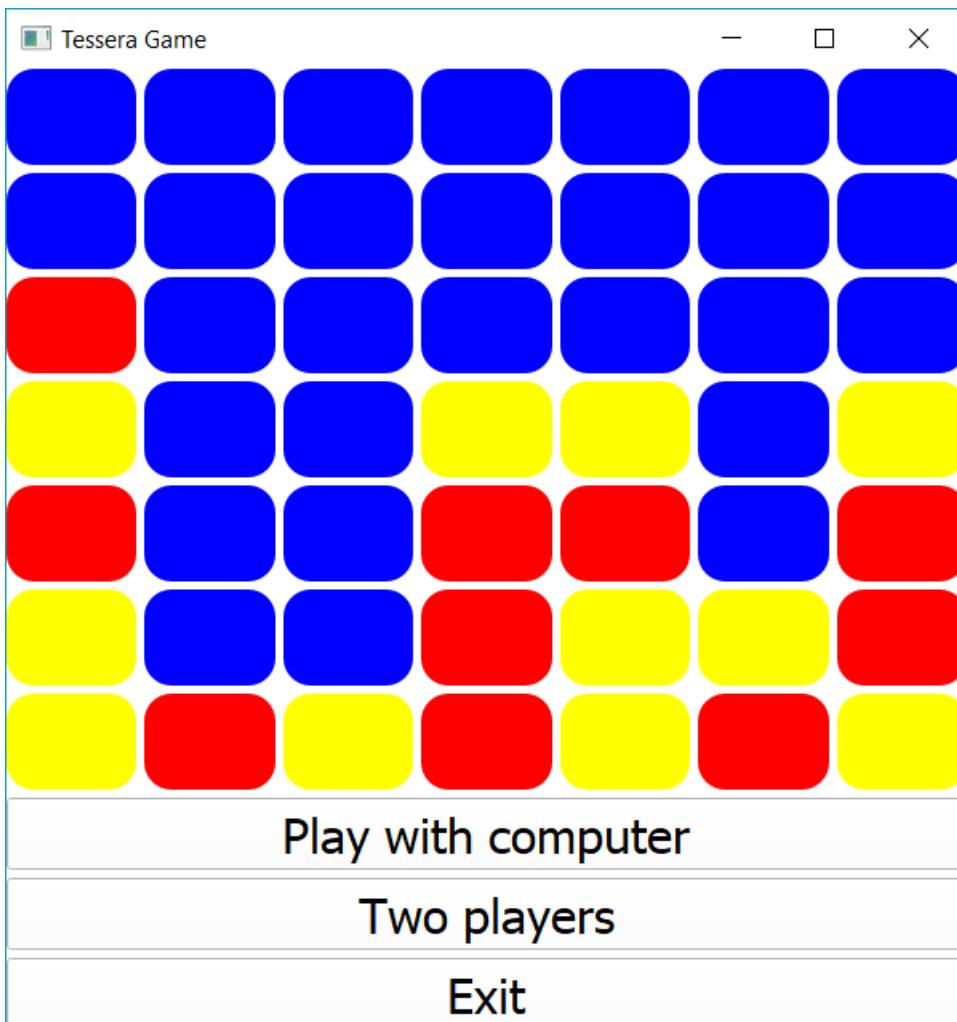
The next games are added to Ring Applications

- (1) The 2048 Game
- (2) The Memory Game
- (3) The Wise Quadrat Game
- (4) The Tessera Game
- (5) The Othello Game

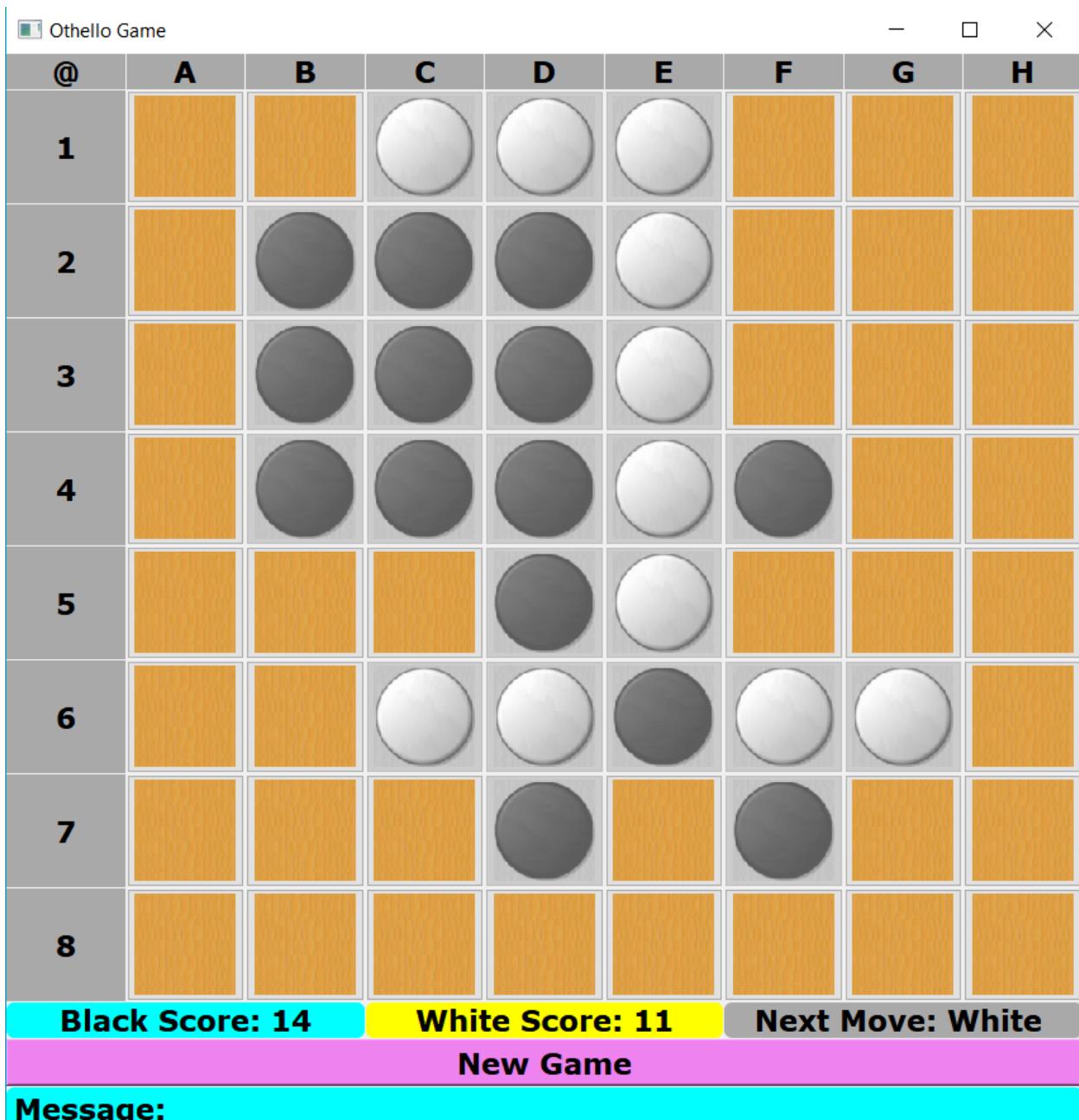
The next screen shot for the 2048 game on Android



The next screen shot for the Tessera game

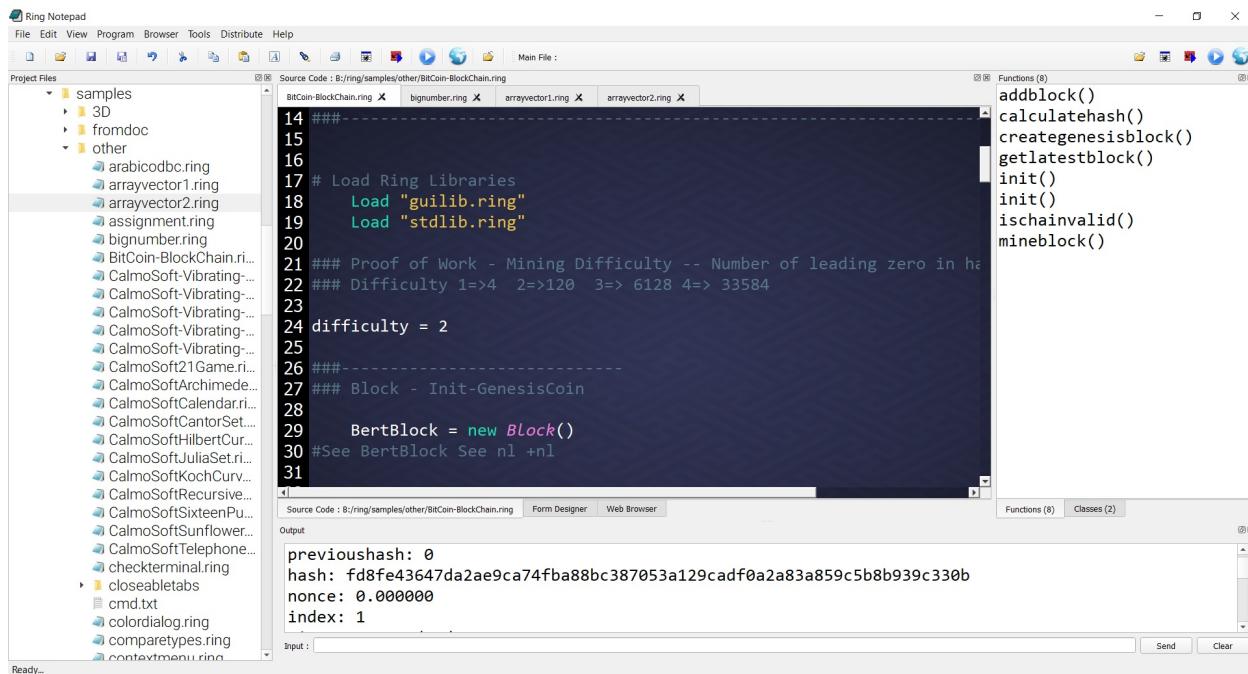


The next screen shot for the Othello game



99.4 Better Ring Notepad

- (1) New Style
- (2) New Mode
- (3) Tabs for opened files
- (4) Support executing batch files



99.5 Better StdLib

(1) The List2Code() function is added to the StdLib

This function convert a Ring list during the runtime to Ring source code that we can save to source files.

The list may contains strings, numbers or sub lists.

Example:

```
load "stdlibcore.ring"
aList = 1:10
? list2Code(aList)
```

Output:

```
[  
    1, 2, 3, 4, 5, 6, 7, 8, 9, 10  
]
```

(2) The Str2ASCIIList() and ASCIIList2Str() are added to the StdLib

Using these functions we can convert between string of bytes and a list of numbers where each item represent the ASCII code of one byte in the string.

So we may convert a string of bytes to ASCII List then do some operations on the list numbers (Like XOR)

Example:

```
load "stdlibcore.ring"

cStr = "MmMm"

aList = Str2ASCIIList(cStr)
```

(continues on next page)

(continued from previous page)

```
? aList

cStr2 = ASCIIList2Str(aList)
? cStr2
? len(cStr2)
```

Output:

```
77
109
77
109

MmMm
4
```

99.6 BigNumber Library

Using the BigNumber library we can do arithmetic operations on huge numbers.

Example:

```
load "bignumber.ring"

num1 = "62345678901234567891678345123456789"      ##### Big
num2 = "1237894567890123419871236545"               ##### Small
num3 = "64"                                              ##### Divide Small
num4 = "765432"
num5 = "3"                                               ##### Power

? "Add big numbers:"
a1 = new BigNumber(num1)          a1.Print()
a2 = new BigNumber(num2)          a2.Print()
a3 = a1 + a2                   a3.Print() ? nl

? "Substract big numbers:"
a1 = new BigNumber(num1)          a1.Print()
a2 = new BigNumber(num2)          a2.Print()
a3 = a1 - a2                   a3.Print() ? nl

? "Multiply big numbers:"
a1 = new BigNumber(num1)          a1.print()
a2 = new BigNumber(num2)          a2.print()
a3 = a1 * a2                   a3.print() ? nl

? "Divide big numbers:"
a1 = new BigNumber(num1)          a1.print()
a2 = new BigNumber(num2)          a2.print()
a3 = a1 / a2                   a3.print() ? nl

? "Divide big numbers: by very small number"
a1 = new BigNumber(num1)          a1.print()
a2 = new BigNumber(num3)          a2.print()
a3 = a1 / a2                   a3.print() ? nl
```

(continues on next page)

(continued from previous page)

```
? "Power of big number:"
a1 = new BigNumber(num1)      a1.print()
a2 = new BigNumber(num5)      a2.print()
a3 = a1 ^ a2                a3.print() ? nl
```

Output:**Add big numbers:**

```
62345678901234567891678345123456789
1237894567890123419871236545
62345680139129135781801764994693334
```

Substract big numbers:

```
62345678901234567891678345123456789
1237894567890123419871236545
52345687663340000001554925252220244
```

Multiply big numbers:

```
62345678901234567891678345123456789
1237894567890123419871236545
77177377243260150103462178714197454736432472780119682305154005
```

Divide big numbers:

```
62345678901234567891678345123456789
1237894567890123419871236545
50364288
```

Divide big numbers: by very small number

```
62345678901234567891678345123456789
64
974151232831790123307474142554012
```

Power of big number:

```
62345678901234567891678345123456789
3
242336636261471172092347146031727004 (Output continue in next line)
371698195628343934238988256152289508 (Output continue in next line)
493964611043228971692389860897069
```

For more information check the [BigNumber Library Chapter](#) in the documentation

99.7 RingPostgreSQL Extension

Ring 1.9 provide native support for PostgreSQL database using the RingPostgreSQL Extension.

Example:

```
load "postgresql.lib.ring"

conninfo = "user=postgres password=sa dbname = mahdb"

exit_nicely = func conn {
    PQfinish(conn)
    shutdown(1)
}

conn = PQconnectdb(conninfo)

if (PQstatus(conn) != CONNECTION_OK)
    fputs(stderr, "Connection to database failed: " + PQerrorMessage(conn))
    call exit_nicely(conn)
ok

res = PQexec(conn, "
    DROP DATABASE mahdb;
")
if PQresultStatus(res) != PGRES_TUPLES_OK
    fputs(stderr, "Remove failed: " + PQerrorMessage(conn))
    PQclear(res)
ok
PQclear(res)

res = PQexec(conn, "CREATE DATABASE mahdb;")
if PQresultStatus(res) != PGRES_TUPLES_OK
    fputs(stderr, "Create database failed: " + PQerrorMessage(conn))
    PQclear(res)
ok

res = PQexec(conn, "
CREATE TABLE COMPANY (
    ID INT PRIMARY KEY      NOT NULL,
    NAME          TEXT      NOT NULL,
    AGE           INT       NOT NULL,
    ADDRESS        CHAR(50),
    SALARY         REAL );
")
if PQresultStatus(res) != PGRES_TUPLES_OK
    fputs(stderr, "Create Table failed: " + PQerrorMessage(conn))
    PQclear(res)
ok
PQclear(res)

res = PQexec(conn, "
    INSERT INTO COMPANY (ID,NAME,AGE,ADDRESS,SALARY)
    VALUES  (1, 'Mahmoud' , 31, 'Jeddah', 10.00 ),
            (2, 'Ahmed'   , 27, 'Jeddah', 20.00 ),
```

(continues on next page)

(continued from previous page)

```

        (3, 'Mohammed', 33, 'Egypt' , 30.00 ),
        (4, 'Ibrahim' , 24, 'Egypt ' , 40.00 );
    ")
if PQresultStatus(res) != PGRES_TUPLES_OK
    fputs(stderr, "Insert Table failed: " + PQerrorMessage(conn))
    PQclear(res)
ok
PQclear(res)

res = PQexec(conn, "
    select * from COMPANY
")
if PQresultStatus(res) != PGRES_TUPLES_OK
    fputs(stderr, "Select failed: " + PQerrorMessage(conn))
    PQclear(res)
    call exit_nicely(conn)
ok

nFields = PQnfields(res)
for i = 1 to nFields
    ? PQfname(res, i-1)
next

? copy("*", 60)

for i = 1 to PQntuples(res)
    for j=1 to nFields
        see PQgetvalue(res, i-1, j-1) + " "
    next
    see nl
next

PQclear(res)

PQfinish(conn)

```

Output:

id	name	age	address	salary
1	Mahmoud	31	Jeddah	10
2	Ahmed	27	Jeddah	20
3	Mohammed	31	Egypt	30
4	Ibrahim	24	Egypt	40

For more information check the PostgreSQL Chapter in the documentation

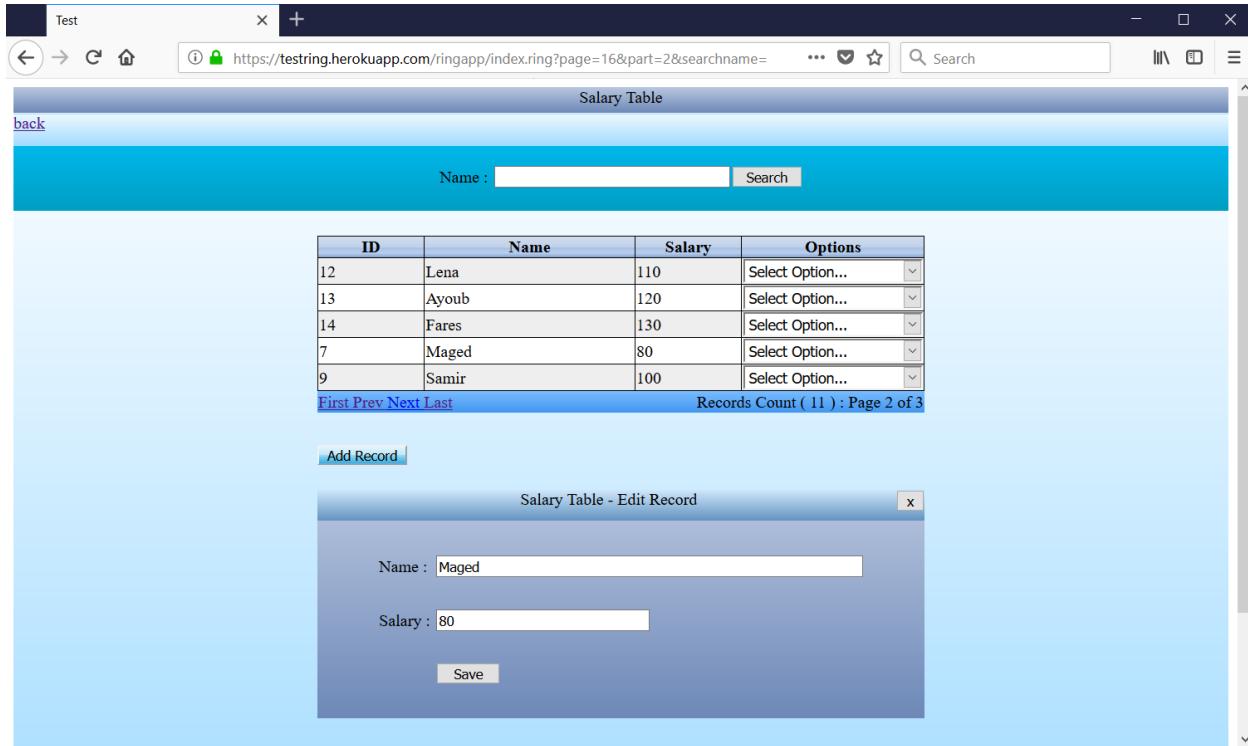
99.8 Deploying Web applications in the Cloud

We created a new project and tutorial to explain how to deploy Ring web applications in the Cloud using Heroku

Demo : <http://testring.herokuapp.com/>

Project : <https://github.com/ring-lang/RingWebAppOnHeroku>

Heroku Website : <https://www.heroku.com/>



For more information check the Deploying Web Applications In The Cloud chapter in the documentation.

99.9 Better RingQt

(1) The next classes are added to RingQt

- QDrag
- QMimeData
- QDropEvent
- QDragMoveEvent
- QDragEnterEvent
- QDragLeaveEvent
- QClipboard
- QChildEvent
- QGeoPositionInfo

- QGeoCoordinate
- QGeoAddress
- QGeoAreaMonitorInfo
- QGeoAreaMonitorSource
- QGeoCircle
- QGeoPositionInfoSource
- QGeoRectangle
- QGeoShape
- QGeoSatelliteInfo
- QGeoSatelliteInfoSource
- QNmeaPositionInfoSource
- QAxWidget
- QTextStream
- QPrinterInfo
- QPrintPreviewWidget
- QPrintPreviewDialog
- QPageSetupDialog
- QAbstractPrintDialog
- QPrintDialog

(2) The next classes are updated

- QAllEvents Class : New Events (ChildAdded, ChildPolished, ChildRemoved).
- QPainter Class : Updated Methods (drawConvexPloygon, drawPoints, drawPolyline) Accept Ring list of points.
- QVariant : More versions that accept different parameters when creating the object.
- QAxBase : Different versions for the dynamicCall() and querySubObject() methods.

The next example for using the QPrintPreviewDialog class

Example:

```
load "guilib.ring"

new qApp {
    win1 = new QWidget() {
        setWindowTitle("Printer Preview Dialog")
        setGeometry(100,100,800,880)
        printer1 = new QPrinter(0)
        show()
        oPreview = new QPrintPreviewDialog(printer1) {
            setParent(win1)
            move(10,10)
            setPaintRequestedEvent("printPreview()")
            exec()
        }
    }
}
```

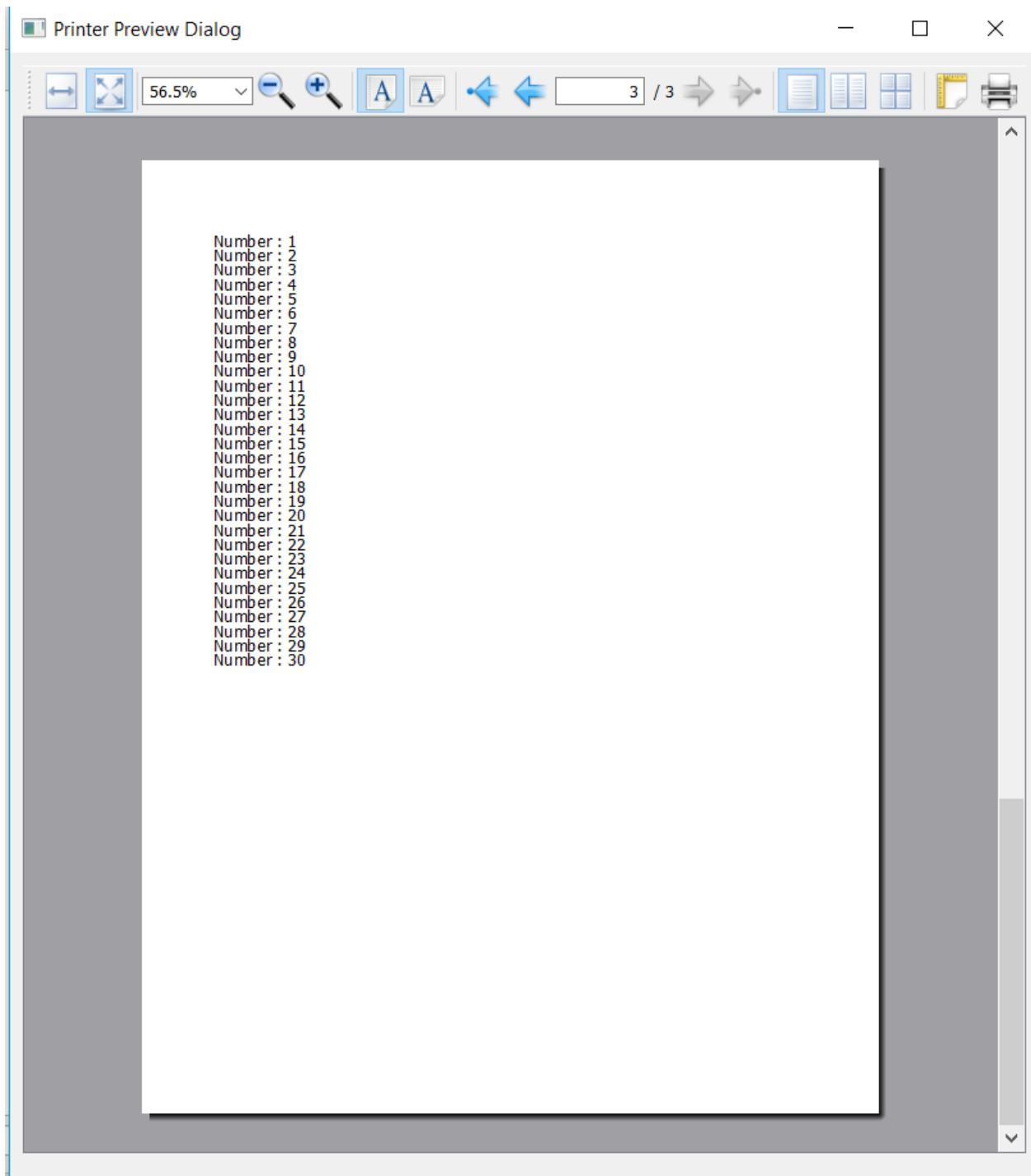
(continues on next page)

(continued from previous page)

```
    exec()
}

func printPreview
    printer1  {
        painter = new qpainter() {
            begin(printer1)
            myfont = new qfont("Times",50,-1,0)
            setfont(myfont)
            drawtext(100,100,"Test - Page (1)")
            printer1.newpage()
            drawtext(100,100,"Test - Page (2)")
            printer1.newpage()
            myfont2 = new qfont("Times",14,-1,0)
            setfont(myfont2)
            for x = 1 to 30
                drawtext(100,100+(20*x),"Number : " + x)
            next
            endpaint()
        }
    }
```

Screen Shot:



99.10 Better Memory Management

The Ring API is updated to include RING_API_RETMANAGEDCPOINTER()

Using RING_API_RETMANAGEDCPOINTER() the Ring extensions written in C/C++ languages can return a managed pointer to Ring. This pointer can be controlled by the Ring VM using reference counting.

This is important to avoid the need to write code that free the unmanaged resources like QPixmap objects in RingQt.

Also the Code Generator for extensions is updated to automatically use RING_API_RETMANAGEDCPOINTER() based on need.

Syntax:

```
RING_API_RETMANAGEDCPOINTER(void *pValue, const char *cPointerType,
                           void (* pFreeFunc) (void *,void *))
```

For more information about RING_API_RETMANAGEDCPOINTER()

See the “Extension using the C/C++ languages” Chapter in the documentation

99.11 Better Code Generator for Extensions

- (1) The code generator for extensions is updated to support the <loadfile> command

```
<loadfile> filename.cf
```

This is useful to separate the extension configuration file to many files

Example:

The file : qt_module_network.cf in the RingQt Extension

```
<comment>
    Module (network)
</comment>

<loadfile> qabstractsocket.cf
<loadfile> qnetworkproxy.cf
<loadfile> qtcpsocket.cf
<loadfile> qtcpserver.cf
<loadfile> qhostaddress.cf
<loadfile> qhostinfo.cf
<loadfile> qnetworkrequest.cf
<loadfile> qnetworkaccessmanager.cf
<loadfile> qnetworkreply.cf
```

- (2) The code generator support the <managed> option when defining classes.

Using this option, the generator will use RING_API_RETMANAGEDCPOINTER() to return the C pointer.

So the Garbage Collector will manage these C pointers.

Example

```
<class>
name: QFont
para: QString, int, int, bool
```

(continues on next page)

(continued from previous page)

managed </ class >

99.12 More Improvements

- (1) Ring Compiler - The Rule (Factor -> ‘-‘ Expr) changed to (Factor -> ‘-‘ Factor).
- (2) Ring VM - Better Error Message.
- (3) Better code for IsNULL() function - updated to check pointers too.
- (4) Better code for ringvm_evalinscope() function - used by the Trace Library.
- (5) Better code for Space() function.
- (6) Better code for Hex() and Dec() functions.
- (7) Better code for Download() function.
- (8) Better code for SubStr() function.
- (9) Better code for the Unsigned() function.
- (10) Better code for Chdir() function.
- (11) Better code for Tempname() function.
- (12) Better code for HashTable - New Key (using ring_strdup() instead of strdup() function).
- (13) New Function : SRandom() - Initialize random number generator.
- (14) New Function : IsPointer().
- (15) IsList() will not return True for C Pointers, we have now the IsPointer() function.
- (16) The ? Operator is updated to respect the ringvm_see() function.
- (17) Scripts to run Ring tests on Linux and macOS (Not only Windows).
- (18) RingAllegro is Updated from Allegro 5.1 to Allegro 5.2.
- (19) Shader Functions are added to RingAllegro.
- (20) Joystick Functions are added to RingAllegro.
- (21) Network functions are added to RingLibSDL.
- (22) Game Engine for 2D Games - Text Class - Check the font object before usage.
- (23) Game Engine for 2D Games - Automatic support for Joystick.
- (24) RingLibCurl is updated to automatically use CURLOPT_COPYPOSTFIELDS when needed.
- (25) Ring Notepad - Find Previous Feature.
- (26) Ring Notepad - Default Style.
- (27) Ring Notepad - Support using Non-English language (Like Arabic) in file names.
- (28) Form Designer - Nice Alignment for Toolbox Icons.
- (29) Form Desginer - QAllEvents Class - Mouse Double Click Event.
- (30) Find in Files - Replace and Replace All options.
- (31) Qt Class Converter is updated for better conversion results.

- (32) More samples are added to ring/samples/other folder.
- (33) Code Refactoring for Ring Notepad, RingQt, Game Engine for 2D Games.
- (34) Better Documentation - Many images are updated to reflect the current state of Ring Environment.
- (35) Better Documentation - More chapters are added to the documentation.

WHAT IS NEW IN RING 1.10?

In this chapter we will learn about the changes and new features in Ring 1.10 release.

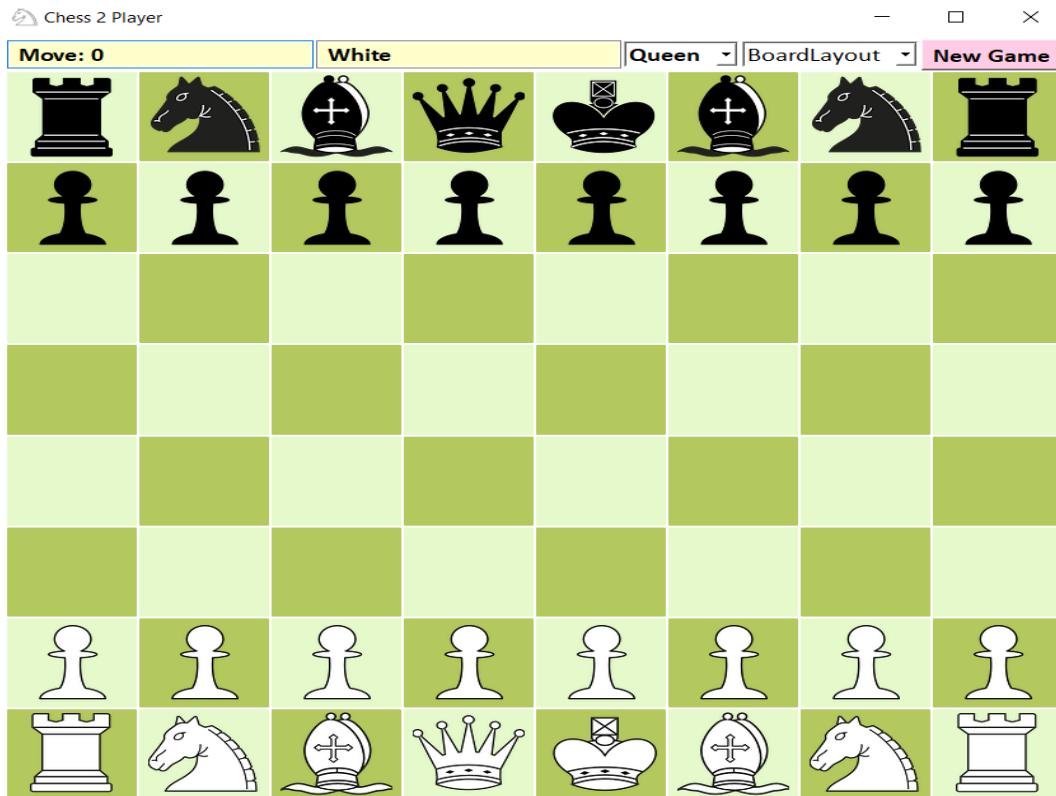
100.1 List of changes and new features

Ring 1.10 comes with the next features!

- Chess Game
- Minesweeper Game
- Knight Tour Game
- Game of Life Game
- Pong Game
- Snakes and Ladder Game
- More Games
- Ring Extension for Visual Studio Code
- The Ring Package Manager (RingPM)
- Better Tests
- More Improvements

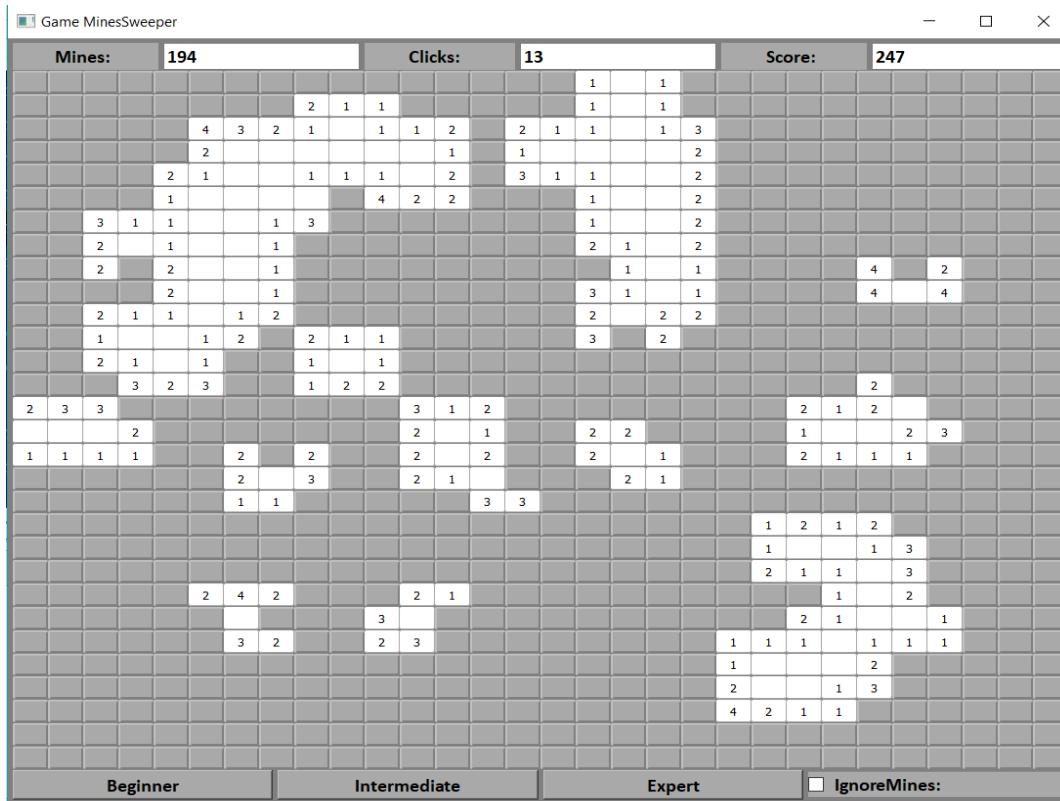
100.2 Chess Game

Chess Game (2 Players)



100.3 Minesweeper Game

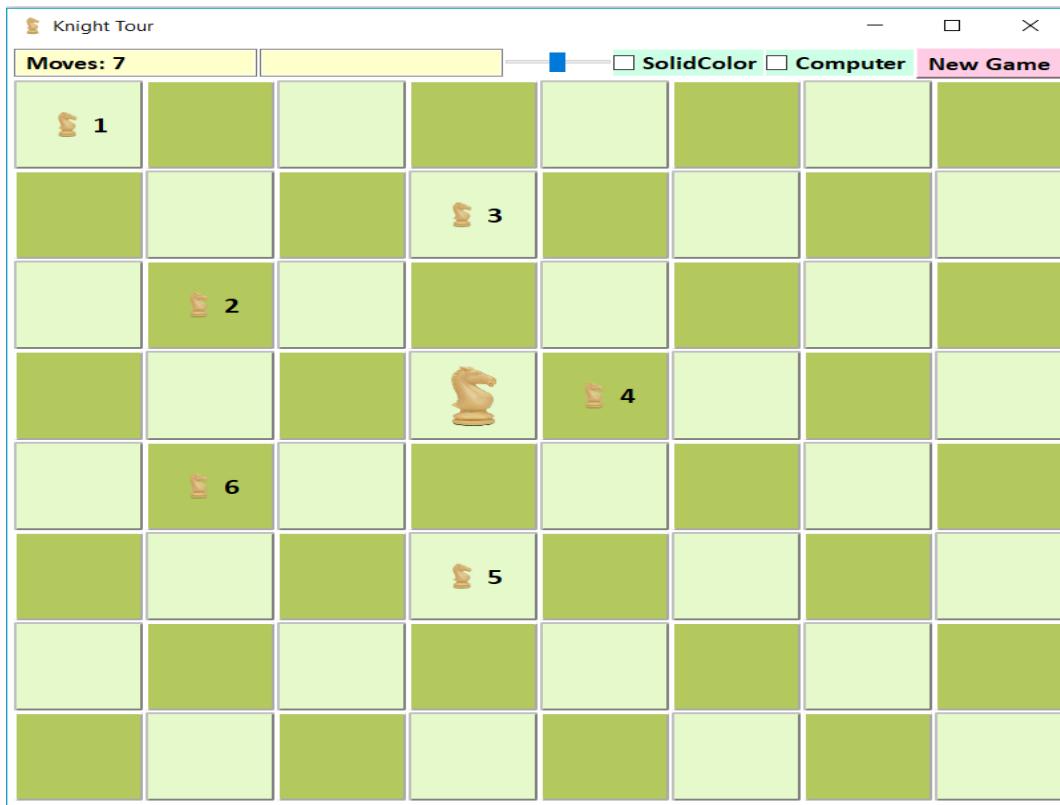
The objective of the game is to clear a rectangular board containing hidden “mines” or bombs without detonating any of them.



100.4 Knight Tour Game

Move to every square on the chess board, using only the moves of a knight.

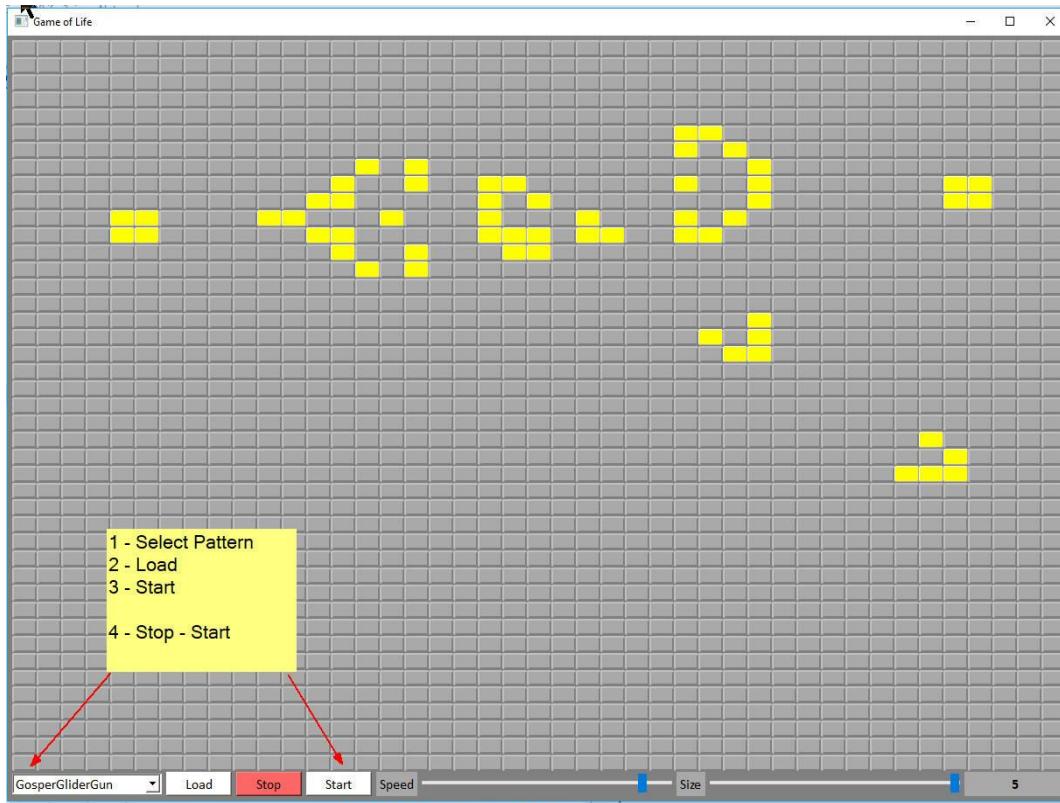
Can you visit every square in just 63 moves?



100.5 Game of Life Game

The game is a zero-player game, meaning that its evolution is determined by its initial state, requiring no further input.

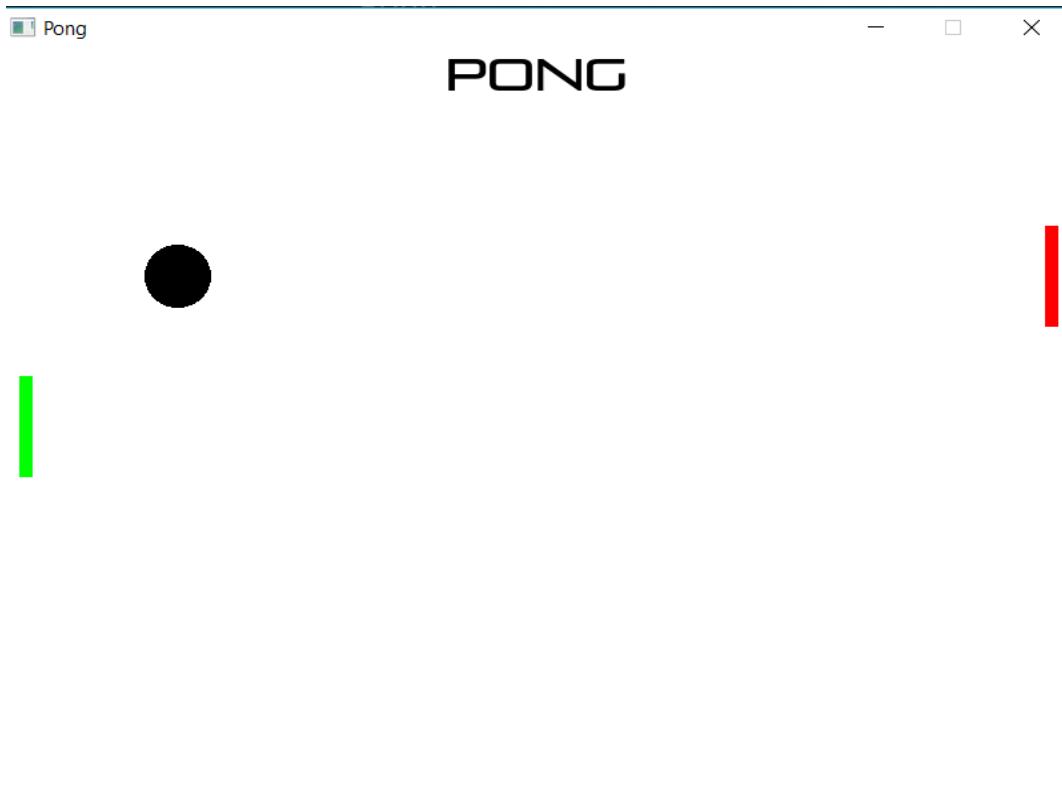
One interacts with the Game of Life by creating an initial configuration and observing how it evolves, or, for advanced players, by creating patterns with particular properties.



100.6 Pong Game

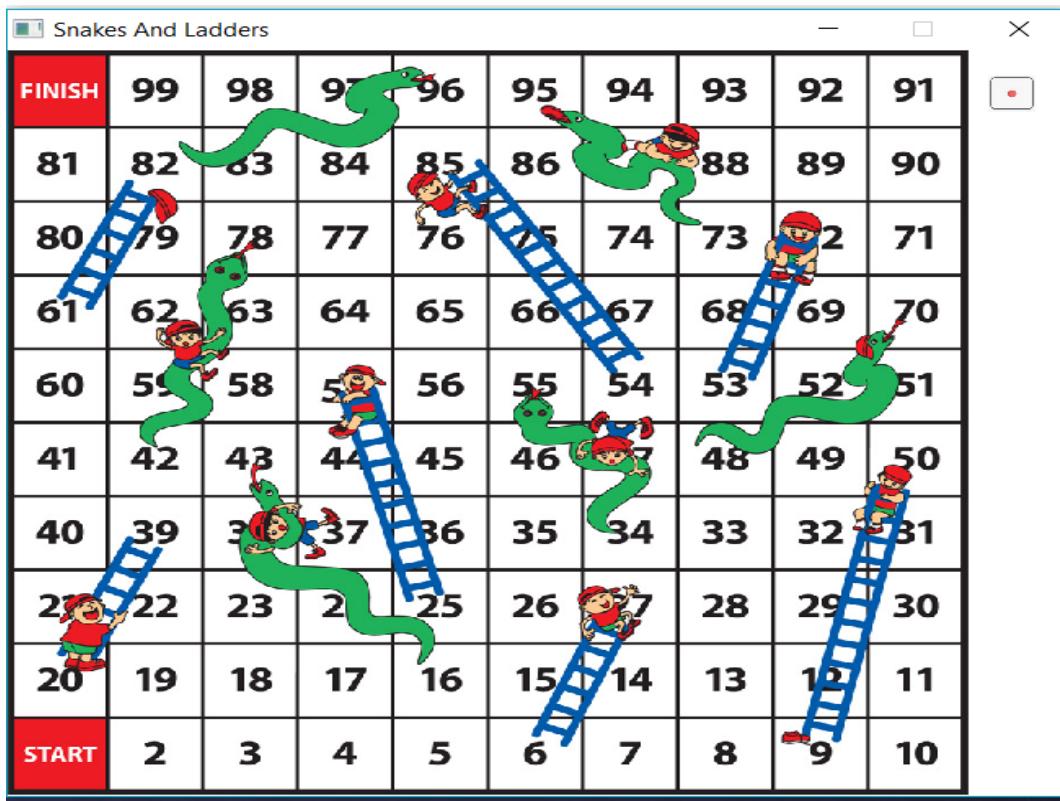
Simple “tennis like” game features two paddles and a ball.

The goal is to defeat your opponent once the opponent misses a ball.



100.7 Snakes And Ladder Game

The Snakes and Ladder Game using Ring Game Engine for 2D Games

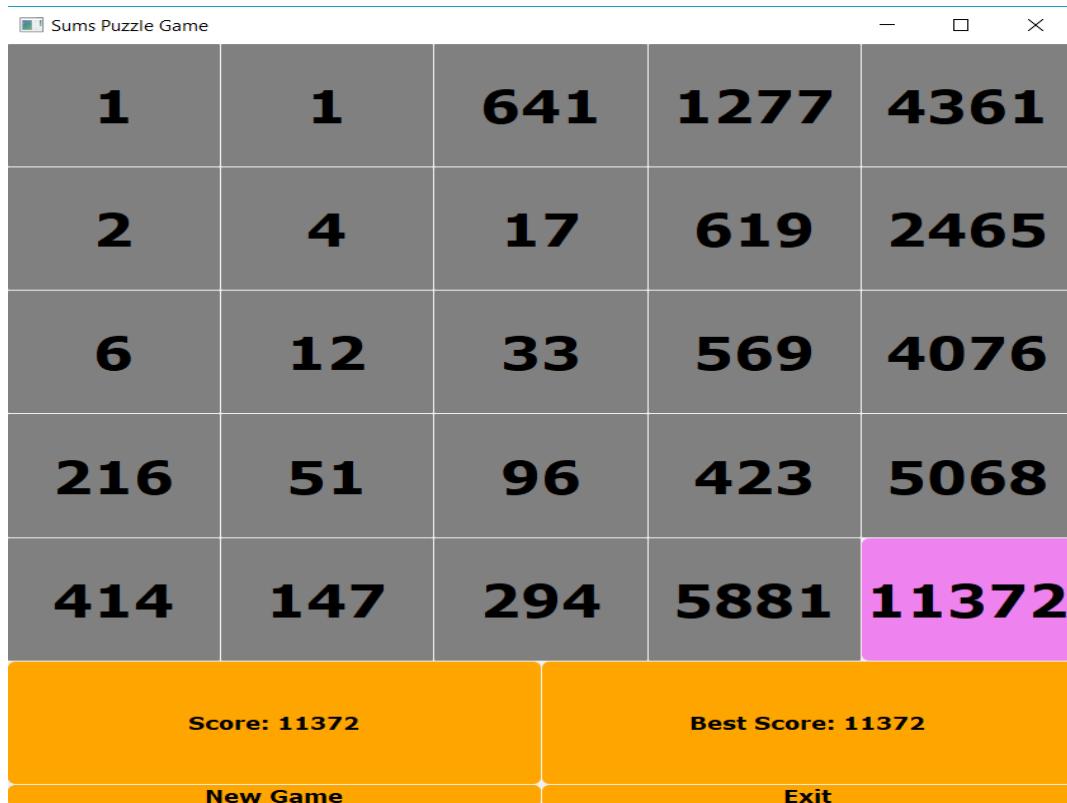


100.8 More Games

The next games are added to the application folder

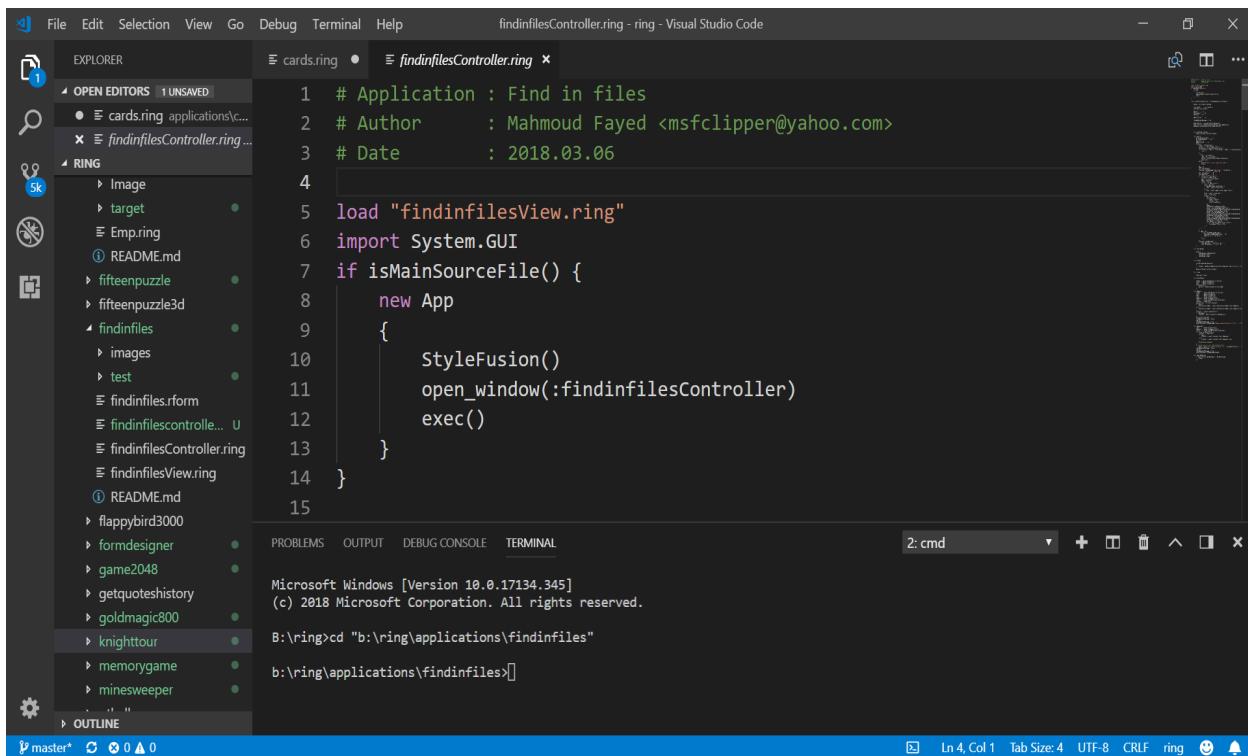
- Lights Out Game
- Dots and Boxes Game
- Magic Four Game
- Sum Puzzle Game

The next screen shot for the Sum Puzzle Game



100.9 Ring Extension for Visual Studio Code

This extension support the Ring programming language in Visual Studio Code



100.10 The Ring Package Manager (RingPM)

Ring comes with a package manager (RingPM) that we can use to install, update and remove packages.

The Package Manager uses Semantic Versioning to check compatibility between packages

The Package Manager comes with the next options

```
=====
Usage   : ringpm [command]
Command : search  [keywords...]
Command : refresh : Update the Registry (Packages List)
Command : install [ <packagename> [from <UserName>] [branch <branchname>] ]
Command : list    [-u : Check updates]
Command : run     [packagename]
Command : update  <packagename>
Command : remove  <packagename>
Command : format  : Delete All Packages
Command : new     <packagename>
Command : package : Create package in the current folder
=====
```

100.11 Better Tests

New framework for Ring programming language tests that test the language.

```
B:\ring\tests>test
=====
Tests Count : 307
=====

Test (1)    : Hello World Program (Using See)           --- PASS
Test (2)    : Hello World Program (Using See and nl)   --- PASS
Test (3)    : Hello World Program (Using Put)          --- PASS
Test (4)    : Hello World Program (Using Put and nl)   --- PASS
Test (5)    : Testing Procedural Programming (Part 1) --- PASS
Test (6)    : Testing Procedural Programming (Part 2) --- PASS
Test (7)    : Testing Procedural Programming (Part 3) --- PASS
Test (8)    : Testing Procedural Programming (Part 4) --- PASS
Test (9)    : Testing Procedural Programming (Part 5) --- PASS
Test (10)   : Testing Procedural Programming (Part 6) --- PASS
Test (11)   : Testing Procedural Programming (Part 7) --- PASS
Test (12)   : Testing Procedural Programming (Part 8) --- PASS
Test (13)   : Testing Object Oriented Programming (Part 1) --- PASS
Test (14)   : Testing Object Oriented Programming (Part 2) --- PASS
Test (15)   : Testing Object Oriented Programming (Part 3) --- PASS
Test (16)   : Testing Object Oriented Programming (Part 4) --- PASS
Test (17)   : Testing Object Oriented Programming (Part 5) --- PASS
Test (18)   : Testing Object Oriented Programming (Part 6) --- PASS
Test (19)   : Testing Object Oriented Programming (Part 7) --- PASS
Test (20)   : Testing Object Oriented Programming (Part 8) --- PASS
```

100.12 More Improvements

- (1) Ring Compiler : Better support for (Operator Operator) to avoid checking the first operator when it's a literal.
- (2) Ring Compiler : When we load a file that doesn't exist, display the caller file name in the error message.
- (3) Ring Compiler : Support source code files with one line of comment without end of line.
- (4) Ring Compiler : change nNoAssignment attribute in Parser Structure to nNewObject.
- (5) Ring VM : Better support for the (Return) command inside braces that access new objects.
- (6) Ring VM : Dir() Function - Don't add ":" and ".." to the output
- (7) Ring VM : Dir() Function - Correct output for the item type (filedirectory) on Linux and macOS.
- (8) Ring VM : ICO_LISTSTART - Clean pVM->a SetProperty when setting an object attribute.
- (9) Ring VM : ICO_NEWOBJECT - Clean pVM->a SetProperty when setting an object attribute.
- (10) Ring VM : Better code for Setter and Getter methods support.
- (11) Ring2EXE: The libraries information are stored in separated files in ring/ring2exe/libs folder.
- (12) WebLib : Separate the library to many source code files.
- (13) StdLib : IsVowel() function - Better Code.
- (14) RingQt : Count(), Left(), Mid() and Right() methods are added to QString class.

(15) Better Read Me File

WHAT IS NEW IN RING 1.11?

In this chapter we will learn about the changes and new features in Ring 1.11 release.

101.1 List of changes and new features

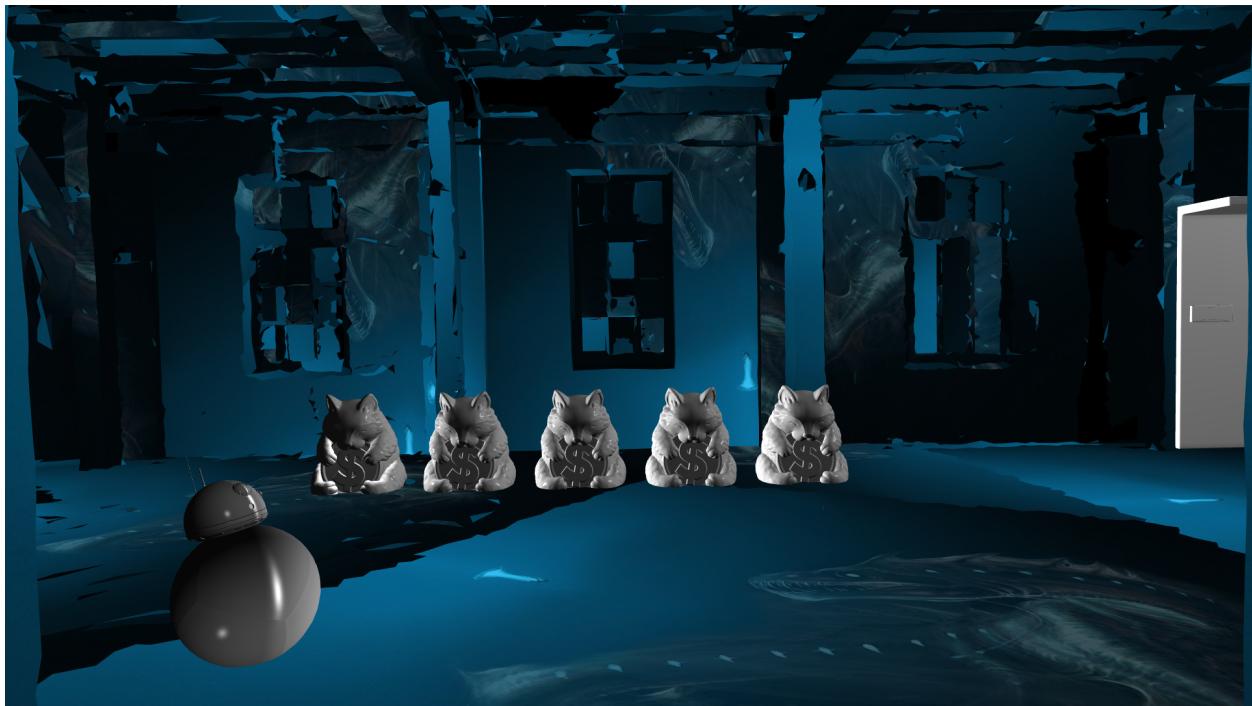
Ring 1.11 comes with the next features!

- More 3D Samples
- Checkers Game
- Sokoban Game
- Maze Game
- Snake Game
- Sudoku Game
- Desktop Screen Shot Application
- Text To Speech Application
- RingRayLib Extension
- ZeroLib Library
- StdLib - More Functions
- Better RingQt
- Better Performance
- Better Documentation
- More Improvements

101.2 More 3D Samples

Ring 1.11 comes with more 3D samples based on Qt3D

- Folder : ring/samples/other/UsingQt3D (Contains 18 samples)



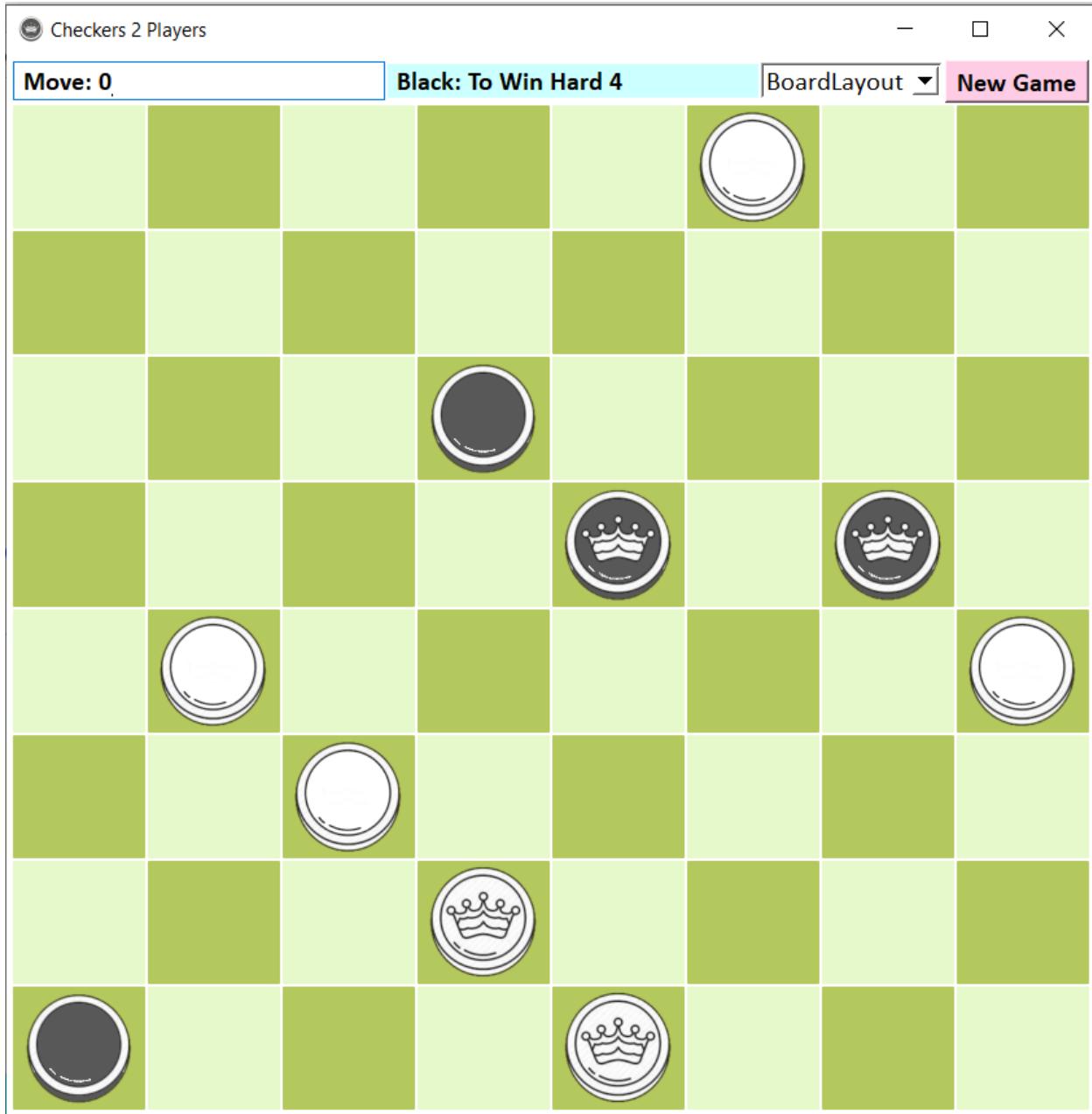
101.3 Checkers Game

It plays the - Must Jump - version of Checkers, The International Rules

It handles various invalid moves, invalid jumps, and must jumps.

The squares are colored to reflect errors.

The Squares are colored to show source and destination of the move or jump.



101.4 Sokoban Game

A quick implementation for the Sokoban Game

Developed using Ring Game Engine for 2D Games in 2 hours (Less than 300 lines of code)

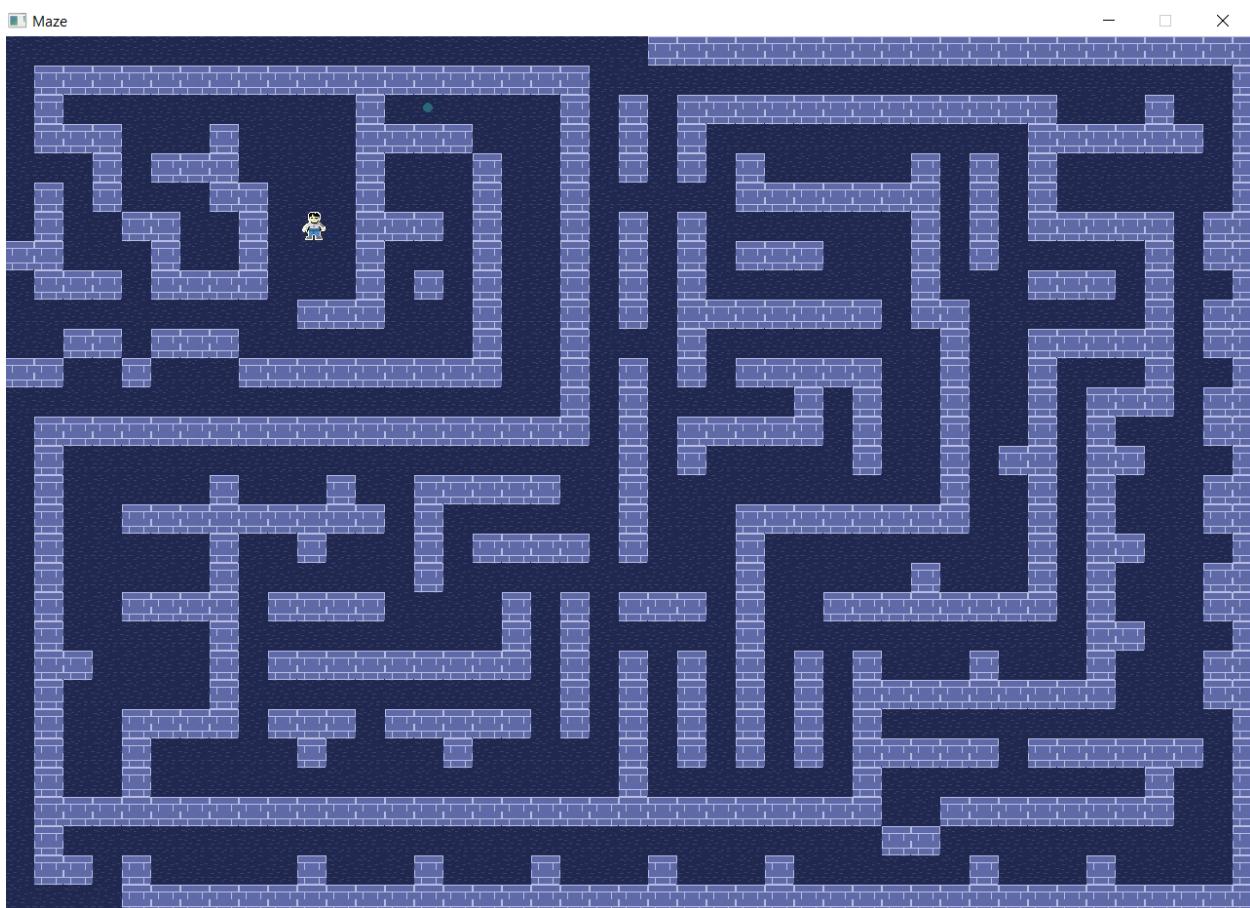


101.5 Maze Game

A quick implementation for the Maze Game

Developed using Ring Game Engine for 2D Games (Around 100 lines of code)

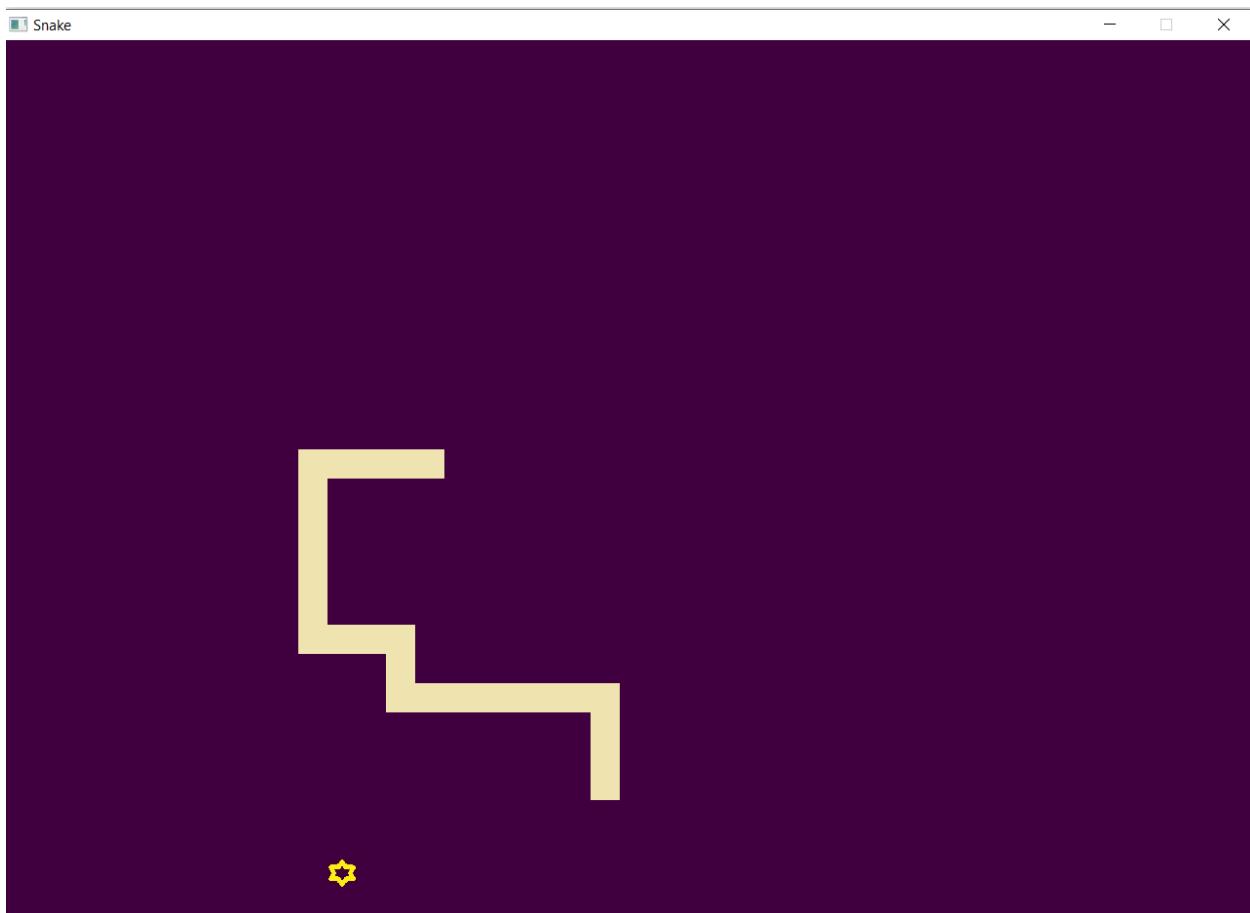
Also the game comes with a level designer (Developed in 10 minutes, 37 Lines of code)



101.6 Snake Game

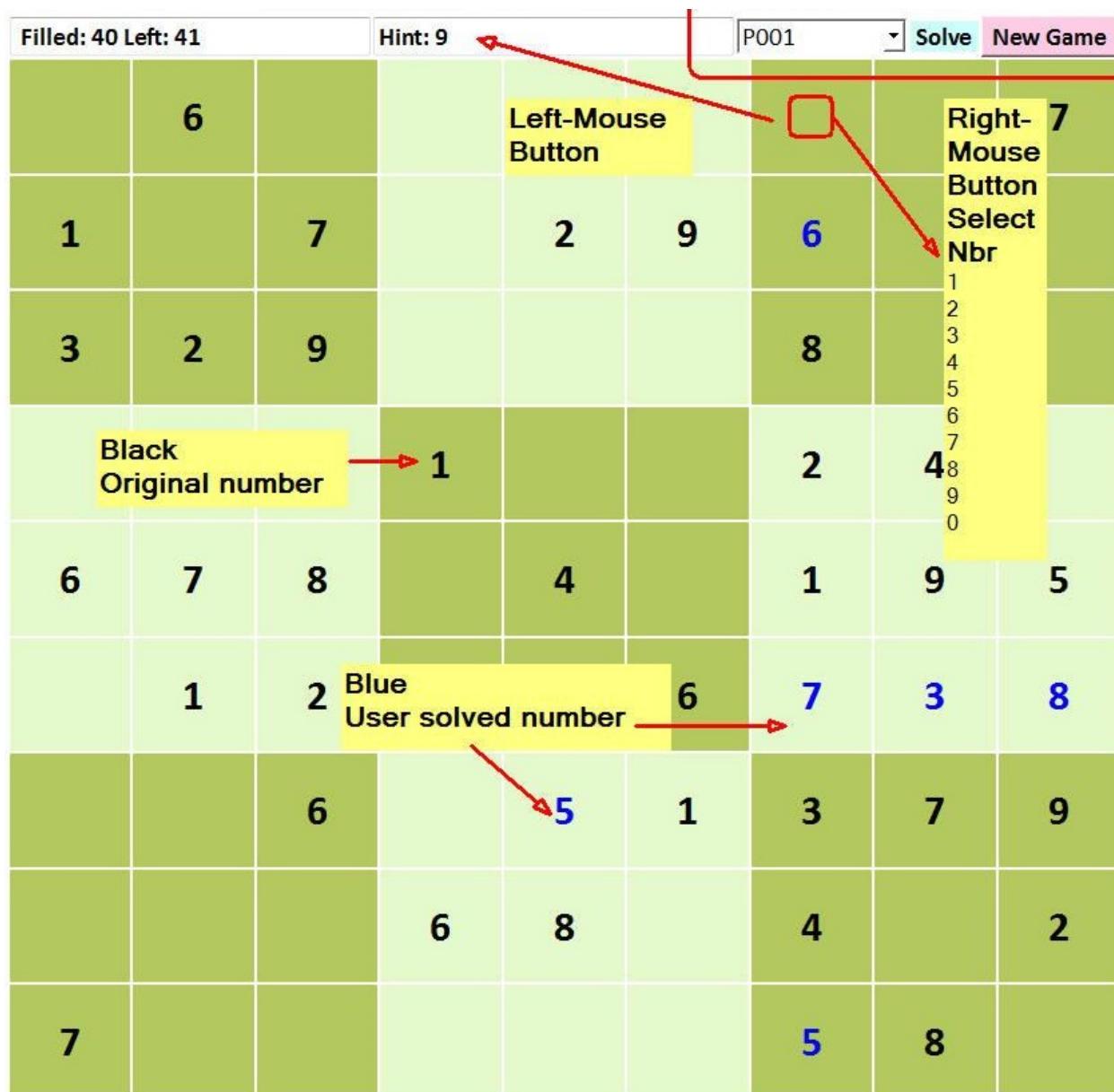
A quick implementation for the Snake Game

Developed using Ring Game Engine for 2D Games (Around 200 lines of code)

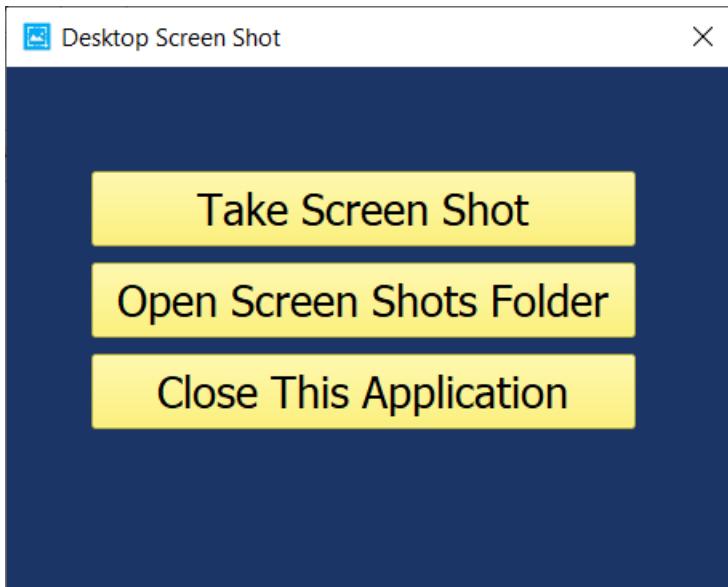


101.7 Sudoku Game

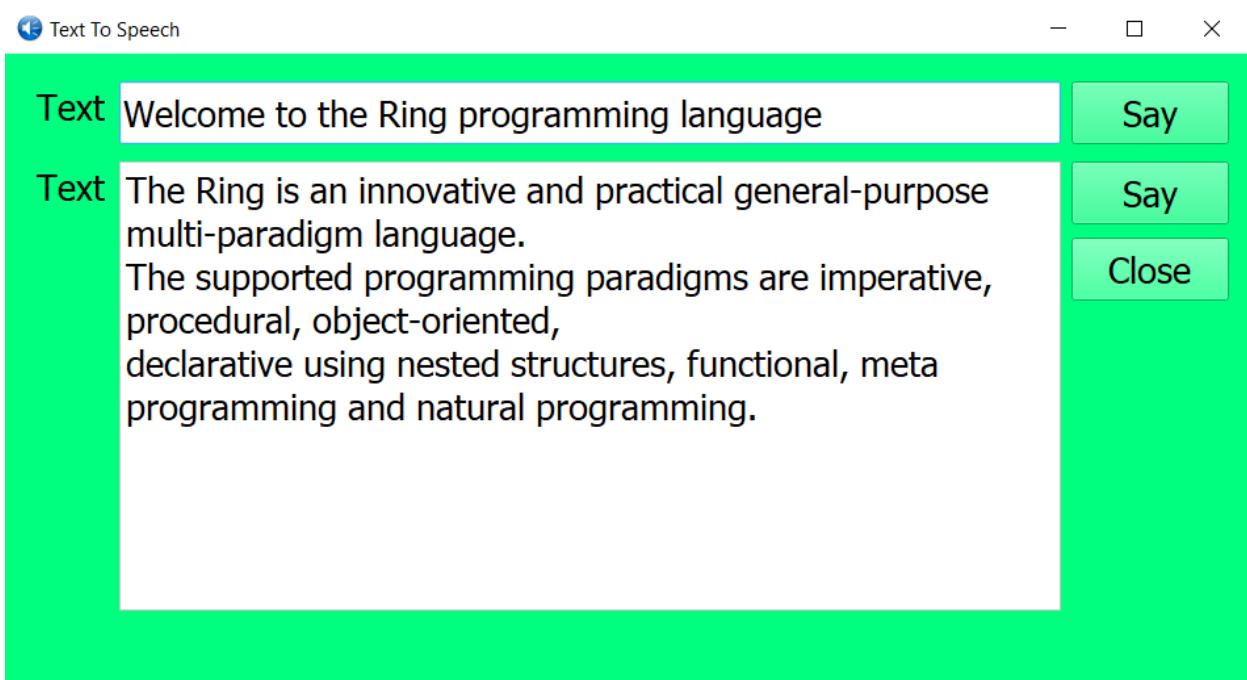
Fill a 9×9 grid with digits so that each column, each row, and each of the nine 3×3 subgrids that compose the grid contain all of the digits from 1 to 9.



101.8 Desktop Screen Shot Application



101.9 Text To Speech Application



101.10 RingRayLib Extension

Ring 1.11 comes with new extension to support the RayLib game programming library

Example:

```
load "raylib.ring"

screenWidth      = 800
screenHeight     = 450

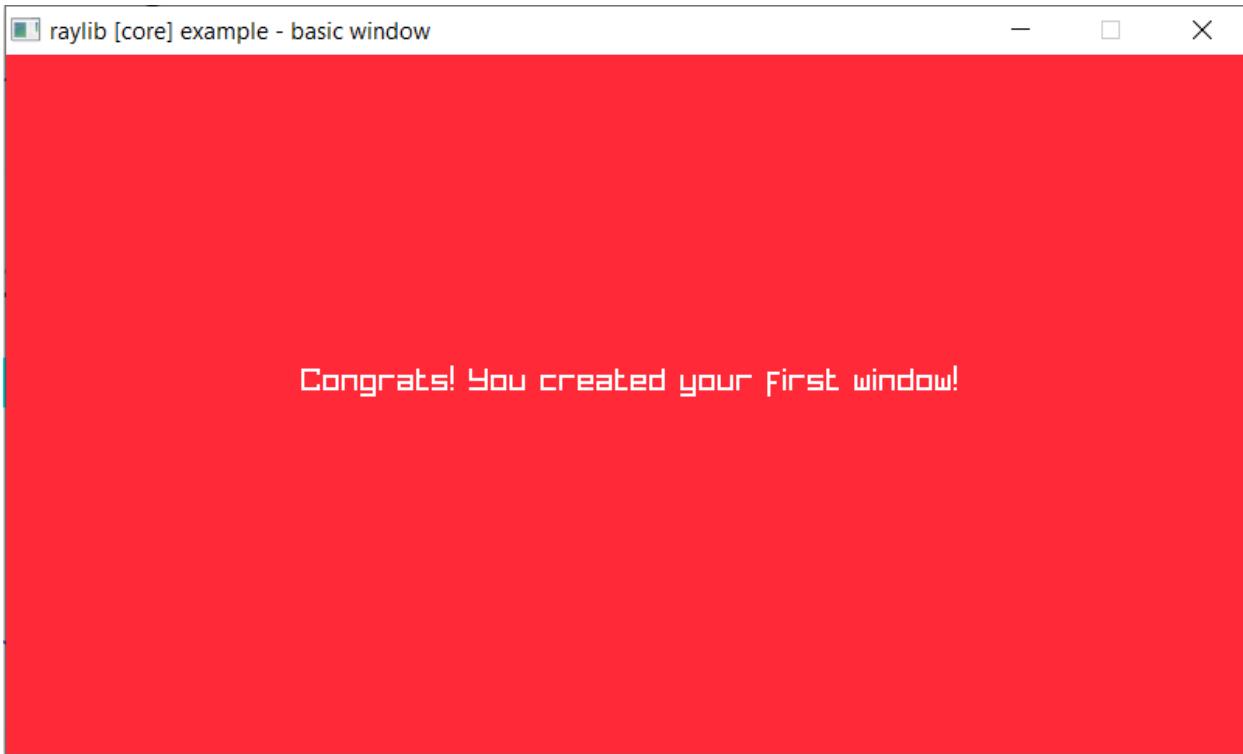
InitWindow(screenWidth, screenHeight, "raylib [core] example - basic window")

SetTargetFPS(60)

while !WindowShouldClose()
    BeginDrawing()
    ClearBackground(RED)
    DrawText("Congrats! You created your first window!", 190, 200, 20, WHITE)
    EndDrawing()

CloseWindow()
```

Output:



Example:

```
load "raylib.ring"

screenWidth = 800
```

(continues on next page)

(continued from previous page)

```

screenHeight = 450

InitWindow(screenWidth, screenHeight, "raylib [shapes] example - basic shapes drawing
→")

SetTargetFPS(60)

while !WindowShouldClose()

    BeginDrawing()

        ClearBackground(RAYWHITE)

        DrawText("some basic shapes available on raylib", 20, 20, 20, DARKGRAY)
        DrawCircle(screenWidth/4, 120, 35, DARKBLUE)
        DrawRectangle(screenWidth/4*2 - 60, 100, 120, 60, RED)
        DrawRectangleLines(screenWidth/4*2 - 40, 320, 80, 60, ORANGE)
        DrawRectangleGradientH(screenWidth/4*2 - 90, 170, 180, 130, MAROON, GOLD)

        DrawTriangle(Vector2(screenWidth/4*3, 80),
                    Vector2(screenWidth/4*3 - 60, 150),
                    Vector2(screenWidth/4*3 + 60, 150), VIOLET)

        DrawPoly(Vector2(screenWidth/4*3, 320), 6, 80, 0, BROWN)

        DrawCircleGradient(screenWidth/4, 220, 60, GREEN, SKYBLUE)

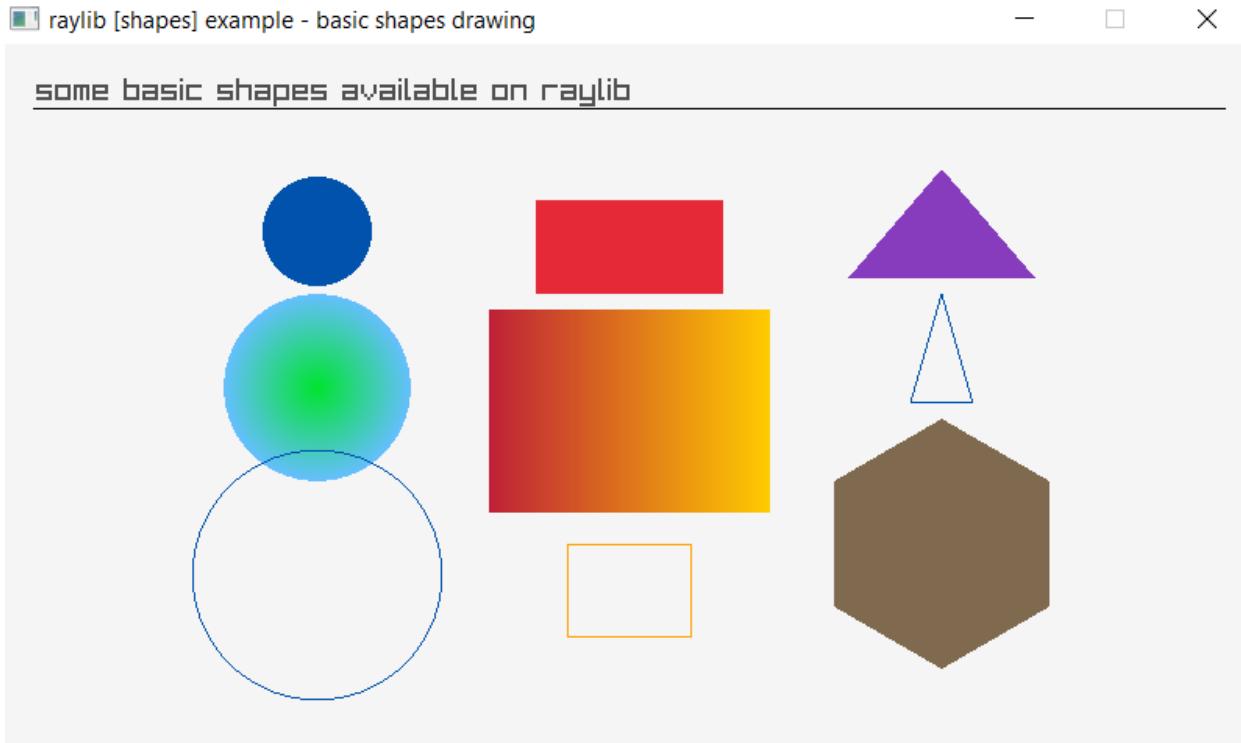
        DrawLine(18, 42, screenWidth - 18, 42, BLACK)
        DrawCircleLines(screenWidth/4, 340, 80, DARKBLUE)
        DrawTriangleLines(Vector2(screenWidth/4*3, 160),
                          Vector2(screenWidth/4*3 - 20, 230),
                          Vector2(screenWidth/4*3 + 20, 230), DARKBLUE)
        EndDrawing()

end

CloseWindow()

```

Output:



101.11 ZeroLib Library

Ring 1.11 comes with the ZeroLib library that contains classes for Lists and Strings where the index starts from 0.

Example:

```
load "zerolib.ring"

? "Using List - Index start from 0"
List = Z( [1,2,3] )
List.Add(4)
List.Add(5)
? List[0]
? List[1]
? List[2]
? List[3]
? List[4]
nIndex = List.find(2)
? "Find(2) = " + nIndex
List.delete(0)
? "After deleting the first item : List[0]"
? "Now List[0] = " + List[0]

? "Using String - Index start from 0"
String = Z( "Welcome" )
? String[0]
? String[1]
? String[2]
? String[3]
```

(continues on next page)

(continued from previous page)

```
? String[4]
? String[5]
? String[6]
```

Output:

```
Using List - Index start from 0
1
2
3
4
5
Find(2) = 1
After deleting the first item : List[0]
Now List[0] = 2
Using String - Index start from 0
W
e
l
c
o
m
e
```

101.12 StdLib - More Functions

The next functions are added to the StdLib

- IsListContainsItems(aParent,aChild)
- IsBetween(nNumber,nMin,nMax)
- TimeInfo(cInformation)

Example:

```
load "stdlibcore.ring"
? "Using the IsListContainsItems() function"
aList1 = "a":"z"
aList2 = [:h,:l,:p,:u]
? IsListContainsItems(aList1,aList2)
? "Using the IsBetween() function"
? isBetween(1,3,4)
? isBetween(4,1,6)
? "Using the TimeInfo() function"
? timeInfo(:date)
? timeInfo(:year)
? timeInfo(:time)
? timeInfo(:hour_12)
```

Output:

```
Using the IsListContainsItems() function
1
Using the IsBetween() function
```

(continues on next page)

(continued from previous page)

```
0
1
Using the TimeInfo() function
05/24/19
2019
15:30:33
03
```

For more information about these functions, see the StdLib functions chapter.

101.13 Better RingQt

- Building RingQt using Qt 5.12.3
- RingQt for Android - project file is updated to include webview module when we have it
- QString Class - New Methods
 - compare()
 - contains()
 - indexOf()
 - insert()
 - isRightToLeft()
 - remove()
 - repeated()
 - replace()
 - startsWith()
 - endsWith()
 - toHtmlEscaped()
 - clear()
 - isnull()
 - resize()
 - fill()
- QAxBase & QVariant - Better API
- The next classes are added to RingQt
 - QQuickView Class
 - QPrintDialog Class
 - QAxWidget2 Class
 - QTextToSpeech Class
 - QGraphicsView Class
 - QAbstractAspect Class
 - QNode Class

- QEntity Class
- QTransform Class
- QAspectEngine Class
- QTorusMesh Class
- QConeMesh Class
- QCylinderMesh Class
- QCuboidMesh Class
- QPlaneMesh Class
- QSphereMesh Class
- QPhongMaterial Class
- QForwardRenderer Class
- Qt3DWindow Class
- QAbstractCameraController Class
- QFirstPersonCameraController Class
- QTextureMaterial Class
- QExtrudedTextMesh Class
- QText2DEntity Class
- QSkyBoxEntity Class
- QConeGeometry Class
- QOrbitCameraController Class
- QDiffuseSpecularMaterial Class
- QGoochMaterial Class
- QMetalroughMaterial Class
- MorphPhongMaterial Class
- QPervertexColorMaterial Class
- QInputAspect Class
- QFrameAction Class
- QLogicAspect Class
- QCamera Class
- QCameraLens Class
- QMesh Class
- QTechnique Class
- QMaterial Class
- QEffect Class
- QRenderPass Class
- QSceneLoader Class

- QPointLight Class
- QRenderAspect Class
- QTextureLoader Class
- QObjectPicker Class
- QCameraSelector Class
- QCullFace Class
- QDepthTest Class
- QViewPort Class

101.14 Better Performance

Ring 1.11 is faster than Ring 1.10

The performance gain is between 10% and 30% based on the application.

101.15 Better Documentation

The next chapters are added to the documentation

- Tutorial : Ring Extensions in C/C++
- Using Qt3D
- Using ZeroLib
- Using RingRayLib

101.16 More Improvements

- New Samples
 - samples/other/ModuloTimesTableCircle folder
 - samples/other/saveimage folder
 - samples/other/UsingQML folder
 - samples/other/myguicontrol.ring
 - samples/other/qcalendarwidget.ring
 - samples/other/qcalendarwidget2.ring
 - samples/other/sudoku-KL02.ring
 - samples/other/sudoku-KL02-longproblem.ring
 - samples/other/zerobasedlist.ring
 - ringlibs/gameengine/lesson17.ring (Using Buttons)
 - samples/other/SQLTutorial/SQL-Tutorial.ring
 - samples/other/DrawFourier/AA-Draw-Fourier.ring

- samples/other/SmartPhoneEmulator/ejemploKey.ring
- samples/other/DiscreteFourierTransform/DiscreteFourierTransform.ring
- samples/other/phonedatabase/PhoneDatabase.ring
- Gold Magic 800 - More levels (44 Levels)
- Fifteen Puzzle Game 3D - Better Code (Animation Speed)
- Flappy Bird 3000 - change the Bird direction to be looking down when we have game over
- Ring Notepad - Keyboard shortcuts for the Dockable Windows Mode
- Ring Notepad - When displaying functions list, don't avoid functions that contains the “_” character
- Ring Notepad - Output Window - Send Data - Better Code
- Ring Notepad - Find and Replace Window - Better Code
- Ring Notepad - Edit Menu - Insert Text Window
- Ring Notepad - Edit Menu - Lower Case and Upper Case options
- Ring Notepad - Edit Menu - Capitalize option
- Ring Notepad - Edit Menu - Comment Lines and Comment Block of lines
- Ring Notepad - File Tabs - Context Menu (Close other files, Close Active file and Close All files)
- RingPM - When updating a package - don't reinstall the dependency again
- Ring Game Engine for 2D Games - Added : GE_FULLSCREEN, GE_SCREEN_W and GE_SCREEN_H
- Ring Game Engine for 2D Games - Added : name property to game objects
- Ring Game Engine for 2D Games - Added : find() method to game class (find an object by name)
- Ring Game Engine for 2D Games - Support oGame[:ObjectName] to access an object
- Natural Library - Better Performance
- FoxRing - Added: frCTOD() function
- Code generator for extensions - generate functions that use managed pointers to new structures
- Ring VM - Error codes for Ring Object File errors
- Ring VM - Eval() function - Better Code (Better Performance)
- Ring VM - State Management - Better Code
- Ring VM - the “>” operator and operator overloading - Better Code
- Ring VM - Assignment and calling object methods - Better Code
- Ring VM - OOP - Getter Methods - Better Performance
- Ring API - Supporting RING_API_ISLIST() in C Extensions
- Ring Compiler - Supporting new lines after numbers and literals when writing conditions
- Ring Compiler - Supporting semi-colon (;) in the start of the line
- Ring Compiler - Prevent using Loop and Exit commands from outside loops

WHAT IS NEW IN RING 1.12?

In this chapter we will learn about the changes and new features in Ring 1.12 release.

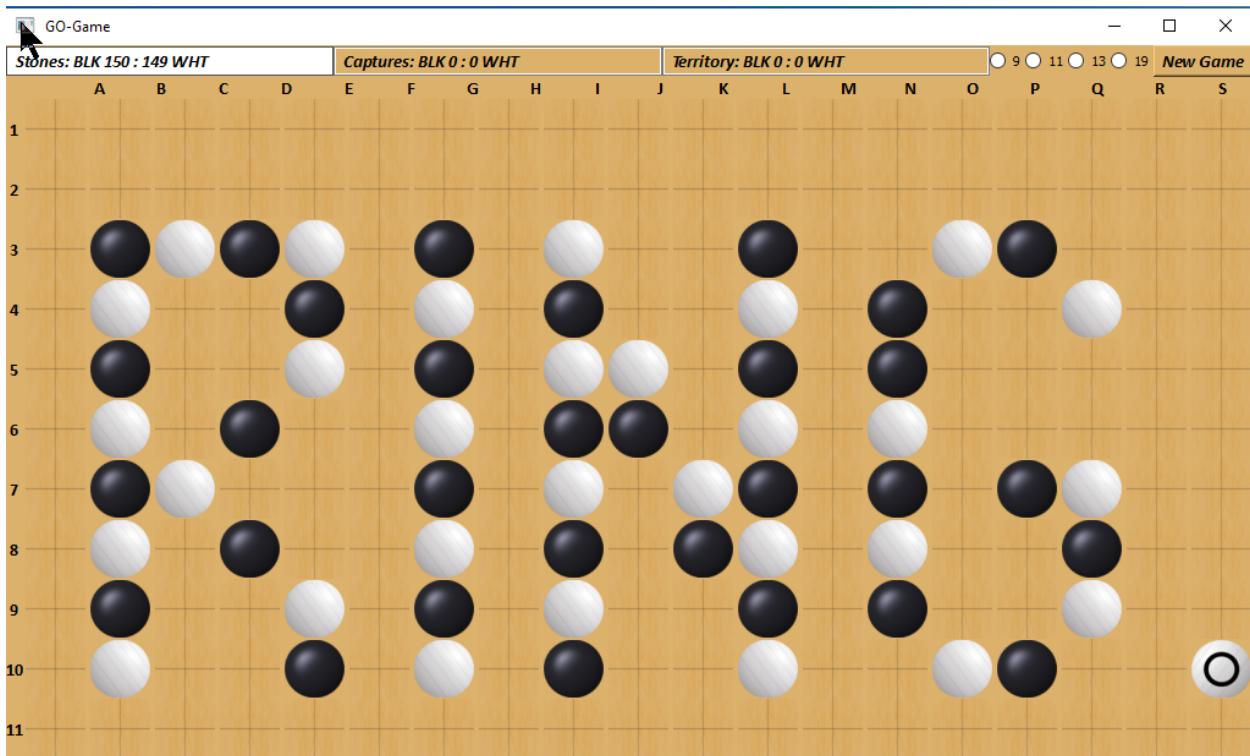
102.1 List of changes and new features

Ring 1.12 comes with the next features!

- Go Game
- ASCII Table application
- BMI Calculator application
- Calendar application
- Julian Day Calendar application
- Tutorial: Number to Words
- Load Again Command
- `ring_state_filetokens()` function
- Embedded Ring Object File
- Better RingRayLib
- More Improvements

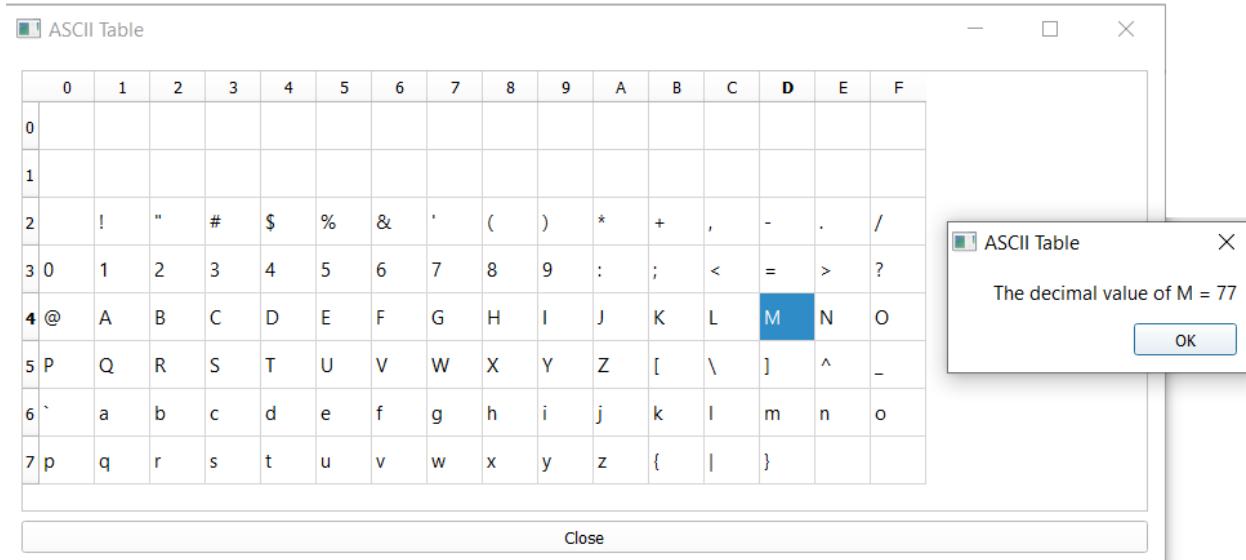
102.2 Go Game

An implementation for the Go Game



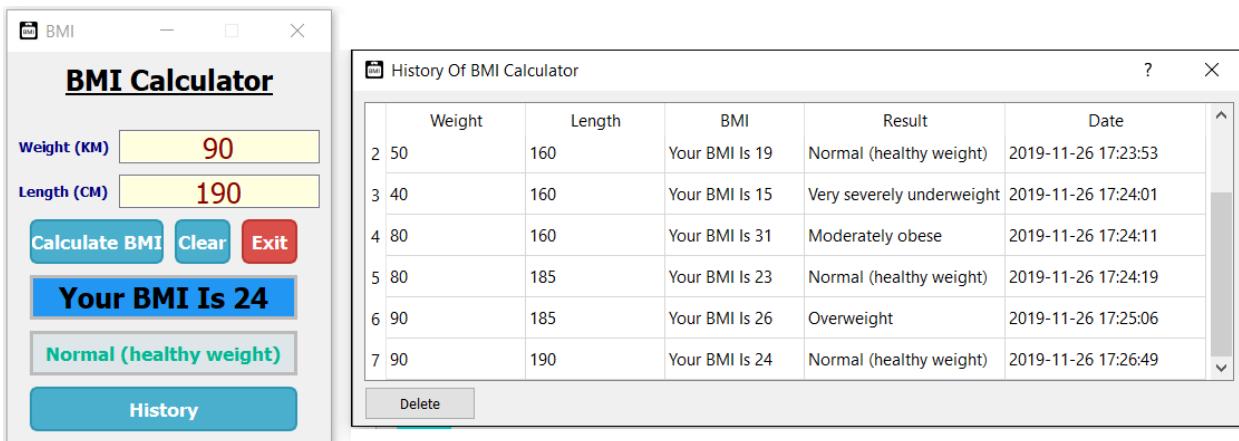
102.3 ASCII Table application

Simple application for displaying the ASCII table



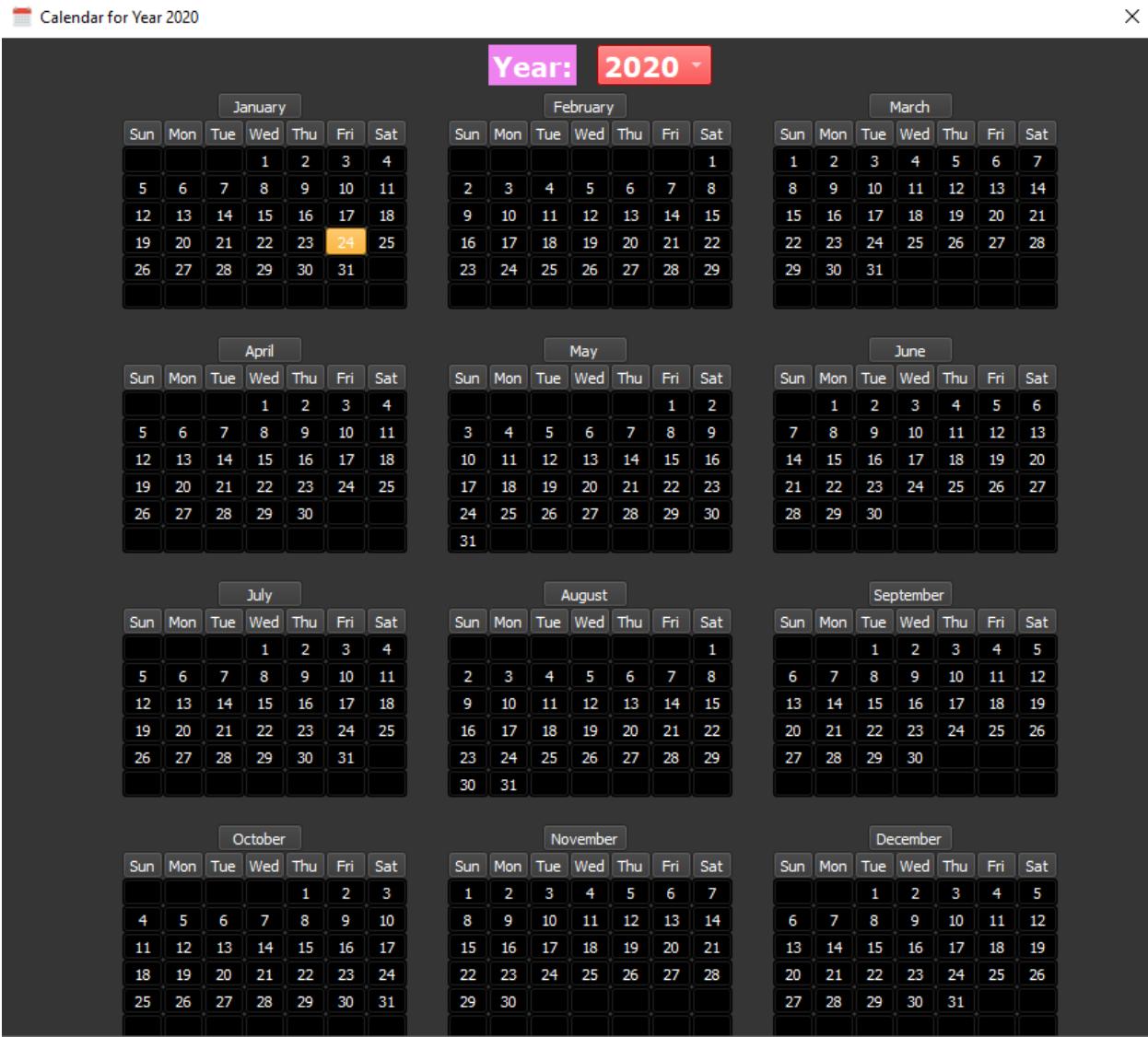
102.4 BMI Calculator application

Simple application for calculating the BMI



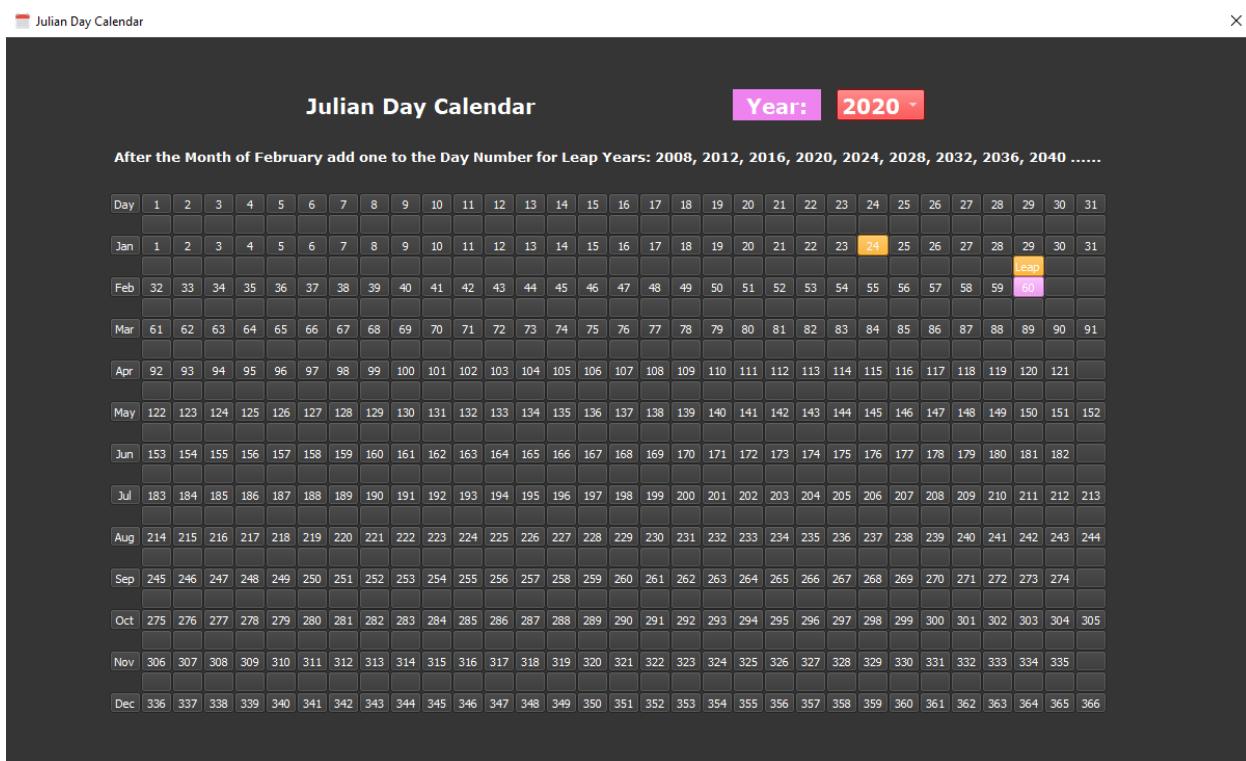
102.5 Calendar application

The Calendar for Year 2020



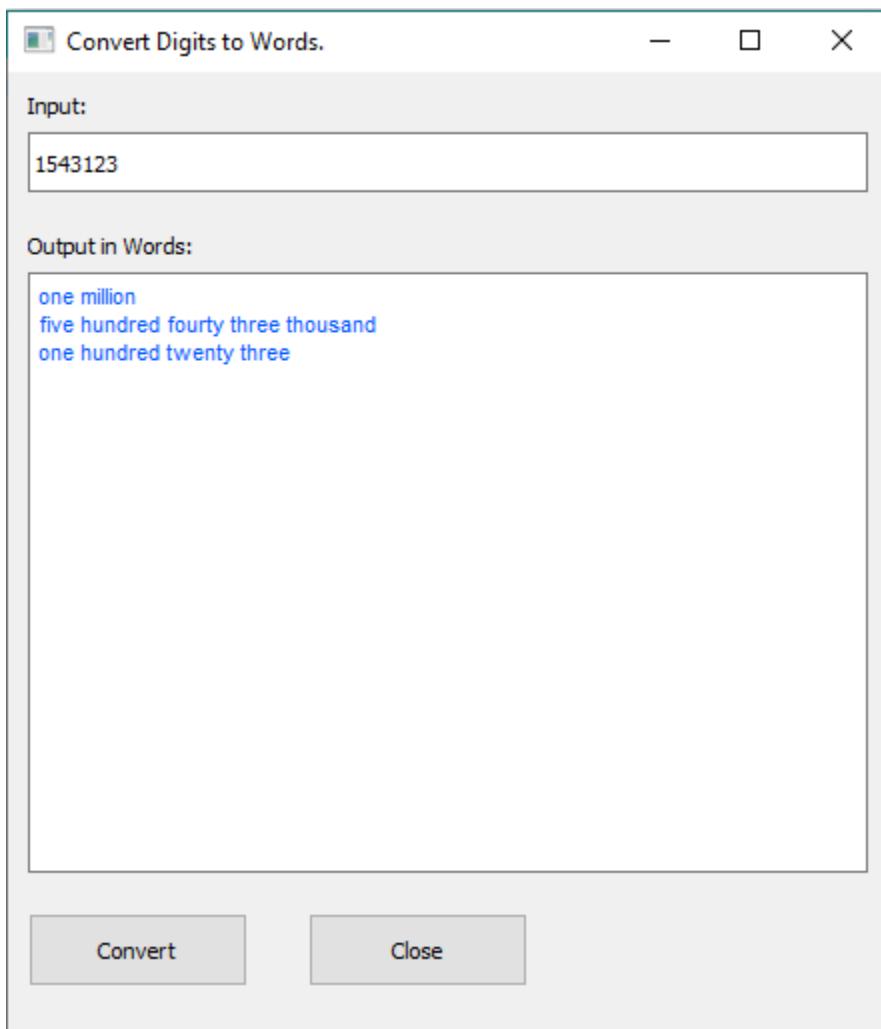
102.6 Julian Day Calendar application

The Julian Day Calendar application



102.7 Tutorial: Number to Words

Folder : ring/samples/other/number2words



102.8 Load Again Command

Ring 1.12 comes with the Load Again command

Using this command we can load the Ring source file which contains constants more than one time.

This is useful when using Ring source files for translations through global constants.

Example:

The next function is part from a project which support Arabic and English languages

The files english.ring and arabic.ring contains constants for translation

One of these files is loaded in the start of the program

Loading the same file again using the (Load) command is not possible

Because the (Load) command load the same source file only for the first time and ignore next times.

So we have to use the (Load Again) command.

Where we can use these files again during the runtime as in the next code

```

func setLang nLanguage
    if C_ENV_DEFAULT_LANG = nLanguage
        return
    ok
    C_ENV_DEFAULT_LANG = nLanguage
    # Change the language
    switch nLanguage
        on C_TRANSLATION_ENGLISH
            load again "translation/english.ring"
        on C_TRANSLATION_ARABIC
            load again "translation/arabic.ring"
    off

```

102.9 ring_state_filetokens() function

Using the ring_state_filetokens() function we can get all the tokens in the ring source code file.

```

C_FILENAME      = "test_tokens.ring"
C_WIDTH         = 12

# write the file
    write(C_FILENAME, '
        see "Hello, World!"
        ? 3*2+3
        Name = "Ring"
        ? Name
    ')

# Token Type
C_KEYWORD       = 0
C_OPERATOR      = 1
C_LITERAL       = 2
C_NUMBER        = 3
C_IDENTIFIER    = 4
C_ENDLINE       = 5

# Keywords List
aKEYWORDS = ["IF", "TO", "OR", "AND", "NOT", "FOR", "NEW", "FUNC",
"FROM", "NEXT", "LOAD", "ELSE", "SEE", "WHILE", "OK", "CLASS", "RETURN", "BUT",
"END", "GIVE", "BYE", "EXIT", "TRY", "CATCH", "DONE", "SWITCH", "ON", "OTHER", "OFF",
"IN", "LOOP", "PACKAGE", "IMPORT", "PRIVATE", "STEP", "DO", "AGAIN", "CALL", "ELSEIF",
"PUT", "GET", "CASE", "DEF", "ENDFUNC", "ENDCLASS", "ENDPACKAGE",
"CHANGERINGKEYWORD", "CHANGERINGOPERATOR", "LOADSYNTAX"]

pState = ring_state_new()
aList = ring_state_filetokens(pState, C_FILENAME)
PrintTokens(aList)
ring_state_delete(pState)

func PrintTokens aList
    for aToken in aList
        switch aToken[1]
        on C_KEYWORD
            ? Width("Keyword", C_WIDTH) + ":" + aKeywords[0+aToken[2]]
        on C_OPERATOR

```

(continues on next page)

(continued from previous page)

```

        ? Width("Operator",C_WIDTH) + ":" + aToken[2]
on C_LITERAL
        ? Width("Literal",C_WIDTH) + ":" + aToken[2]
on C_NUMBER
        ? Width("Number",C_WIDTH) + ":" + aToken[2]
on C_IDENTIFIER
        ? Width("Identifier",C_WIDTH) + ":" + aToken[2]
on C_ENDLINE
        ? "EndLine"
off
next

func Width cText,nWidth
    return cText+copy(" ",nWidth-len(cText))

```

Output:

```

EndLine
Keyword : SEE
Literal : Hello, World!
EndLine
Operator : ?
Number : 3
Operator : *
Number : 2
Operator : +
Number : 3
EndLine
Identifier : name
Operator : =
Literal : Ring
EndLine
Operator : ?
Identifier : name
EndLine

```

102.10 Generate Embedded Ring Object File

We can generate embedded object file (C source code) from the source code file (*.ring) using -geo option

Command:

```
ring test.ring -geo
```

This command will generate at least three files

```
test.c
ringappcode.c
ringappcode.h
```

More files could be generated based on the project size

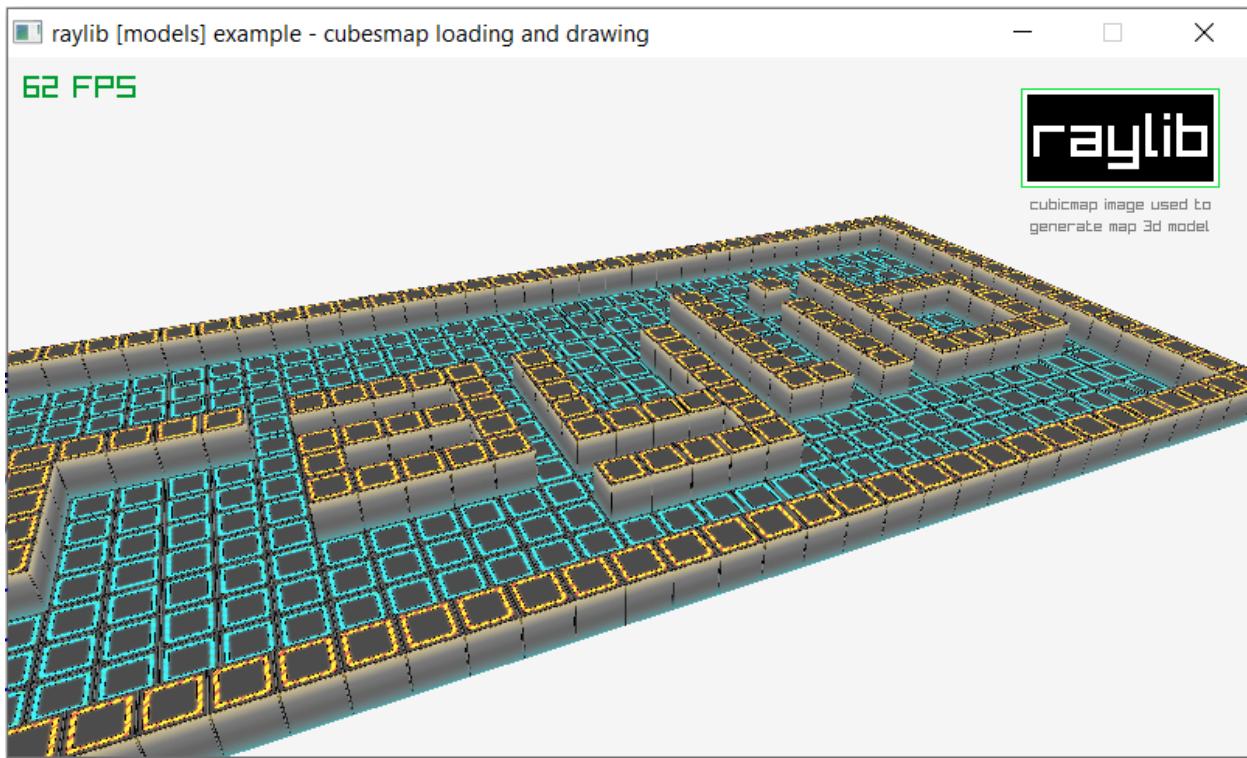
The generated files will pass the byte code to Ring VM to be executed

102.11 Better RingRayLib

More Samples are added to RingRayLib

- Sound Loading Playing
- Texture Source
- Music Playing Streaming
- Rectangle scaling
- Colors Palette
- Following Eyes
- Collision Area
- Bezier Lines
- Images Generation
- Fifteen Puzzle Game
- Cubic Map

Screen Shot:



102.12 More Improvements

- **New Samples**

- ring/samples/other/Hex2UTF8.ring
- ring/samples/other/CalmoSoftPrimesTable.ring
- ring/samples/other/CalmoSoftTicTacToeGame.ring
- ring/samples/other/CalmoSoftSimpleGoGame.ring
- ring/samples/other/arabicmysql.ring
- ring/samples/other/CalmoSoftExtraCube.ring
- ring/samples/other/DynamicCode/anonfunc.ring
- ring/samples/other/DynamicCode/deletethisfile.ring
- ring/samples/other/DynamicCode/modifythisfile.ring
- ring/samples/other/changesyntax/ArabicDemo.ring
- ring/samples/other/changesyntax/EnglishDemo.ring
- ring/samples/other/changesyntax/ChangeKeywordsArabic.ring
- ring/samples/other/changesyntax/ChangeKeywordsEnglish.ring
- ring/samples/other/changesyntax/pascal.ring
- ring/samples/other/hijridate.ring

- Ring Notepad - Project Files - set minimum width based on desktop screen width
- Ring Notepad - Output Window - Move the Cursor to the end of text
- Ring Notepad - Output Window - Correct displaying for line breaks
- Form Designer - Better Style - Controls colors and size
- VideoMusicPlayer is updated to work as expected after RingQt update
- FlappyBird3000 - Fast response on Android
- Snake Game : Change the default window size (800x600)
- Maze Game : Change the default window size (800x600)
- Maze Game : Move the camera with the player
- Maze Game : Restarting the game will hide the (You Win) message
- Game Engine : display error message when we can't create the game window
- Ring Tests : Added File build.sh for building on Linux and macOS
- RingQt : Updated to Qt 5.12.6
- RingQt : Added QQMLEngine class
- RingQt : Added files for building RingQt without Bluetooth support
- RingQt : The size of the events code is changed from 100 characters to 200 characters
- RingQt : Correct links for Qt documentation in RingQt classes chapter
- RingQt for Android : Better code for executing the ring object file (ringo)

- Ring2EXE configuration files are updated for RingQt to correctly distribute RingQt apps
- Code Generator : Convert function names to lower case when generating the functions for structures
- OSCopyFolder() function is updated to copy the files in sub folders too
- fgetpos() function is updated to work as expected
- IsFunction() function is updated to be not case sensitive
- Space() function is updated to clear the output string with spaces
- Ring Compiler : Added file buildclang.bat for building on Windows using Clang compiler
- Ring VM - Internal hash function is updated
- Ring VM - Better Code for setting pVM->a SetProperty when creating new objects
- Ring VM - Better Code for state management

WHAT IS NEW IN RING 1.13?

In this chapter we will learn about the changes and new features in Ring 1.13 release.

103.1 List of changes and new features

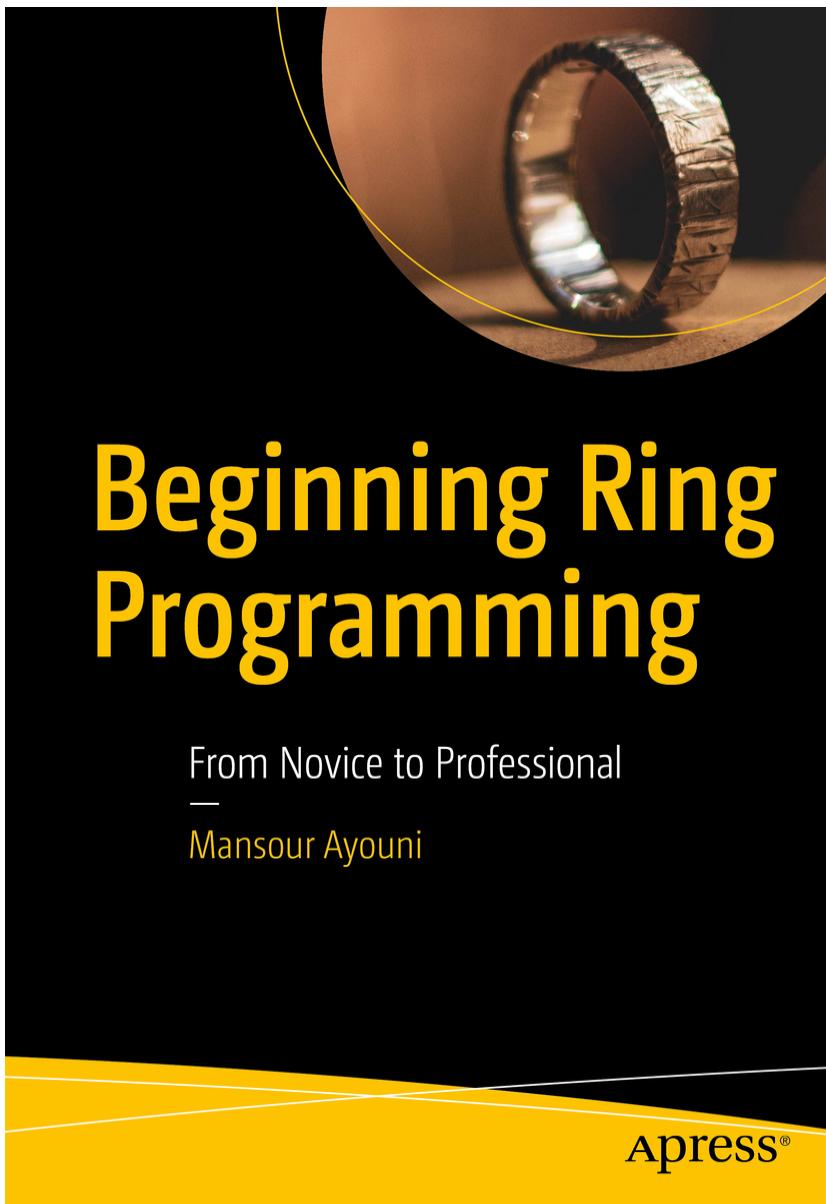
Ring 1.13 comes with the next features!

- New Book by Apress
- Ring For WebAssembly
- Better Threads Support
- Laser Game
- Magic Balls Game
- MoneyBoxes Game
- Matching Game
- Pairs Game
- Word Game
- Tetris Game
- Escape Game
- Hassouna Course Samples
- Ring support in SpaceVim
- Better RingQt
- Better RingRayLib
- RingStbImage Extension
- More Low Level Functions
- Better Organization
- More Improvements

103.2 New Book by Apress

Apress: Beginning Ring Programming (From Novice to Professional)

URL: <https://www.apress.com/gp/book/9781484258323>



Gain a gentle introduction to the world of Ring programming with clarity as a first concern using a lot of practical examples.

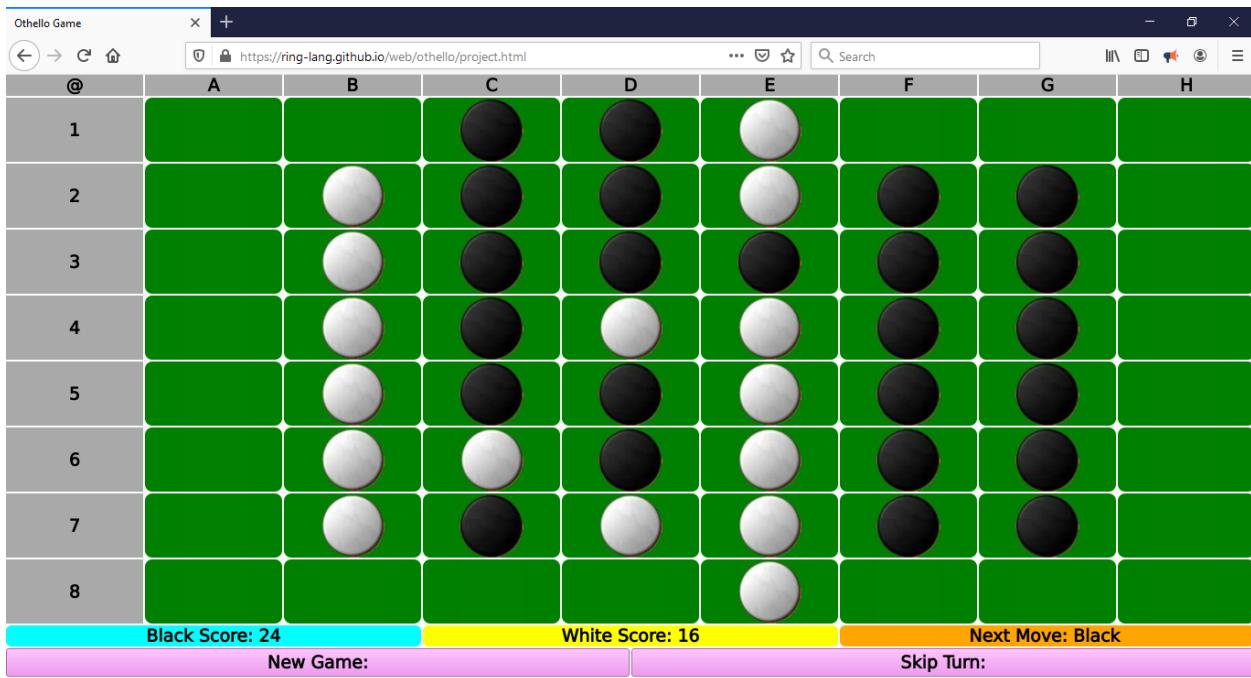
What You Will Learn

- Get started with Ring and master its data types, I/O, functions, and classes
- Carry out structural, object-oriented, functional, declarative, natural, and meta programming in Ring
- Use the full power of Ring to refactor program code and develop clean program architectures
- Quickly design professional-grade video games on top of the Ring game engine

103.3 Ring for WebAssembly

Ring support distributing applications for WebAssembly (Using Qt for WebAssembly)

- Hello World : <https://ring-lang.github.io/web/helloworld/project.html>
- Matching Game : <https://ring-lang.github.io/web/matching/project.html>
- Pairs Game : <https://ring-lang.github.io/web/pairs/project.html>
- Othello Game : <https://ring-lang.github.io/web/othello/project.html>
- Game of Life : <https://ring-lang.github.io/web/gameoflife/project.html>
- Online Form Designer : <https://ring-lang.github.io/web/formdesigner/project.html>



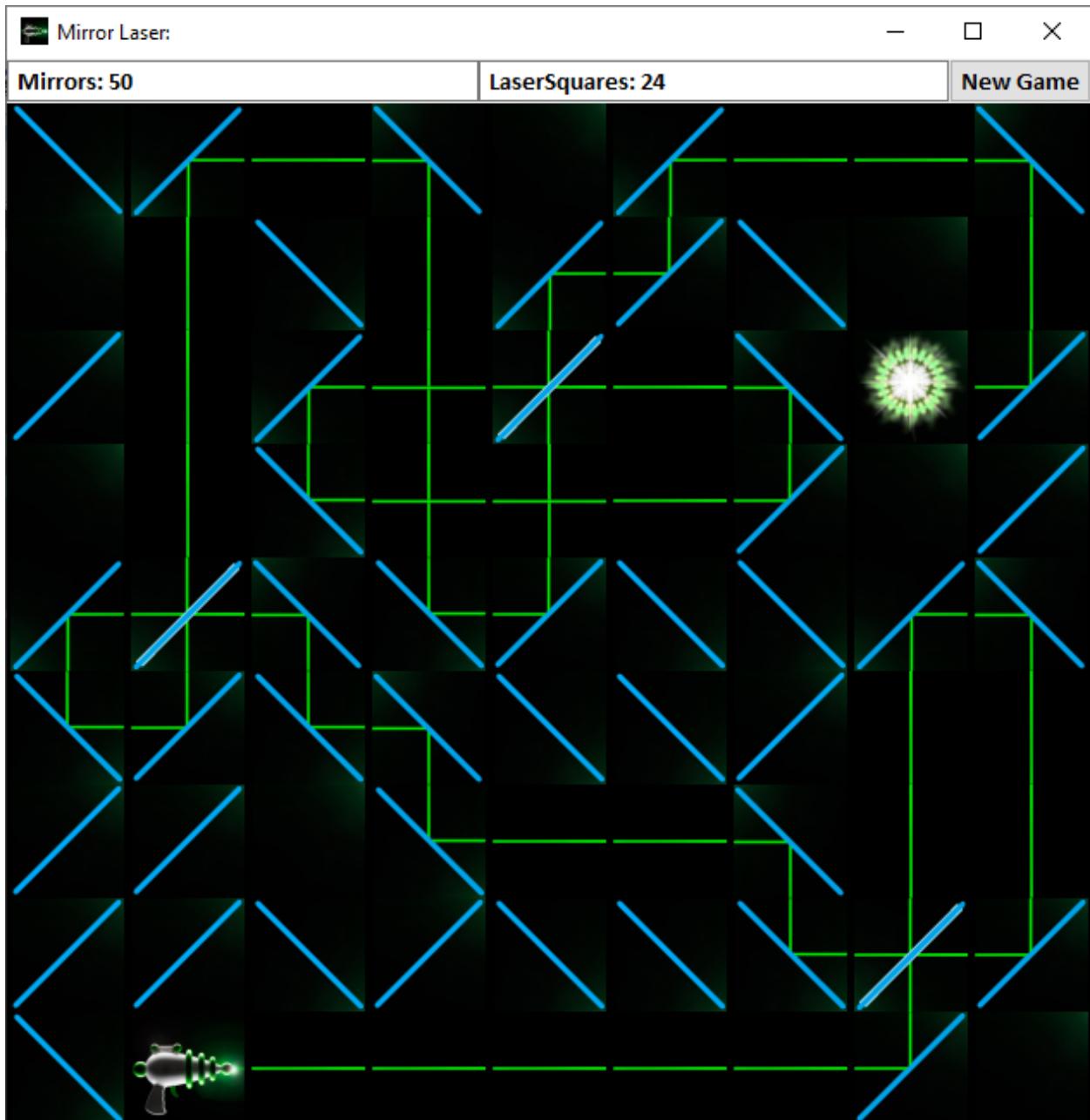
103.4 Better Threads Support

Ring 1.13 provides better support for threads

- (1) Ring VM is updated to use a memory pool for each thread (Faster)
- (2) More tests for RingAllegro threads functions
- (3) RingLibUV is updated to be thread safe when using callback functions

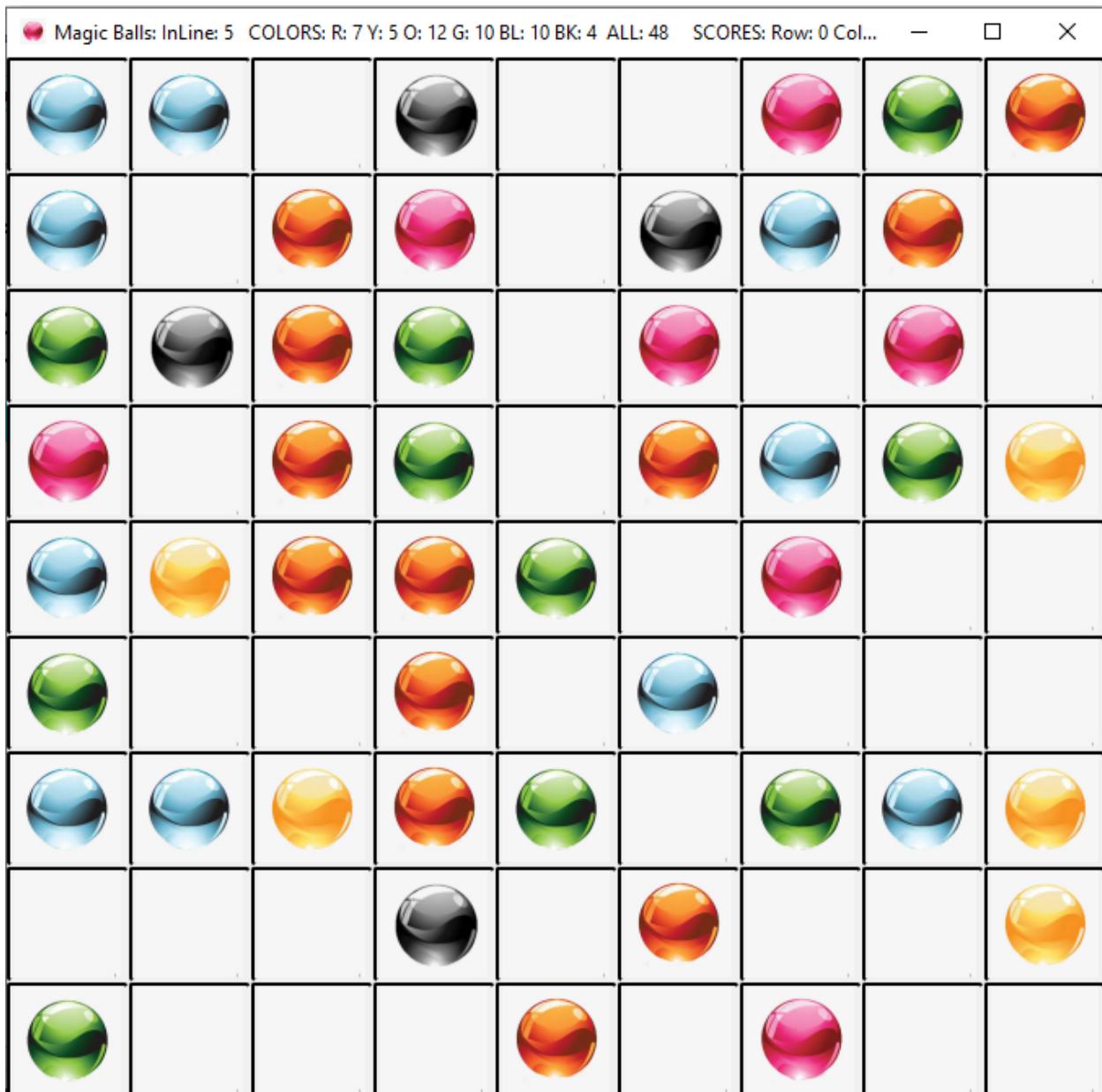
103.5 Laser Game

An implementation for the Laser Game



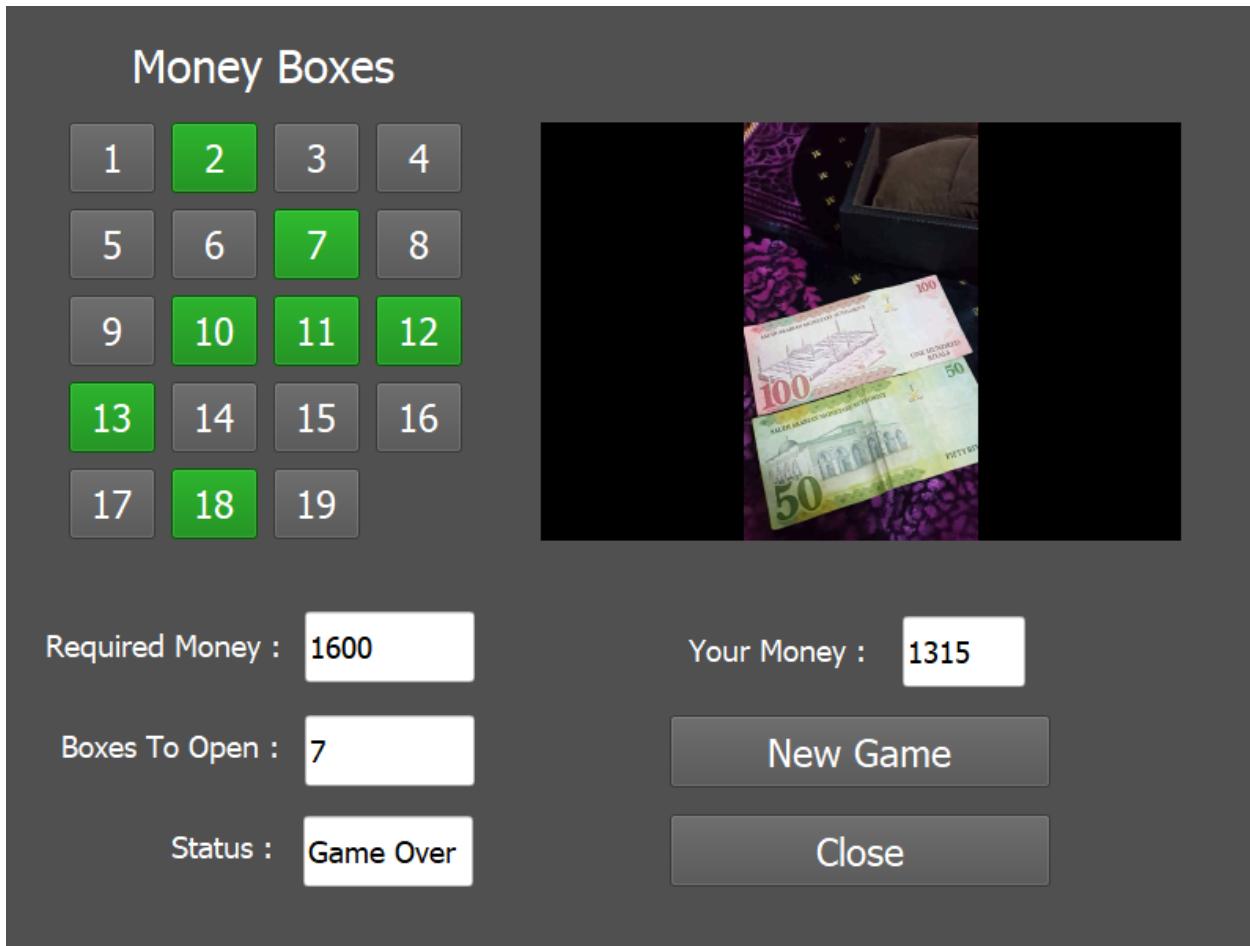
103.6 Magic Balls Game

An implementation for the Magic Balls Game



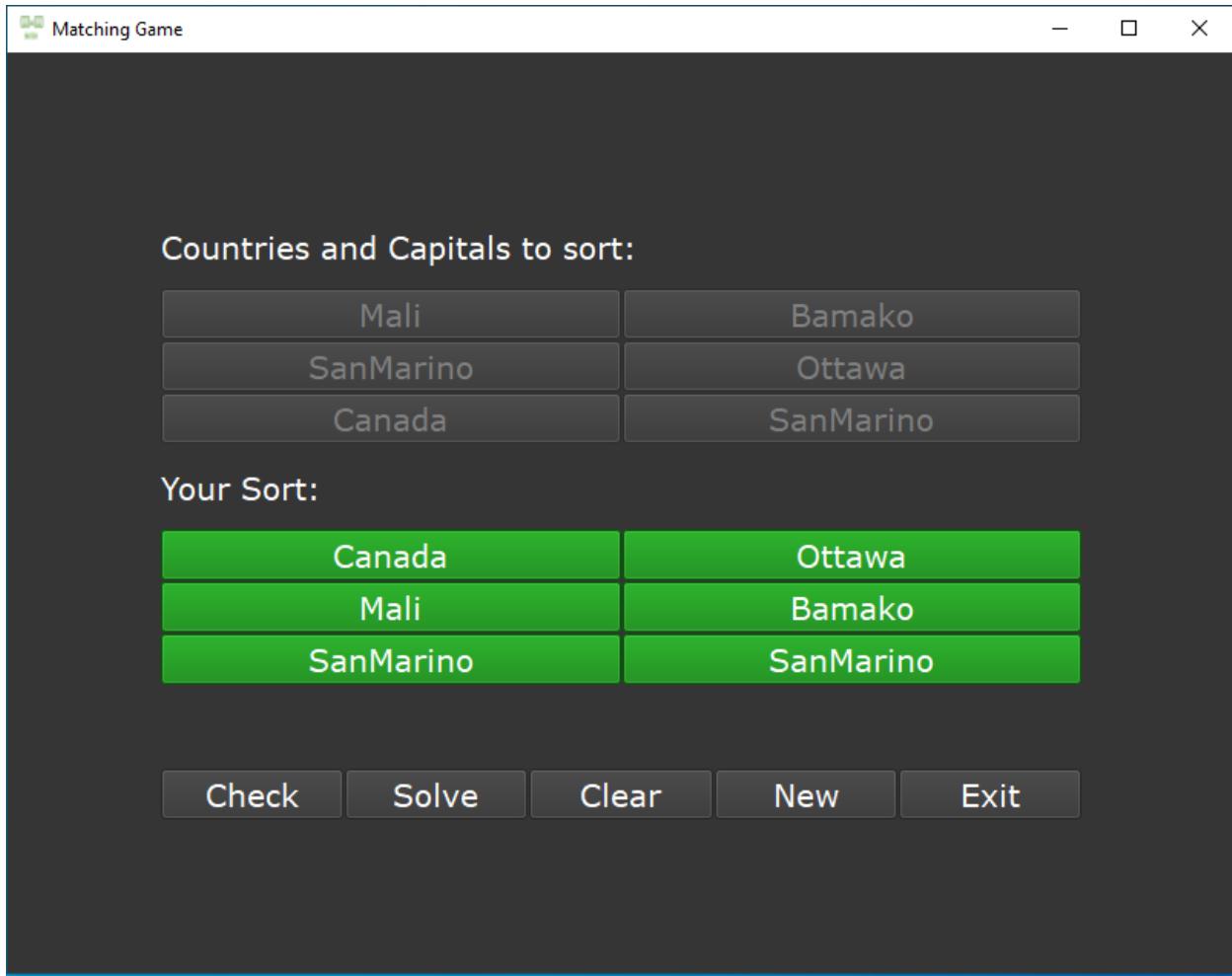
103.7 Money Boxes Game

See if you can collect the required amount of money by opening boxes!



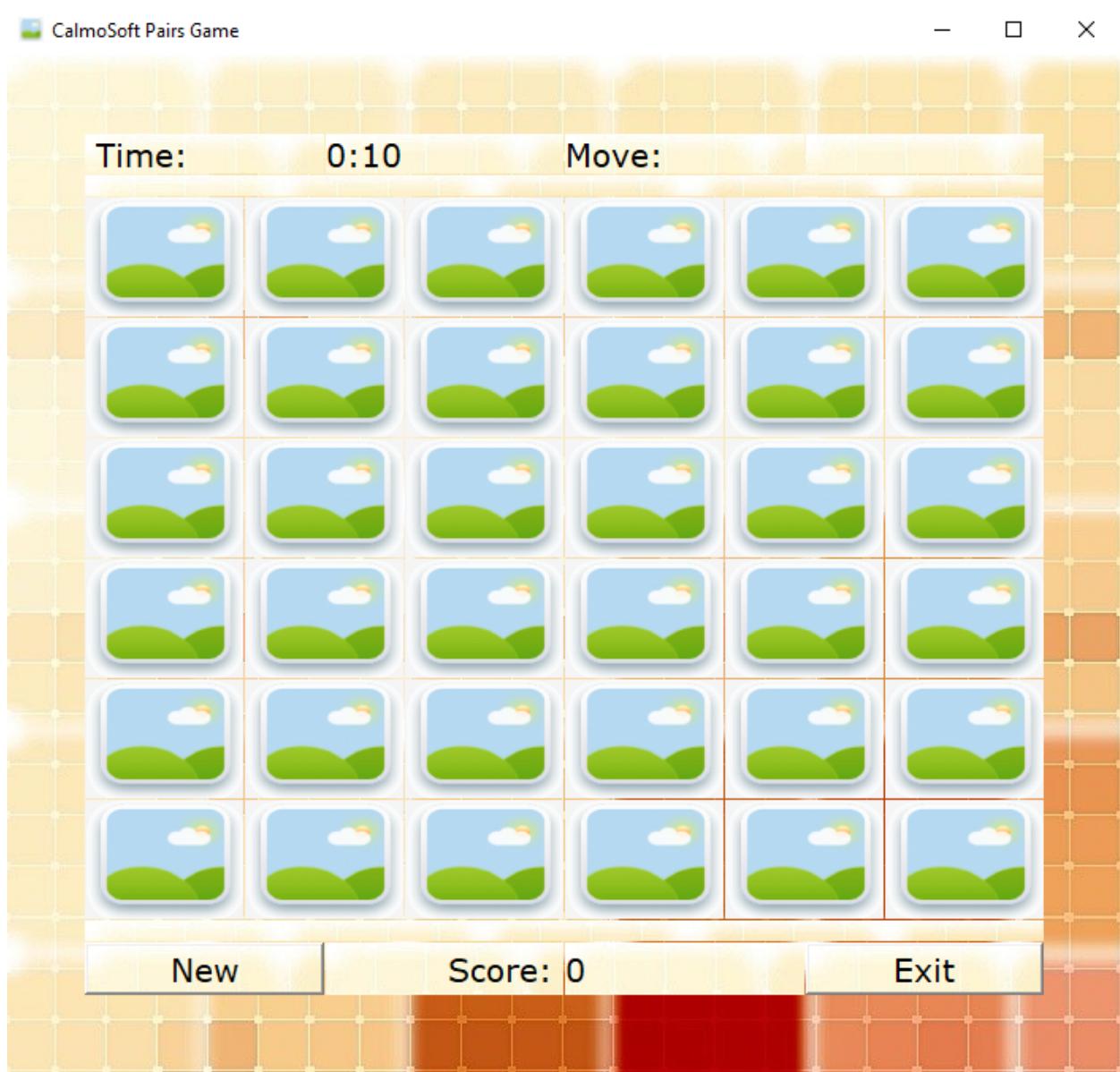
103.8 Matching Game

An implementation for the Matching Game



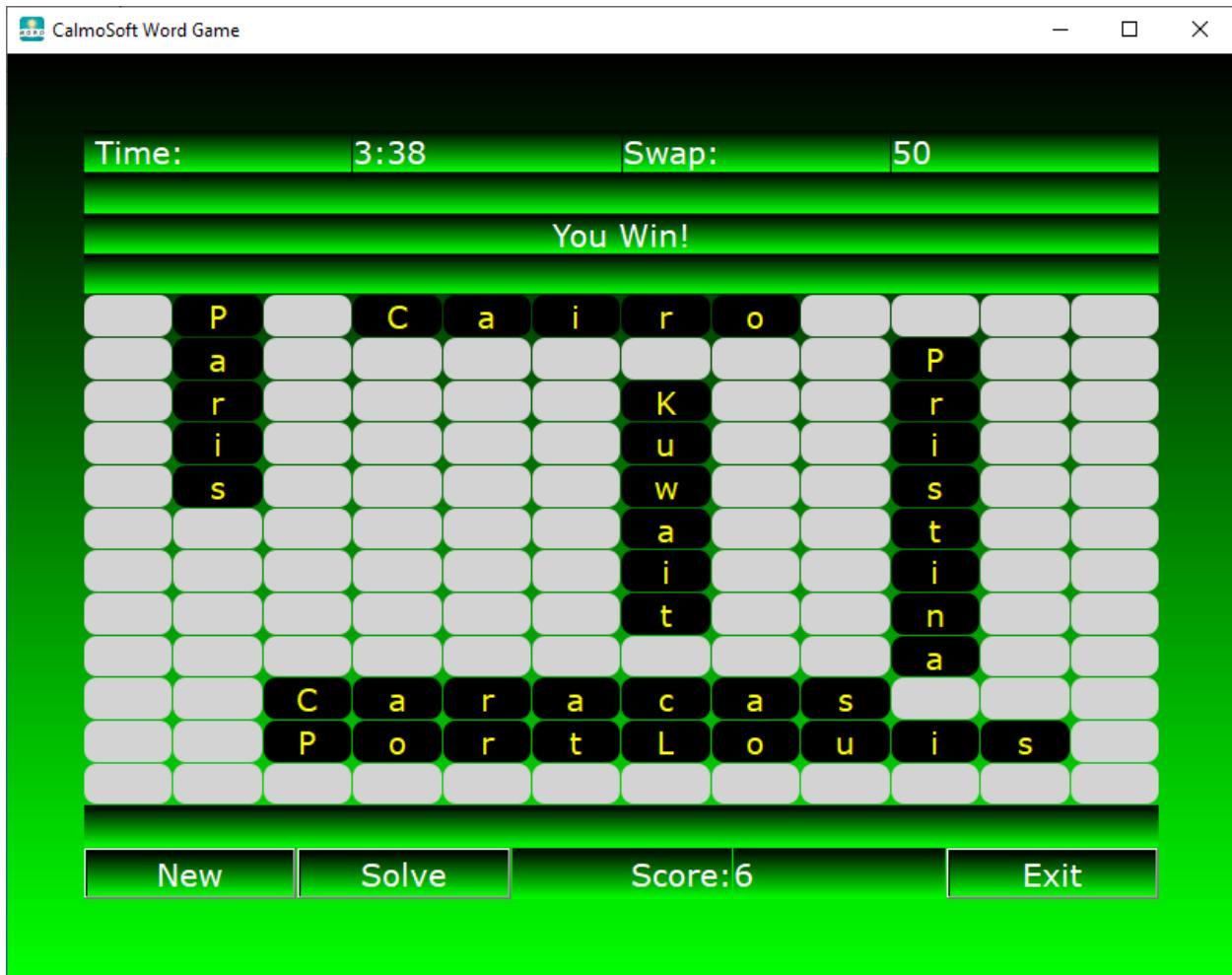
103.9 Pairs Game

An implementation for the Pairs Game



103.10 Word Game

An implementation for the Word Game

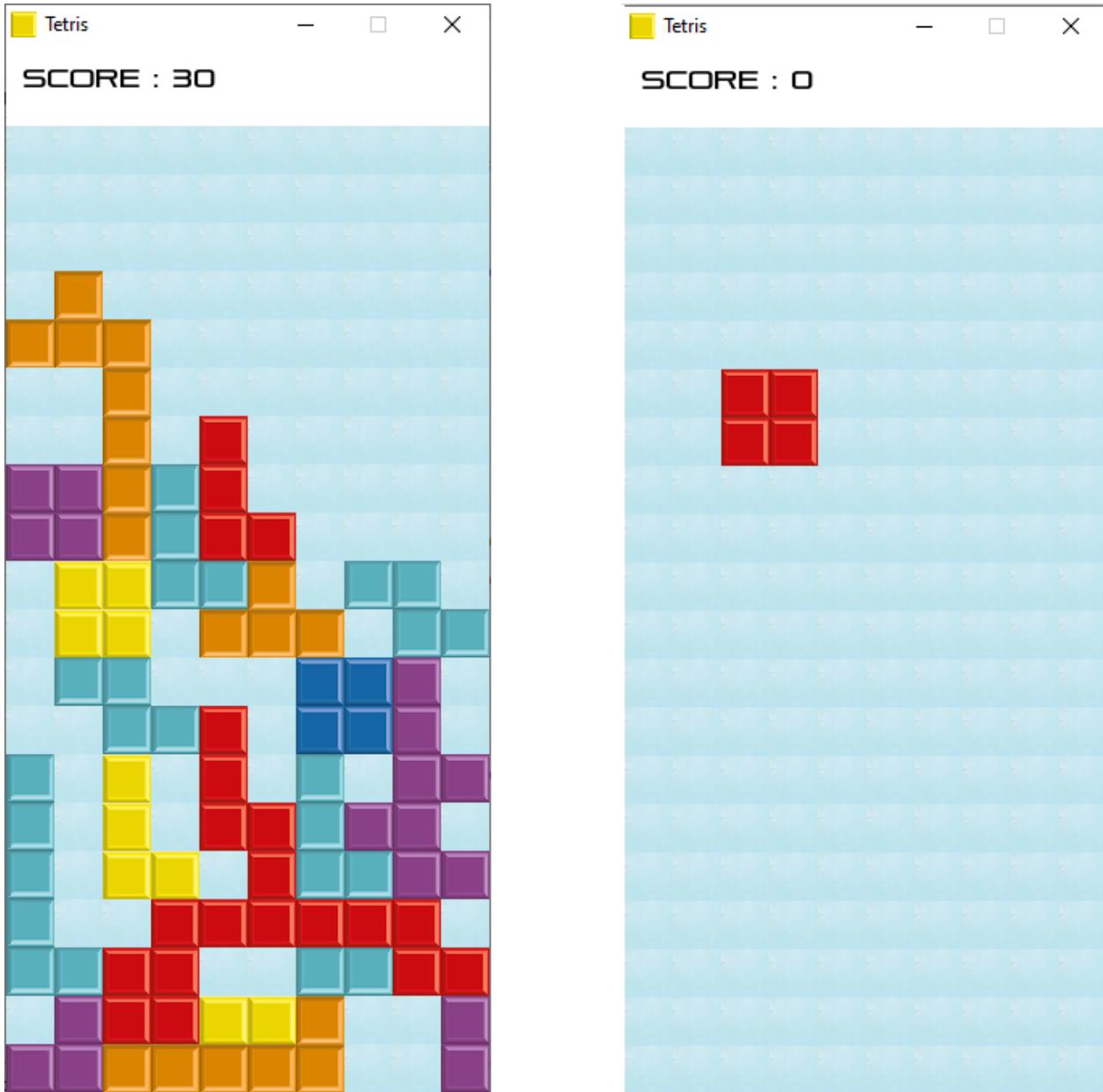


103.11 Tetris Game

An implementation for the Tetris Game

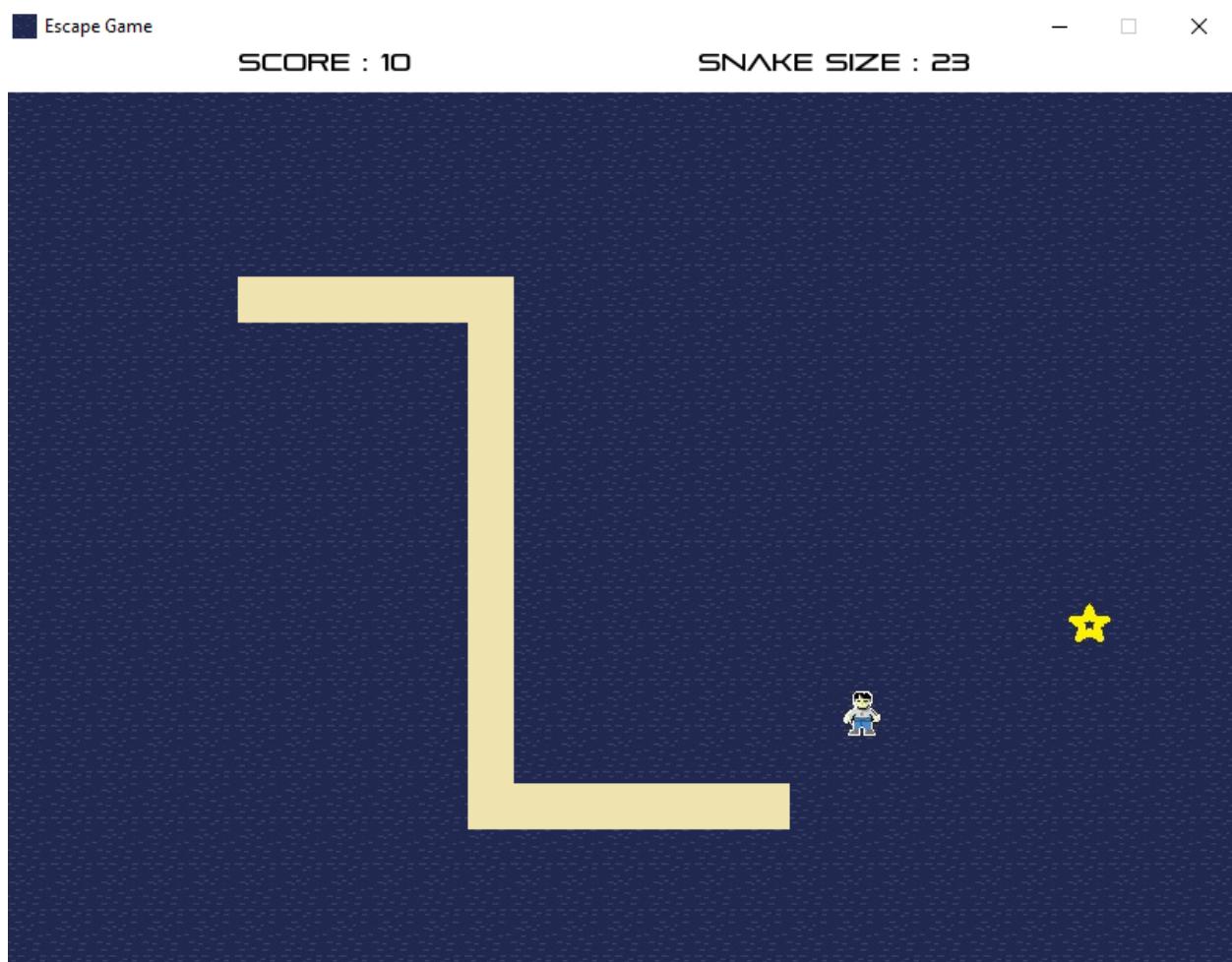
Features

- New Shapes are selected in random way (Different Shape, Color & Position)
- You can move and rotate the shapes, increase the speed.
- Score: You get 10 points when completing a row (The game check for nested rows completion as expected)
- The game is designed to work forever without user interaction (After Game Over, the Game restarts automatically)



103.12 Escape Game

Escape from the Snake and collect the Stars to prevent it from growing!

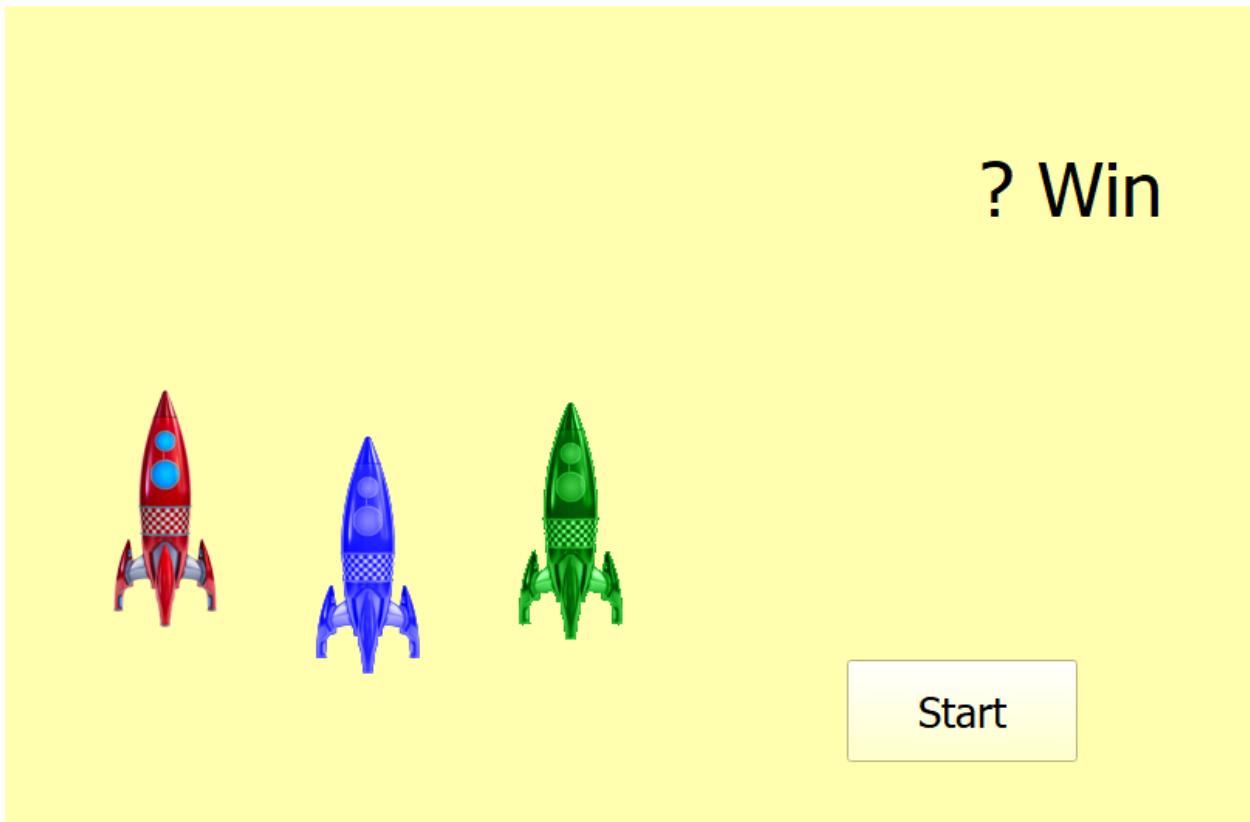


103.13 Hassouna Course Samples

URL (YouTube): <https://www.youtube.com/watch?v=6VIHMyrEilw&list=PLHIfW1KZRIf6KzfLziFl650MmThnQ0jT>

The course samples are added to ring/samples/UsingArabic/HassounaCourse folder

The Rockets sample



103.14 Ring support in SpaceVim

URL: <https://github.com/SpaceVim/SpaceVim>

Screen Shot:

The screenshot displays the SpaceVim interface. On the left, a code editor shows a Ring script named `test.ring`. The script contains the following code:

```

1 /*
2  Program Name : My first program using Ring
3  Year        : 2017
4 */
5
6 see "What is your name? "    # print message on screen
7 give cName                  # get input from the user
8 see "Hello " + cName        # say hello!
9
10 // See "Bye!"
11

```

On the right, a file browser titled "Buffers" shows the project structure:

- [in]: -/SpaceVim/vim-ring/
 - ftdetect/
 - syntax/
 - ring.vim
 - LICENSE
 - README.md

Below the code editor and file browser is a terminal window. The title bar says "252 bytes test.ring ring". The terminal output shows:

```

[Running] ring C:\Users\wsd jeg\Desktop\test.ring
-----
What is your name?
Hello wsd jeg
[Done] exited with code=0 in 5.751047 seconds

```

At the bottom, there is a "Runner" tab.

103.15 Better RingQt

(1) The next classes are added to RingQt

- QAbstractAxis
- QAbstractBarSeries
- QAbstractSeries
- QAreaLegendMarker
- QAreaSeries
- QBarCategoryAxis
- QBarLegendMarker
- QBarSeries
- QBarSet
- QBoxPlotLegendMarker
- QBoxPlotSeries
- QBoxSet
- QCandlestickLegendMarker
- QCandlestickModelMapper
- QCandlestickSeries
- QCandlestickSet
- QCategoryAxis
- QChart
- QChartView
- QDateTimeAxis
- QHBarModelMapper
- QHBoxPlotModelMapper
- QHCandlestickModelMapper
- QHPieModelMapper
- QHXYModelMapper
- QHorizontalBarSeries
- QHorizontalPercentBarSeries
- QHorizontalStackedBarSeries
- QLegend
- QLegendMarker.
- QLineSeries
- QLogValueAxis
- QPercentBarSeries

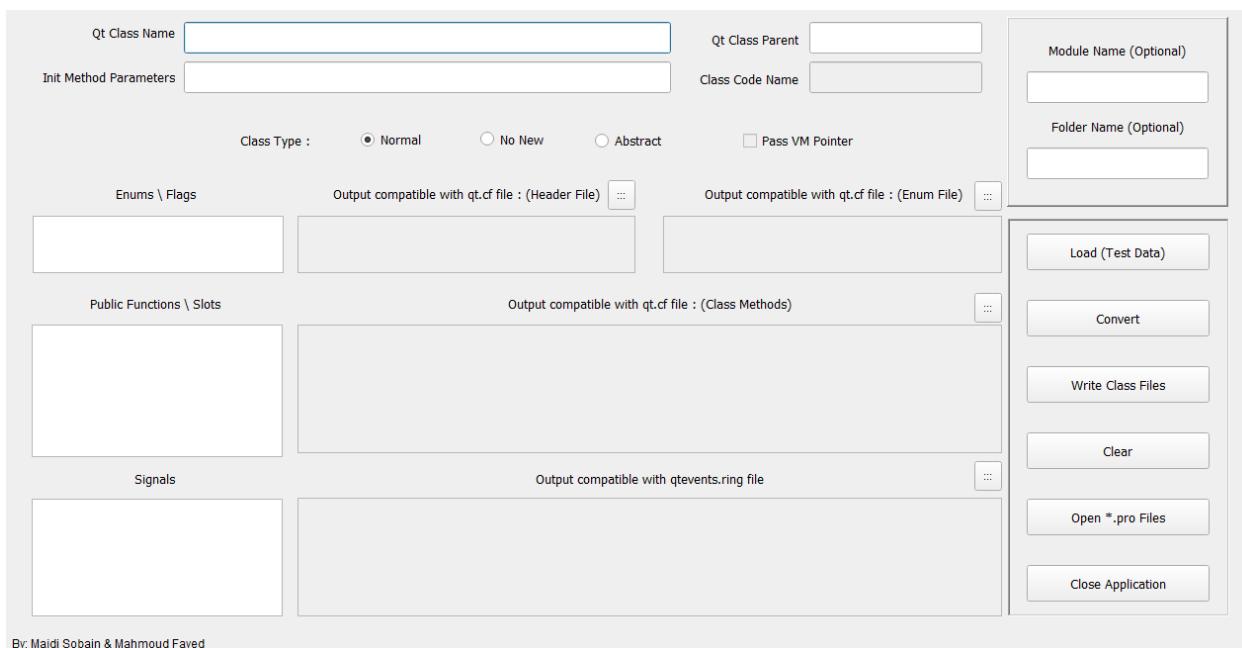
- QPieLegendMarker
- QPieSeries
- QPieSlice
- QPolarChart
- QScatterSeries
- QSplineSeries
- QStackedBarSeries
- QVBarModelMapper
- QVBoxPlotModelMapper
- QVCandleStickModelMapper
- QVPieModelMapper
- QVXYModelMapper
- QValueAxis
- QXYLegendMarker
- QXYSeries
- QGraphicsScene
- QMovie

(2) Better QtConverter application

This application is used for preparing Qt classes for the Ring Code Generator

Then using the Ring Code Generator we generate RingQt classes

The application user interface is updated for better productivity!

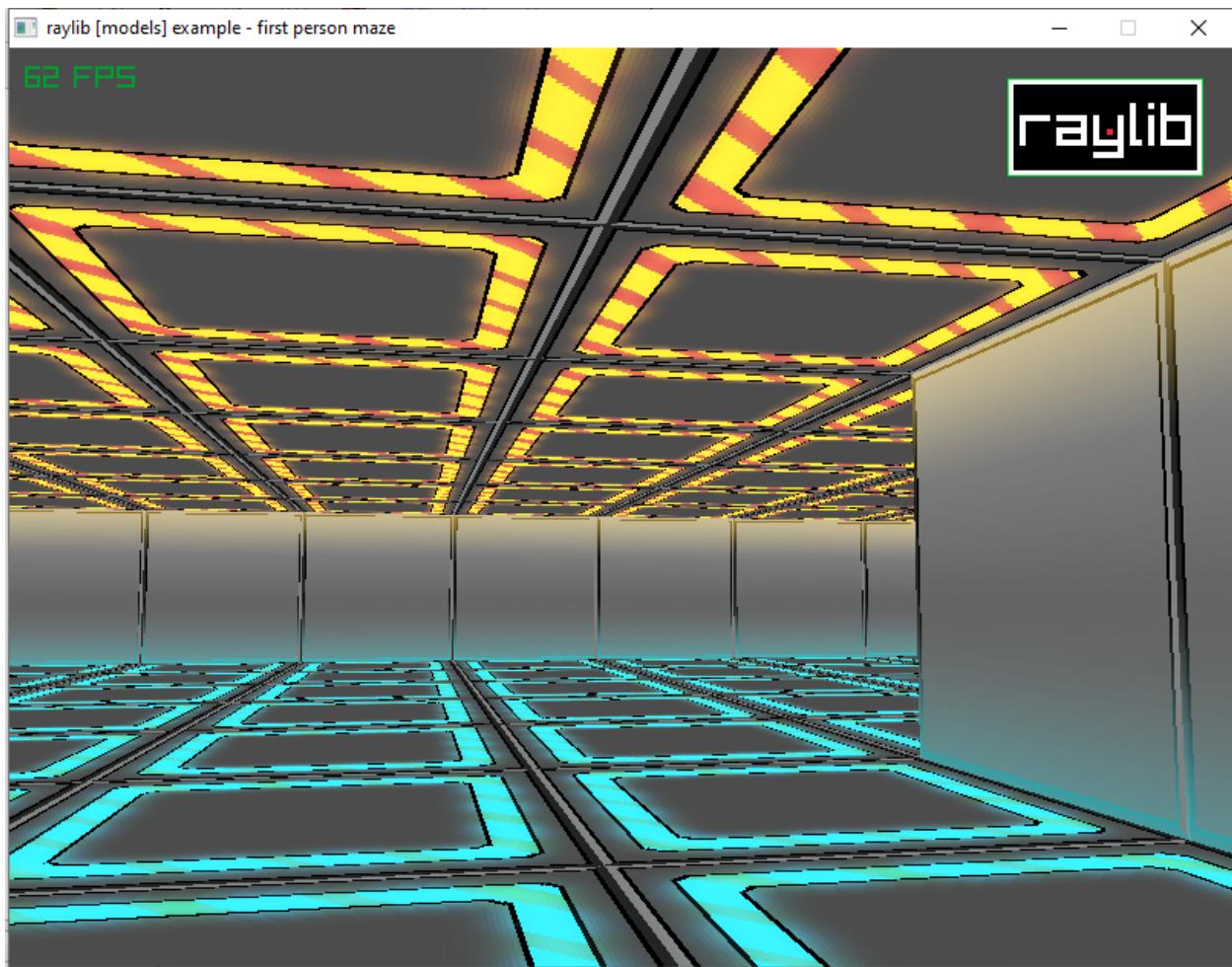


(3) RingQt for Android - Qt Project - Special folders for Ring and RingQt

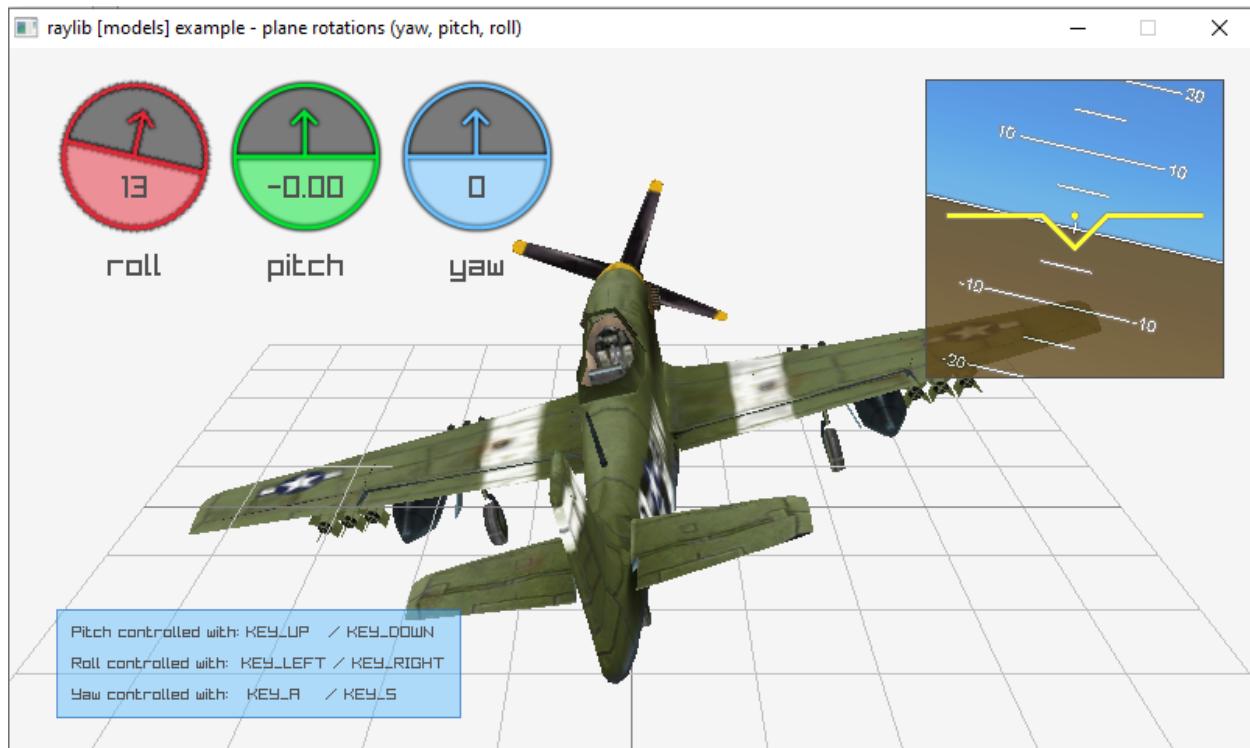
- (4) Using Qt 5.15.0

103.16 Better RingRayLib

- (1) All functions return objects instead of pointers
- (2) Support RayMath libary functions
- (3) More Samples are ported from RayLib to RingRayLib
 - Scissor Test
 - Input Gestures Detection
 - Bouncing Ball
 - Rectangle Rounded
 - Draw Circle Sector
 - RayLib Logo Animation
 - First Person Maze



- Plane Rotations



103.17 RingStbImage Extension

New extension support the stb_image library

Example:

```
# Load the library
load "stbimage.ring"
# Image Information
width=0 height=0 channels=0
# Ring will Free cData automatically in the end of the program
cData = stbi_load("ring.jpg",:width,:height,:channels,STBI_rgb)
# Display the output
? "Size (bytes): " + len(cData)
? "Width : " + width
? "Height: " + height
? "Channels: " + channels
```

Output:

```
Size (bytes): 557371
Width : 563
Height: 330
Channels: 3
```

103.18 More Low Level Functions

The next functions are added to the Low Level functions

For more information see the Low Level Functions chapter in the documentation

```
setpointer(pointer, nNewAddress)
getpointer(pointer) ---> nAddress
pointer2string(pointer, nStart, nCount) ---> cString
memcpy(pDestinationPointer, cSourceString, nSize)
```

103.19 Better Organization

We have better organization for the project folders and source code files

- (1) A folder called (Language) contains the source code and the visual source of the Compiler and the Virtual Machine
- (2) The (Extensions) folder (Bindings for C/C++ libraries) - contains also the (libdepwin, android & webassembly folders)
- (3) The (Libraries) folder - contains Ring libraries written in Ring itself, contains now (GuiLib & ObjectsLib) too
- (4) The (Tools) folder - contains development tools - contains now (Editors, RingNotepad, FormDesigner, etc)
- (5) The (Samples) folder - contains Ring samples - a lot of organization is done in this folder

103.20 More Improvements

- **More Applications**

- Towers of Hanoi
- Questions Game
- Money Case Game
- Rock Paper Scissors Game
- Lottery Game
- Nim Game
- Eight Queens Game
- Typing Quiz
- Pong 2 Game
- Space Shooter Game

- **More Samples**

- ring/samples/Language/HelloWorld folder
- ring/samples/Language/ChangeIsNULL folder
- ring/samples/Language/Console/customsee.ring
- ring/samples/Language/Numbers/decimalscount.ring

- ring/samples/Language/EvalInScope/swap.ring
 - ring/samples/Language/EvalInScope/global.ring
 - ring/samples/Language/EvalInScope/enum.ring
 - ring/samples/Language/Endian/endian.ring
 - ring/samples/Language/VariablePointer/varptr4.ring
 - ring/samples/Language/VariablePointer/varptr5.ring
 - ring/samples/Language/DebugCode folder
 - ring/samples/Language/ClassMethods folder
 - ring/samples/Language/Lists/CheckHashTableAttribute.ring
 - ring/samples/Language/RingFileTokens folder (Ring Compiler - Scanner Output)
 - ring/samples/ProblemSolving/Fib folder
 - ring/samples/ProblemSolving/ArrayPathDest/solveArrayPathDest.ring
 - ring/samples/ProblemSolving/PegSolitaire/peg-soli.ring
 - ring/samples/General/RosettaCode/uniquecharacters.ring
 - ring/samples/General/RosettaCode/similarcharacters.ring
 - ring/samples/General/RandomLatinSquares folder
 - ring/samples/General/FactorialRecursion folder
 - ring/samples/UsingArabic/RightToLeft folder (Set Layout Direction)
 - ring/samples/UsingWebLib/Unicode folder
 - ring/samples/UsingQt/InputMask folder
 - ring/samples/UsingQt/PlayGif folder
 - ring/samples/UsingQt/TableWidget folder
 - ring/samples/UsingQt/ButtonSizeInLayout folder
 - ring/samples/UsingQt/DateTimeEditFormat folder (Date Picker Control)
 - ring/samples/UsingQML/sample10 folder (Charts Samples)
 - ring/samples/UsingQML/sample11 folder (Data Visualization Samples)
 - ring/samples/UsingQtWASM/colordialog folder
 - ring/samples/UsingQtWASM/fontdialog folder
 - ring/samples/UsingQtWASM/filedialog folder
 - ring/samples/UsingQtWASM/filecontent folder (Download/Upload Files)
 - ring/samples/UsingRayLib/more/ex4_levelsofcubes.ring
 - ring/samples/UsingOpenGL/cubeongpu/cubeongpu.ring
 - ring/samples/UsingOpenGL/cubeongpu2/cubeongpu.ring
- Ring Notepad - Output Window - set the buffer size to 1 MB
 - Ring Notepad - View Menu - Source Code (Full Screen)
 - Ring Notepad - Keyboard shortcuts for different styles

- Ring Notepad - Support saving files in folders contains the dot character
- Ring Notepad - Browser Window - Set colors based on the current style
- Ring Notepad - Functions List - Display functions defined using “def”
- Ring Notepad - Distribute Menu - Distribute for Web Browser using WebAssembly (RingQt)
- Form Designer - ToolBox - Larger width in Windows style
- Form Designer - ToolBar - New icon for the (Select Objects) button
- Gold Magic 800 - Level Editor - Decrease the window size
- Super Man 2016 - Increase speed of (Game Over) message animation
- Super Man 2016 - Better code for collision detection between SuperMan and Walls
- Game Engine - Game Class - Icon property (set the window icon)
- Set the window icon for many games developed using the Ring game engine
- Type Hints library - Better Code
- StdLib - IsMainSourceFile() function - Better Code
- StdLib - TimeInfo() function - All TimeList() information are now available
- StdLib - Map() & Filter() functions - Support accessing the global scope
- StdLib - NewList() function is no longer required - Use the List() function
- WebLib - Template() function - Support accessing the global scope
- Objects Library - Better API
- Natural Library - Better Code
- RingLibSDL - Update LibSDL version from 2.0.10 to 2.0.12
- RingOpenGL - Better Code (Added GLEW functions)
- RingFreeGLUT - Better Code (Added many functions)
- RingLibUV - Better Code - Samples that uses the VarPtr() function
- RingPM - Support terminals that pass the executable name using UPPER case
- Ring2EXE - Distribute for Web Browser using WebAssembly (RingQt)
- Ring2EXE - Delete the executable file if we have it in the target folder
- Ring2EXE - Always copy files listed in the resources file to the target folder
- Ring2EXE - Distribute for Android - Copy Ring and RingQt folders
- Ring Tests - Display report summary after running all of the tests
- CodeGen - Add Option: PassNullBeforeVMPointer (For C++ Classes)
- CodeGen - Using RING_API_ISCPOINTER() instead of RING_API_ISPOINTER()
- Ring Compiler - ChangeRingKeyword - Support comments and many commands in the same line
- Ring Compiler - ChangeRingOperator - Support comments and many commands in the same line
- Ring Compiler - ring_parser.c - Better Code
- Ring Compiler - ring_stmt.c - Better Code
- Ring Compiler - ring_expr.c - Better Code

- Ring Compiler - ring_state.c - Flag for the (Not Case Sensitive) feature
- Ring Compiler - Load Command - Support loading libraries from ring/bin/load folder
- Ring Compiler - LoadSyntax Command - Support loading libraries from ring/bin/load folder
- Ring Compiler - Command: ? <expr> - Clear error message when the expression is missing
- Ring Compiler - Better Error Messages
- Ring VM - Using lists during definition - Support using the list itself (not only items)
- Ring VM - List() Function - Support List(nRow,nCols) to create 2D lists
- Ring VM - List() Function - Better Performance
- Ring VM - Object File - Save/Restore the files list
- Ring VM - ring_vexpr.c - Better Code - Avoid magic numbers
- Ring VM - ring_state_filetokens() - Optional parameter for the (Not Case Sensitive) feature.
- Ring VM - ring_state_setvar() - Better Code
- Ring VM - int2bytes(), float2bytes() & double2bytes() uses sizeof() function
- Ring VM - fclose() function - Display error message if the FILE pointer is NULL
- Ring VM - Extensions API - Support local scope of the caller when getting integer pointer

USING OTHER CODE EDITORS

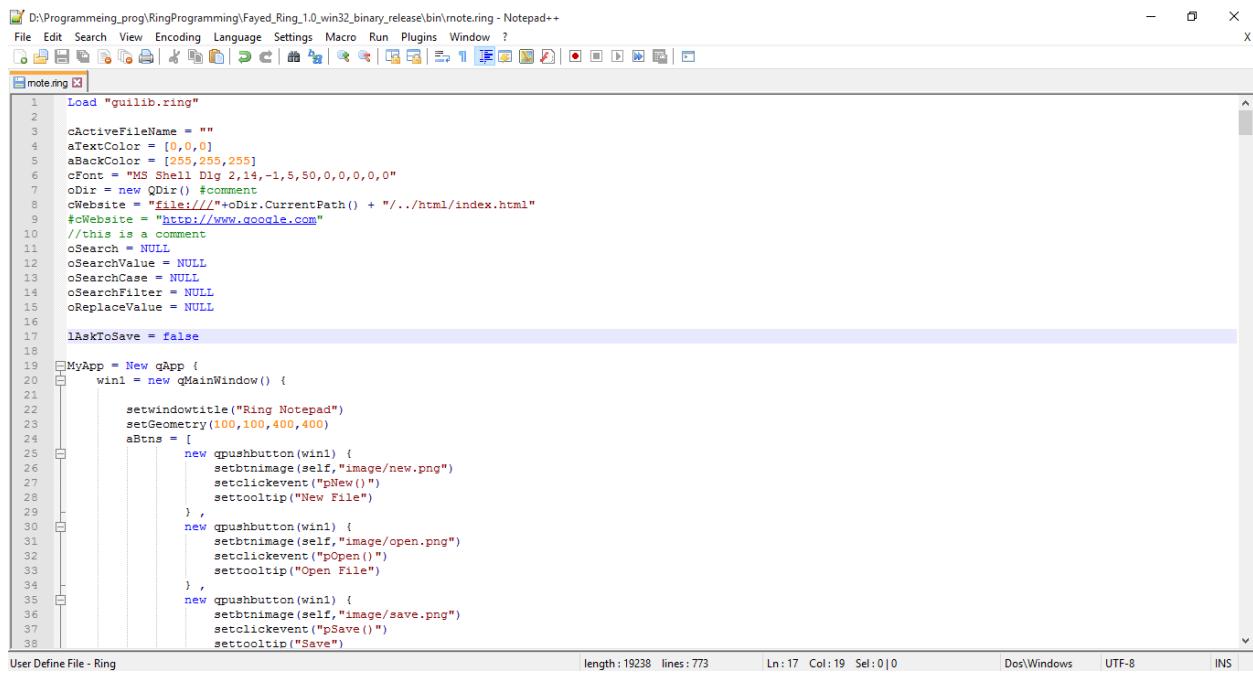
In the Ring/Tools/Editors folder you will find extensions for the next editors

- Notepad++
- Geany
- Atom
- Sublime Text 2
- Visual Studio IDE
- Emacs
- Visual Studio Code (VSCode)
- SpaceVim

104.1 Using Notepad++

Folder : ring/tools/editors/notepad_plus_plus

- Open Notepad++
- Open the “Language” menu
- Select “Define your language...”
- Click “Import...”
- select *Ring.xml*
- Select “OK” on the “Import successful” dialog and close the “User Defined Language” dialog/panel
- You may need to restart notepad++



The screenshot shows a Notepad++ window titled "mote.ring". The code is written in Ring programming language and defines a GUI application. It includes loading a library ("guilib.ring"), setting up a main window ("qMainwindow") with a title ("Ring Notepad") and geometry (100,100,400,400), and creating three buttons ("qpushbutton") for New, Open, and Save operations. The code uses various Ring API functions like setwindowtitle, setGeometry, and setclickevent.

```

1 Load "guilib.ring"
2
3 cActiveFileName = ""
4 aTextColor = [0,0,0]
5 aBackColor = [255,255,255]
6 cFont = "MS Shell Dlg 2,14,-1,5,50,0,0,0,0,0,0"
7 oDir = new QDir() #comment
8 cWebsite = "file:///"+oDir.CurrentPath() + "/../../html/index.html"
9 #cWebsite = "http://www.google.com"
10 //this is a comment
11 oSearch = NULL
12 oSearchValue = NULL
13 oSearchCase = NULL
14 oSearchFilter = NULL
15 oReplaceValue = NULL
16
17 lAskToSave = false
18
19 MyApp = New qApp {
20   win1 = new qMainwindow() {
21     setWindowTitle("Ring Notepad")
22     setGeometry(100,100,400,400)
23     aBtns = [
24       new qpushbutton(win1) {
25         setbtnimage(self,"image/new.png")
26         setclickevent("pNew()")
27         settooltip("New File")
28       },
29       new qpushbutton(win1) {
30         setbtnimage(self,"image/open.png")
31         setclickevent("pOpen()")
32         settooltip("Open File")
33       },
34       new qpushbutton(win1) {
35         setbtnimage(self,"image/save.png")
36         setclickevent("pSave()")
37         settooltip("Save")
38     }
39   }
40 }
41
42 length : 19238 lines : 773 Ln : 17 Col : 19 Sel : 0 | 0 Dos\Windows UTF-8 INS

```

104.2 Using Geany

Folder : ring/tools/editors/geany

- Run Geany editor
- Click on “Tools -> configuration files -> filetypes_extensions.conf” menu
- Add this line “Ring=*.ring;” without quotes after [Extensions]
- In unbuntu copy file “filetypes.Ring.conf” to folder “/home/USERNAME/filetypes.Ring.conf”
- You can run your files by pressing F5 button

The screenshot shows a dual-pane interface. The top pane is a code editor titled "new.ring - /home/magdy/ring - Geany". It contains the following Ring script:

```
1 see "What is your name? "
2 give cName
3 see "Hello " + cName + nl
4 #comment
5 /* comment open */
```

The bottom pane is a terminal window titled "Terminal". It displays the output of running the script:

```
What is your name? Magdy
Hello Magdy

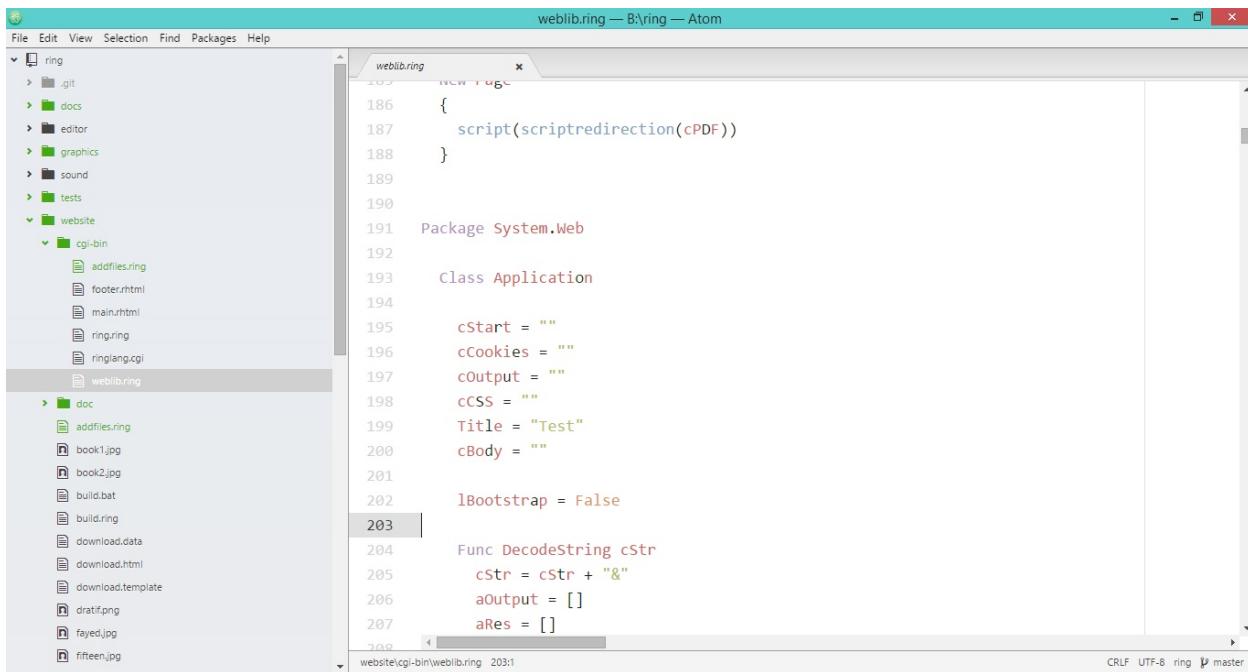
-----
(program exited with code: 0)
Press return to continue
```

104.3 Using Atom

Folder : ring/tools/editors/atom

Just Copy the folder atom-language-ring to the next path

```
"C:\Users\{UserName}\.atom\Packages"
```



104.4 Using Sublime Text 2

Folder : ring/tools/editors/sublime text 2

In the folder Sublime_Text_2 you will find the next three files

- 1 - ring.json-tmlanguage
- 2 - ring.sublime-build
- 3 - ring.tmlanguage

Just Copy the files to the next path

```
"C:\Users\{UserName}\AppData\Roaming\Sublime Text 2\Packages\User\"
```

The file ring.sublime-build includes the next line

```
"cmd": ["B:\\ring\\bin\\ring.exe", "$file"],
```

You can modify it according to the ring.exe path in your machine

The screenshot shows a Sublime Text 2 window with multiple tabs open. The active tab contains Ring script code to generate a multiplication table. The code uses functions like `multiplication_table` and `fsize`. Below the code, the generated multiplication table for numbers 1 through 12 is displayed:

	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2		4	6	8	10	12	14	16	18	20	22	24
3			9	12	15	18	21	24	27	30	33	36

104.5 Using Visual Studio IDE

Folder : ring/tools/editors/visualstudio

Check the ReadMe file for installation instructions.

The screenshot shows the Microsoft Visual Studio IDE interface. On the left, the Server Explorer and Toolbox are visible. The main code editor window displays Ring script code. The output window shows the execution results:

```
#ring file 'NewFile1'
see "Welcome to Ring Programming Language" + nl
name = "Mohamed" + nl
see name
name = 50 + nl
see name

lstNum = [20,25,26,27]
see lstNum

m = new Member
see m.getName('Ahmed','Omar')

class Member
func getName fName,lName
    return fName + " " + lName
```

Output:

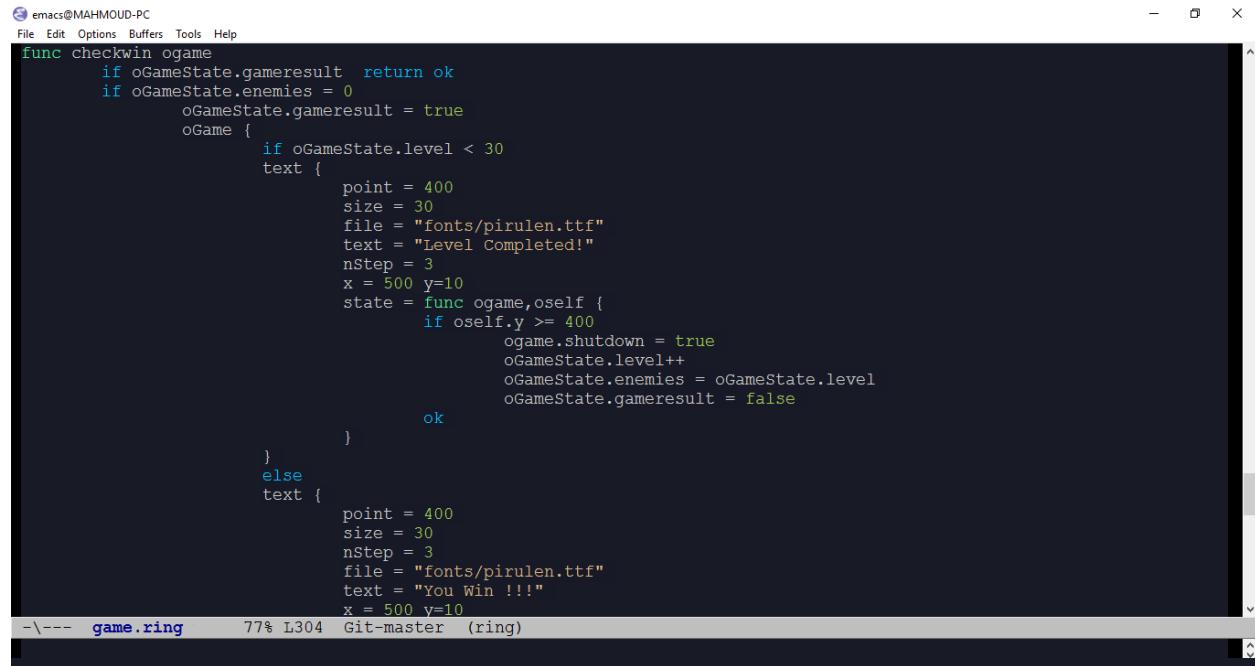
```
Show output from: Ring
Welcome to Ring Programming Language
Mohamed
50
20
25
26
27
Ahmed Omar
```

104.6 Using Emacs Editor

Folder : ring/tools/editors/emacs

Check the ReadMe file for installation instructions.

Screen Shot:



The screenshot shows the Emacs text editor interface. The title bar reads "emacs@MAHMOUD-PC". The menu bar includes "File", "Edit", "Options", "Buffers", "Tools", and "Help". The main window displays a portion of a file named "game.ring". The code is written in a custom language or dialect, likely Ring, and defines a function named "checkwin" which handles game completion logic. The status bar at the bottom shows the file name "game.ring", the line number "77%", and the commit hash "Git-master".

```

func checkwin ogame
    if oGameState.gameresult return ok
    if oGameState.enemies = 0
        oGameState.gameresult = true
        oGame {
            if oGameState.level < 30
            text {
                point = 400
                size = 30
                file = "fonts/pirulen.ttf"
                text = "Level Completed!"
                nStep = 3
                x = 500 y=10
                state = func ogame,oself {
                    if oself.y >= 400
                        ogame.shutdown = true
                        oGameState.level++
                        oGameState.enemies = oGameState.level
                        oGameState.gameresult = false
                    ok
                }
            }
            else
            text {
                point = 400
                size = 30
                nStep = 3
                file = "fonts/pirulen.ttf"
                text = "You Win !!!"
                x = 500 y=10
            }
        }
    }

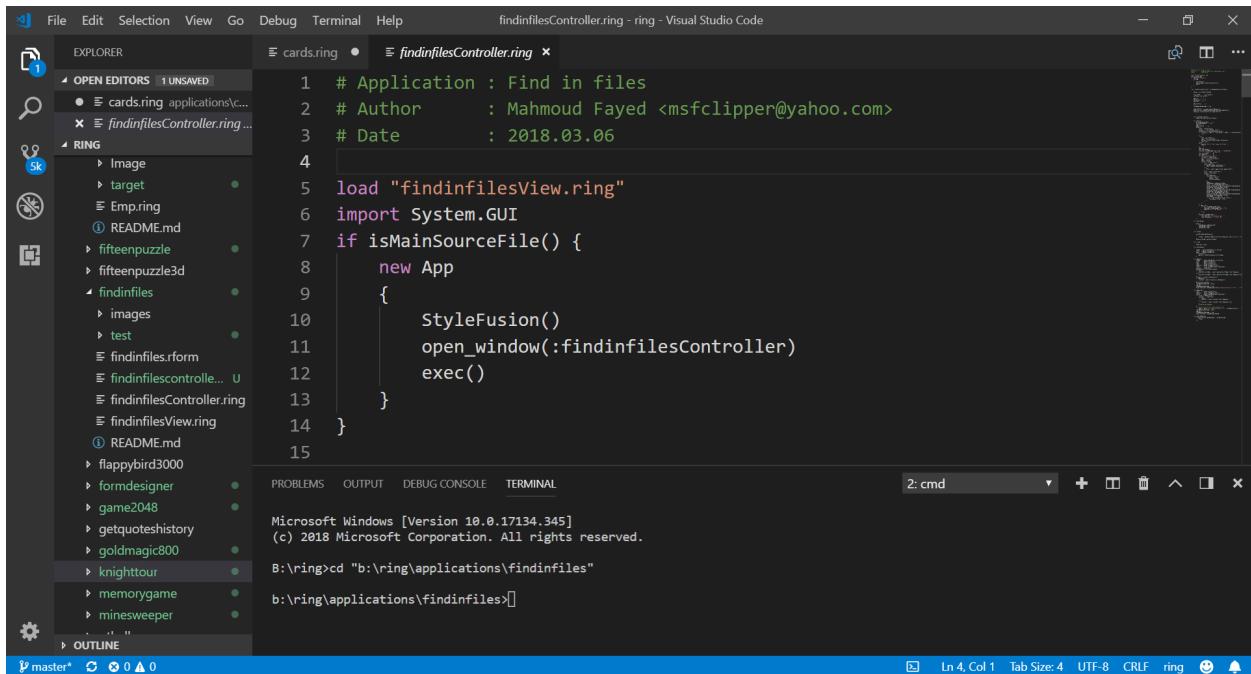
```

104.7 Visual Studio Code

Folder : ring/tools/editors/vscode

Check the ReadMe file for installation instructions.

Screen Shot:



The screenshot shows the Visual Studio Code interface with the following details:

- File Bar:** File, Edit, Selection, View, Go, Debug, Terminal, Help.
- Editor Area:** The active tab is "findinfilesController.ring". The code content is as follows:


```

1 # Application : Find in files
2 # Author      : Mahmoud Fayed <msfclipper@yahoo.com>
3 # Date        : 2018.03.06
4
5 load "findinfilesView.ring"
6 import System.GUI
7 if isMainSourceFile() {
8     new App
9     {
10         StyleFusion()
11         open_window(:findinfilesController)
12         exec()
13     }
14 }
15
      
```
- Explorer:** Shows a tree view of files and folders, including "cards.ring", "findinfilesController.ring", and various game projects like "Emp.ring", "fifteenpuzzle", "fifteenpuzzle3d", etc.
- Terminal:** Displays a Windows command prompt output:


```

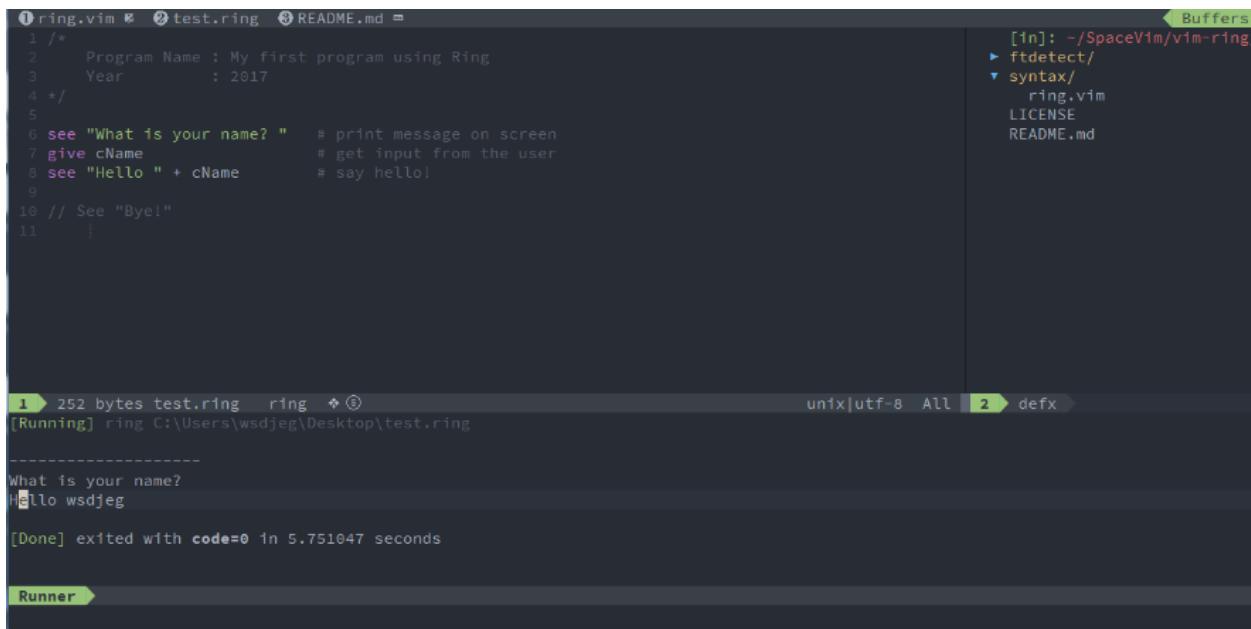
Microsoft Windows [Version 10.0.17134.345]
(c) 2018 Microsoft Corporation. All rights reserved.

B:\ring>d ":"\ring\applications\findinfiles"
b:\ring\applications\findinfiles[]
      
```
- Status Bar:** Shows "Ln 4, Col 1", "Tab Size: 4", "UTF-8", "CRLF", and other status indicators.

104.8 SpaceVim

URL: <https://github.com/SpaceVim/SpaceVim>

Screen Shot:



The screenshot shows the SpaceVim interface with the following details:

- Left Panel:** Shows a buffer list with "ring.vim", "test.ring", and "README.md".
- Right Panel:** Shows a "Buffers" list with "[in]: ~/SpaceVim/vim-ring/", "ftdetect/", "syntax/", "ring.vim", "LICENSE", and "README.md".
- Terminal Buffer:** Displays a Ring program execution:


```

1 ► 252 bytes test.ring  ring  ↵ ③
[Running] ring C:\Users\wsdjeg\Desktop\test.ring
-----
What is your name?
Hello wsdjeg

[Done] exited with code=0 in 5.751047 seconds
      
```
- Bottom Status Bar:** Shows "unix|utf-8 All" and "defx".
- Bottom Buttons:** Includes "Runner" and other navigation icons.

FREQUENTLY ASKED QUESTIONS (FAQ)

105.1 Why do we need Yet Another Programming Language (YAPL)?

The language comes with better support for natural language programming and declarative programming. The innovation comes in supporting these paradigms with new practical techniques on the top of object-oriented programming and functional programming. Ring provides the programmers with the tools required to build a natural language like Supernova or a declarative language like REBOL and QML without the need to know anything about (compilers and parsing). You get the language constructs ready for use to create domain-specific languages in a fraction of time.

Take a look at the Supernova programming language, in this language you can type: (I want window and the window title is hello world.) and it will create a GUI window with “Hello, World!” as the window title. When I created Supernova language in 2010, i discovered that using the natural code can be (similar to English and without limits and we can use the power of human language in programming) but to implement that you need a new language that has:

- (1) General Purpose
- (2) Practical
- (3) Can create natural languages very quickly.

So we can get a system that can increase ease of use and productivity to the maximum level.

So I created Ring because it was the best way to achieve this goal.

Supernova was just a test of the idea, it helped getting a better view of the advantages and the disadvantages of the idea. And After testing the new ideas you are provided with something practical. So now we have Ring after Supernova. A story that is maybe similar to having Python after ABC. Where Python avoids the problems of ABC, but keeps the advantages of ABC. Also, Ring learns from Ruby and ROR’s story. The language power could appear in frameworks better than the direct usage as a general purpose language. Also Ring comes with a clear goal/motivation; (Creating a new version of the PWCT Software) something that was learned from the design the C language in a certain way to create the Unix Operating System. In other words, you have a goal that directs you in each design decision.

You will understand the value of our decisions once you start trying to solve the problem that we will use Ring to solve. The questions is: could you enable any one in the world without knowledge about computer programming concepts to create very powerful software? Scientifically the answer is (visual Programming) and (natural Programming). In practice we are still away from switching to these paradigms without introducing other problems. Ring is designed to solve this problem. It is designed to provide natural programming in a practical way. And to create a powerful visual programming tool. Ring is designed to be a new world of programming after 10 years of research in visual programming and natural languages.

The Ring Programming Language (Compiler+VM) is developed 100% using visual programming without writing a single line of code. I used my tool (Programming Without Coding Technology) to design everything and get the C code generated for me.

Advantages ?

- (1) Faster

- (2) No Syntax Errors
- (3) Easy to understand and manage the code because the abstraction level is higher
- (4) No critical disadvantages because you can control everything as writing your code.

Using my experience in using visual programming for 10 years and natural programming for 5 years, I designed Ring to move the knowledge to mainstream programmers by providing a practical language that supports these ideas.

I agree that each programmer/developer has the freedom to form his opinions about any software including programming languages. Ring is not an exception but you may miss the idea behind the language. It is innovative and may help you to think differently about how to solve your problems. Maybe this is not clear to many programmers because It is a practical language and includes many features known to programmers and when a programmer looks at the language they might think that nothing new because it's familiar. I created Ring to solve problems in a different way. Where I will start programming just by describing the software using new natural interfaces that I will implement later when I move from the design stage to the implementation stage. (I don't determine the time to switch between stages, You are free to use Agile methods). Since Ring is a new language you have 3 options:

- (1) To not care at all for now.
- (2) Think of the future of the language and help us if you understand the idea and want to contribute.
- (3) Wait and come back again in the future to use it.

Summary:

- Ring is designed based on a need to develop a new version of the PWCT software.

Once we finish PWCT 2.0 we will have good and large software developed using Ring.

- We will push declarative and natural paradigms many steps forward. Also in next versions

we have a plan to present a new paradigm for network programming and concurrency. We tested this new paradigm through simple prototypes during the last years and we will integrate it with Ring in future releases.

105.2 What is the Ring Architecture?

We have the next architecture

- (1) Ring Applications (Your Code) - Written in Ring - See folder : ring/applications
- (2) Ring Libraries (StdLib, WebLib, GameEngine, etc) - Written in Ring - See folder : ring/libraries
- (3) Ring Extensions (RingAllegro, RingQt, etc) - Written in C/C++ (may include Ring code) - See folder : ring/extensions
- (4) Ring Virtual Machine (Ring VM) - Written in C language
- (5) Operating System (Current Platform) - (Windows, Linux, macOS, Android, etc)

The extensions are just dynamic libraries (DLL, So, Dylib) You can update the extensions without the need to update your code.

Folder (ring/extensions/libdepwin) ==> C libraries used for building Ring Extensions (written in C) on Windows platform

Folder (ring/libraries) ==> Ring libraries written in Ring itself (StdLib, WebLib, GameEngine, etc)

Folder (ring/language/visualsrc) ==> The Visual Source Code of the Ring Compiler & Ring VM developed using Programming Without Coding Technology (PWCT)

We use the term Ring Library —> When the library code is written in Ring We use the term Ring Extension —> When the library code is Written in C or C++

105.3 What about Memory Management in Ring?

(1) When we call function, we get a new scope for this function, inside this scope we store variables.

Also we get Temp. memory for this function. Inside this temp. memory we store temp. lists

All of this will be deleted directly after the end of the function call (end of scope)

(2) In Ring to delete memory, you have the next options

2.1 Wait until the end of the function scope

2.2 Use the Assignment operator

2.3 Use callgc() function (delete temp. lists only)

(3) Ring Garbage Collector uses Escape Analysis and Reference Counting

In 90% of cases, the Escape Analysis is used so we don't waste time in running the garbage collector. We directly know what will be deleted and what will remain in the memory.

https://en.wikipedia.org/wiki/Escape_analysis

In 10% of cases (or less than that) Ring may use Reference Counting.

For example when we pass a list and sub list to a function Ring will pass the lists by reference, but what will happen if we deleted the Parent List? In this case, the Sub List will use reference counting, and when deleting the Parent List, it will stay in memory until the end of the function.

Remember that Ring encourage us to avoid using references, and the Assignment Operator will copy lists by value, so Ring usage of reference counting is very limited to special cases and in most cases the Escape Analysis is enough which is very fast.

Starting from Ring 1.9 we extended the Reference Counting support to Ring Extensions and low level C pointers. So we don't have to care about using fclose() when we use fopen() for example. and the same for other extensions like RingODBC, RingSQLite, RingMySQL, RingQt, etc.

All of the allocated resources will be cleaned by the Garbage Collector when we finish using it (when we lost the last reference).

105.4 What about Data Representation in Ring?

(1) In Ring, The String is just (Array of bytes)

Ring is 8-bit clean, Each character in the string is 8 bits (1 byte)

So these functions (Int2Bytes(), Float2Bytes() and Double2Bytes()) just return a string.

Also we can store binary data in strings

```
mystring = read("myfile.exe")
```

(2) Remember this, when you think about variables

- Value —> What we have (What we are storing in the computer memory as data) - Low Level Concept
- Type —> What we can do with what we have or how we do things with what we have (Just a Logical Concept)

Computer memory —> Just store [Bytes] - Each byte is 8-bit - (Here we avoid the memory word concept)

These bytes could be grouped together when moved between the memory and the processor registers. Here we have (The register size) and things like 32-bit and 64-bit for example. Also we have the bytes order.

Programming Languages —> Add Types (Just as a concept) to these bytes so we can determine what to do with them and how operations should be done.

And programming language could allow (Type Conversion) —> Because the Type is a logical concept in most cases, What we really have is just data (Bytes, Bytes Count, Bytes Order, etc)

Ring Strings —> You have these bytes (each byte is 8-bit) and Ring know the string size (stored as number in the String structure)

So we don't check the NULL character or add it to the end of the string (Not Required)

All operations inside Ring VM, will check the Ring size and deal with the string as binary data (each character is 8-bit)

In the C language —> The normal case is adding NULL character (0) to the end of each string

And the string functions check this character, This is not suitable for binary data.

Signed vs Unsigned —> Is a logical concept which is important when you do arithmetic operations on the data, but when storing the data, if you will include all of the (8-bits) and will not ignore any of them —> Then don't care.

In Ring, don't think about these details, we are hiding it from you, so you can focus on your application and what you will do.

Think in C when you write C code which could be (based on need) low level code to have control on everything.

—> Good for performance and memory management

Think in Ring when you write Ring code which let you ignore a lot of details and concentrate only on the result —> Good for productivity and delivering software quickly

The good news (We can mix between Ring and C in our projects)

(3) The functions Int2Bytes(), Float2Bytes() and Double2Bytes()

These function take input as (Number) —> Convert it to group of bytes based on the number type (int|float|double)
—> Then return a Ring string that contains these bytes

Int2Bytes() —> Ring string (Group of bytes) and the string size = sizeof(int)

Float2Bytes() —> Ring string (Group of bytes) and the string size = sizeof(float)

Double2Bytes() —> Ring string (Group of bytes) and the string size = sizeof(double)

Example:

```
? len( int2bytes(1) )
? len( float2bytes(1) )
? len( double2bytes(1) )
```

Output:

```
4
4
8
```

(4) Storing Numbers

When we use a number, Ring always use the (Double) data type for representing these numbers in memory. This is important to know when we do arithmetic operations on numbers.

But when we convert the number to a String using “” + number or using string(number) we get a string where each digit is represented in 1 byte (Not good idea for storage, but useful for string processing)

If you need the number to be represented in specific size (int|float|double) for storage then use bytes2int() , bytes2float() and bytes2double() when writing the data to binary files.

Ring Number (double) —> int2bytes() - will cast the number from double to int then return the bytes —> 4 bytes (Ring String)

Ring Number (double) —> float2bytes() - will cast the number from double to float then return the bytes —> 4 bytes (Ring String)

Ring Number (double) —> double2bytes() - will use the number (double) to return the bytes —> 8 bytes (Ring String)

The (int) type is used only for internal Ring operations, but Ring applications\code will use only the (double) type for numbers.

(5) The Unsigned() Function

The function unsigned() expect the first and the second parameters as numbers

```
unsigned(nNumber1,nNumber2,cOperator)
```

We can use the bytes2int() function to convert the bytes to a number

Example:

```
B = list(4)

for k=1 to 4
{
    B[k]= Space(4)
    for kk=1 to 4 { B[k][kk]= char(60+4*k +kk) }
    ? " B" +k +": " +B[k]
}

A12= Space(4)      A12= bytes2int(B[1]) ^ bytes2int(B[2])
? "A12: " +string(A12)
A34= Space(4)      A34= bytes2int(B[3]) ^ bytes2int(B[4])
? "A34: " +string(A34)
A12= space(4)     A12= Unsigned(bytes2int(B[1]),bytes2int(B[2]),"^")
? "unsigned A12: " +A12
A34= space(4)     A34= Unsigned(bytes2int(B[3]),bytes2int(B[4]),"^")
? "unsigned A34: " +A34
```

Output:

```
B1: ABCD
B2: EFGH
B3: IJKL
B4: MNOP
A12: 201589764
A34: 470025220
unsigned A12: 201589764
unsigned A34: 470025220
```

105.5 Why is Ring weakly typed?

Because it's faster and more natural, and this is important for the language's goals. One of the rules is: the data type at the beginning affects the final result. For example, when you type "Print : " + 5 , The String comes first, so 5 will be converted to a String. While when you type 5 + "10" The number comes first so "10" will be converted to 10. This helps a lot to quickly convert between numbers and strings using the same operator. If you want to prevent conversion (Write code that prevent conversion) In these cases you will notice that what you are writing is less code (And can be removed).

Weakly typed = automatic conversion and *automatic* is *good thing* and is better than *manual* if you know how to use it correctly.

105.6 What are the advantages to using Ring over Lisp or Smalltalk?

Smalltalk and Lisp are GREAT languages. I like many of the concepts behind them but I'm sure that selecting the right programming language is based on the problem and comes after the problem's definition. I have a problem that I want to solve and these GREAT languages are not ideal for this problem so I designed Ring.

When you design a new language, You can learn from the past but you must look forward and live in the future. What you know about natural programming maybe based on the *old knowledge* about the power of these paradigms in the practical world and I agree with you but I see other techniques that can be applied to get this to work in practice. What you miss about *natural language* is that they are *context sensitive* and this means we can use it and think differently about how we can express our ideas.

Example : I want window contains 3 buttons.

In one sentence I created 4 objects (The window and the three buttons) and added the buttons to the window. The idea of natural programming is to get many things done like that.

105.7 Why is Ring largely focussed on UI creation?

Yes UI creation is one of the important things in the language features because it is designed to create a visual programming tool, But the language is a multi-paradigm language where we can select the programming paradigm based on the problem.

105.8 Is Ring some sort of an improvement of PHP?

Ring is not designed to replace PHP, Lua or Smalltalk. Ring's support for declarative programming and natural language programming is very innovative and much better than staying with procedural, object-oriented and functional languages. Ring see the future in programming without code (using natural languages) and is designed to support that.

105.9 What are the advantages of using Ring over native C or C++?

Ring provides a better way to mix between different programming paradigms in solving problems.

The different programming paradigms play well together in the same language.

- (1) It's easy to switch from one programming paradigm to another one because the language constructs use similar syntax for similar concepts.
- (2) The paradigms are provided to interact and used together in different layers in the software.

for example you can create a game engine using object-oriented programming but write the game code using declarative programming or natural programming and behind the scenes your declarative or natural code will use the object-oriented classes.

- (3) Ring is more productive and natural than C/C++.
- (4) Ring is a dynamic language. We can generate and execute code during the runtime. Ring is dynamically typed and weakly typed for flexibility.
- (5) The Garbage collector is generational (escape analysis) and also uses reference counting. it's very fast and still provides control to the programmer who can delete memory at any time.
- (6) Ring's compiler and virtual machine are just 20,000 lines of ANSI C code that can be compiled and used in any platform.
- (7) You can use C/C++ libraries and Ring comes with code generator to create wrappers from C functions or C++ classes. so when you need more performance or when you need to use more libraries you can easily do that.

105.10 What is the difference between Ring and Python? And is Ring Open Source?

Yes the language is Open Source (MIT license)

In general I like Python and Ruby but I was looking for a language more suitable for creating the next version of the Programming Without Coding Technology (PWCT) software so I started the Ring design.

Some simple changes that matters for my goal are

- (1) Not case sensitive
- (2) The list index start from 1
- (3) You can call functions before definition
- (4) Don't use Python syntax like (indentation, using self, :, pass & _)
- (5) Weakly typed (convert automatically between types based on context)
- (6) The programs follow simple and constant structure (Statements then functions then packages and classes)
- (7) Using the '=' operator for assignment and for testing values

Critical changes are

- (1) Small Language : The Ring compiler + Virtual Machine = 15K lines of C code , the other 500K lines are related to libraries and are optional when we go for using the language in C/C++ programs.
- (2) The Garbage collector : Uses Escape Analysis/Reference counting and give the programmer the ability to determine when to delete memory using the assignment operator

- (3) Compact Syntax : Ring is not line sensitive, you don't need to write ; or press ENTER to separate between statements
- (4) Using { } to access the object then using the object attributes and methods directly
- (5) Natural Programming : It's very easy to create natural interfaces using Ring based on OOP
- (6) Declarative Programming using Nested Structure

The Ring programming language is designed based on my experience from using many other languages like C, C++, C#, Lua, PHP, Python, Ruby, Harbour, Basic and Supernova And the language comes with innovative features added to achieve the language goal

- Applications programming language.
- Productivity and developing high quality solutions that can scale.
- Small and fast language that can be embedded in C/C++ projects.
- Simple language that can be used in education and introducing Compiler/VM concepts.
- General-Purpose language that can be used for creating domain-specific libraries, frameworks and tools.
- Practical language designed for creating the next version of the Programming Without Coding Technology software.

105.11 What are the advantages to using Ring over Perl, PHP, Python or Ruby?

- (1) Ring is New and Innovative. The language will let you think different about programming.
- (2) Ring is Smaller. (Lessons learned from the Lua language)
- (3) Ring is Simple. (Lessons learned from the BASIC and Clipper/Harbour languages)
- (4) Ring is more Natural. (Lessons learned from the Supernova language)
- (5) Ring is more Declarative. (Lessons learned from REBOL and QML languages)
- (6) Ring Implementation is Transparent, Visual and comes with Rich Features.

105.12 What are the advantages to using Ring over Tcl or Lua?

- (1) Clean Code (More Natural)
- (2) More Features (A lot of useful programming paradigms)

105.13 What are the advantages to using Ring over C# or Java?

- (1) Compact Code (Clean and Natural), More Productivity and Flexibility.
- (2) Better support for Declarative Programming and Natural Programming

105.14 The documentation says functional programming is supported, but then this happens?

The question was about this code

```
f = func {
    a = 42
    return func { return a }
}

innerF = call f()
call innerF()
```

Output:

```
Using uninitialized variable : a In function _ring_anonymous_func_16601()
```

The Answer:

- It's Anonymous Functions, i.e. Not Closures.
- Many developers asked about supporting Closures and during language development we may add new features that doesn't go against the language goals or spirit.
- You can use classes and objects when you want to merge between the state and functions to provide a clear solution.
- You can use Lists and put the anonymous function inside the List then return the list that contains the state and the function. Pass the list to the function when you use it.
- You can use eval() and substr() to add the variable value directly to the anonymous function before return.
- We protect you from other scopes when you define the function. In Ring we provided the Three Scopes Rule where at each point you have only at maximum three scopes (Global, Object Scope and Local Scope).
- We don't get everything from everywhere to be like others! We don't need to do that. If we will think like that then we will create a very complex language or we will save our time and use other languages.
- When you think about learning or studying a new language concentrate about (What is new?) and (What is better in this language?) to know when to use it. Don't compare a new language just released little months ago with languages started many years ago and expect to find everything that you used to have.
- Each programming language miss features in other languages. The idea is not the Features. it's the spirit and ability behind all of the features together.

105.15 Why the ability to define your own languages Instead of just handing over the syntax so you can parse it using whatever code you like?

It's innovation - You create natural statements without the need to learn about parsing. You just use Classes which is intelligent decision (where later we can mix between classes to support more statements based on the context - We can change and translate the defined statements and many more!). Also the statements are added in Ring World where you can use any Ring statement.

105.16 Why you can specify the number of loops you want to break out of?

The language supports programming in the small and programming in the large. The selection of what features to use is based on what are you going to do. Any programmer can write poorly code in any language if he/she wants to do that. The idea is what must be done in the language design to prevent errors without causing other problems like killing flexibility.

Read some source code in the Linux Kernel and Ruby Implementation for example, You will find good usage for GOTO as a practical example that General Rules are not for All Use Cases and great programmers know when to break the rules. I'm not saying go and use GOTO or saying Ring add things like that. But the ability to break more than one loop and/or the ability to break the loop from sub functions is practical for small programs.

Anyway these are some of the small new things added by the language (Not the big idea).

105.17 Why Ring uses ‘See’, ‘Give’, ‘But’ and ‘Ok’ Keywords?

See and Give are selected not to be “opposite actions” but to reflect what I want to do as a programmer.

When I want to see something on the screen I use ‘See’.

When I want to give some input to the program I use ‘Give’.

My selection of “but” and “ok” is based on selecting keywords that can be written quickly.

Also using “but” is easy to remember than elseif/elif/elsif where each language select a different keyword.

In Ring 1.1 and later versions All of this is just an option.

You can use ‘Put’ and ‘Get’ instead of ‘See’ and ‘Give’

You can use ‘elseif’ and ‘end’ instead of ‘But’ and ‘Ok’

It’s your choice. In Ring we have syntax flexibility where we provide more than one style.

Also you can change the language keywords and operators.

Also you can define new natural languages too.

105.18 What is the philosophy behind data types in Ring?

The Ring programming language is designed to be SMALL. The language provides the basic constructs that you need to do anything! One of the goals is to keep the basic constructs simple and small as possible.

Using Lists in Ring you can

- Create Arrays (one data type)
- Create Lists (Mix of data types)
- Create Tree (Nested arrays)
- Use String Index (Looks like Dictionary/Hash Table)

The same principle is applied to Numbers

- You can use the number for int value
- You can use the number for double value

- You can use the number for Boolean value (True/False)

The sample principle is applied for Strings

- You can use the string for storing one character
- You can use the string for storing text (one or many lines)
- You can use the string for storing binary data
- You can use the string for storing date
- You can use the string for storing time
- You can use the string for storing NULL values (empty strings)

And we have Object Oriented Support + Operator Overloading where the programmer can define new data types and use them as default types defined by the language

So We have

- A small and simple language that someone can pick in little days
- A fast language that provide primitive types (String - Number - List - Object)
- A flexible language that can be extended using OOP to add new types according to the application domain

105.19 What about the Boolean values in Ring?

You can use true for 1 and false for 0

when you test the result of Boolean expressions in your code.

Just when you print the value using the see command you will see 1 for (true) and 0 for (false)

Why ?

Because Ring contains only 4 types of variables

- (1) Number
- (2) String
- (3) List
- (4) Object

The first type (Number) is used to represent int, double and Boolean values.

The second type (String) is used to represent char, array of characters, date and time.

The third type (List) is used to represent Arrays of one type, Arrays of more than one type, Hash (Dictionary), Tree, etc.

The object can be an object created from a Ring class (Any Class) or just a C Pointer that we get from calling a C/C++ function/method.

Why ?

The Ring is designed to give the programmer/developer the most simple constructs that can be used to do everything. The programmer/developer can customize the language by creating new classes (and use operator overloading) to get more types that he care about according to the problem domain.

Why ?

Because simple is better, and easy to learn and remember! And this provide flexibility to convert between high level types that can be represented using the same basic type

105.20 What is the goal of including the “Main” function in Ring?

The main function is very important, you need it when you want to write statements that uses local variables instead of the Global scope.

Example:

```
x = 10
myfunc()
See "X value = " + X # here I expect that x will be (10)
# but I will get another value (6) because myfunc() uses x !
Func myfunc
  for x = 1 to 5
    See x + nl
  next
```

Output:

```
1
2
3
4
5
X value = 6
```

Now using the Main function

```
Func Main
  x = 10
  myfunc()
  See "X value = " + X

Func myfunc
  for x = 1 to 5
    See x + nl
  next
```

Output

```
1
2
3
4
5
X value = 10
```

105.21 Why the list index start from 1 in Ring?

It's about how we count in the real world, when we have three apples in our hand

we say 1 2 3

We don't start from 0

The question must be why the other languages start from 0 ?

The answer is, because this is related to the machine and how we deal with values and memory address.

Example

we have array called myarray[5]

In memory : myarray will have an address

The first item will be stored in that address

The second item will come after that address and so on

Now when we need to point to the first item we need the address of myarray

So we type myarray[0] because myarray + 0 result will still point to the first item

for the second item myarray[1] because myarray + 1 result will point to the second item and so on

In Low Level languages or languages near to the machine it's good to be like this

But for high level language designed for applications it's better to be natural

Example

```
mylist = [1,2,3,4,5]
for x = 1 to len(mylist)
    see x + nl
next
```

In the previous example we start from 1 to the length of the array if the index starts from 0 we will write

```
for x = 0 to len(mylist)-1
```

or remember the for loop in other languages

```
for(x=0 ; x<nMax ; x++ )
```

You will use the < operator !

105.22 Why Ring is not case-sensitive?

- (1) To be more human-friendly
- (2) Like Ada, SQL, Pascal, Delphi, Visual Basic, Visual FoxPro, etc.
- (3) To help in supporting Natural Language Programming.
- (4) To be able to select your favorite style when writing the language keywords

```
see "lower case!"
```

SEE "UPPER case!"

See "First Letter is UPPER case!"

- (5) To avoid getting error message when writing quick tests then type “variable” instead of “Variable”.
- (6) To avoid getting error message when you type “Dosomething()” instead of “doSomething()”
- (7) In Ring, No conflict between Variables, Method Names & Classes Names

We can write person as variable name and Person as class name.

```
person = new Person
class Person
    name address phone
```

105.23 Why the Assignment operator uses Deep Copy?

“Because it’s a poor tradeoff to add complexity for dubious performance gains, a good approach to deep vs. shallow copies is to prefer deep copies until proven otherwise.”

, Steve McConnell, Code Complete

- (1) It’s more natural, When you use the assignment operator, You expect a deep copy.
- (2) If you don’t need a deep copy, Just don’t use it!
- (3) The Ring language is designed to reduce references usage as much as possible.
- (4) The Ring language is designed to make using references simple and possible in special cases where this make sense.
- (5) **We have references when this is natural, like passing lists and objects to functions,** creating objects (Like GUI Objects) from a C/C++ library, returning an object stored inside a list.
- (6) **It is a feature, We can use it to create pure functions. The Value() function in the stdlib** uses this feature to pass lists & objects by value when we need this.
- (7) When we need references, It’s recommended to create a class that manage sharing lists and objects.
- (8) It’s more safe at the application level to avoid many logical errors.
- (9) **In Ring, we start without thinking about the little details and concentrate on the application,** You don’t have to write the type (Dynamic Typing), You don’t have to write explicit conversions between numbers and strings (Weakly Typed) and you don’t have to select between using values or references, You don’t have to write the scope (Lexical Scoping).
- (10) **In Ring, we have smart garbage collector (Simple & Fast), We can delete the memory directly** at any time using the Assignment operator too. Reducing references usage or using them through managers helps a lot to achieve this goal. by doing this we have full control.
- (11) **If you want to create references and avoid creating a manager,** You can use Object2Pointer() and Pointer2Object() functions But It’s not the Ring way “Spirit” to do things.

105.24 Is there constructor methods in Ring?

When you create new object for example

```
new point
```

1 - Ring will allocate dynamic memory space to be used for the new object attributes that Ring doesn't know anything about them.

2 - Ring will change the current local scope and the current object scope to use the object state created in step (1)

3 - Ring will move the execution to the class Region (After the class name and before any methods)

4 - Any Instructions/Code in the class region will be executed as any Ring code

5 - Control is moved from the class region to the location of (new point) once we reach the end of the class region or we uses a Return command.

So All attributes that added to the object are dynamic attributes, this mean that you can control what attributes will be added through the runtime.

Example:

```
$3D = False
see new point
$3D = True
see new point

class point
    x y
    if not $3D return ok
    z
```

Output:

```
x: NULL
y: NULL
x: NULL
y: NULL
z: NULL
```

You have an option to call init() method directly when you create a new object

This method can do anything with the object attributes as it will be called after creating the object and executing the class region code.

```
p1 = new point3d(100,200,300)
see p1

class point3d
    x y z
    func init p1,p2,p3
        x=p1 y=p2 z=p3
```

105.25 What happens when we create a new object?

- 1- When you create an object, the class region code will be executed and you will have the object attributes based on the code in that region
- 2- Ring don't care about the object methods until you start calling a method
- 3- When you call a method, Ring will check the object class and the class parent (if you are using inheritance) and will collect the methods for you to be used now or later from any object that belong to the same class.
- 4- Since methods are dynamic and each object get the method from the class, you can after creating objects, add new methods and use it with the object or any object created or will be created from the same class.

Example:

```
o1 = new point {x=10 y=20 z=30}
o2 = new point {x=100 y=200 z =300}

addmethod(o1,"print", func { see x + nl + y + nl + z + nl } )

o1.print()
o2.print()

class point x y z
```

Output:

```
10
20
30
100
200
300
```

105.26 Can we use the attributes by accessing the Getter and Setter methods?

Yes we can, The setter/getter methods are called automatically when you start using the attributes from outside the class Also you can call the methods instead of using the attributes. It's your choice.

Example:

```
o1 = new Developer
o1.name = "Mahmoud" see o1.name + nl
o1 { name = "Gal" see name }
o1 { name = "Bert" see name }

o1.setname("Marino")
see o1.getname()

Class Developer

    name language = "Ring Programming Language"

    func setname value
```

(continues on next page)

(continued from previous page)

```

see "Message from SetName() Function!" + nl
name = value + " - " + language

func getname
see "Message from GetName() Function!" + nl + nl
return "Mr. " + name + nl

```

Output

```

Message from SetName() Function!
Message from GetName() Function!

Mr. Mahmoud - Ring Programming Language

Message from SetName() Function!
Message from GetName() Function!

Mr. Gal - Ring Programming Language
Message from SetName() Function!
Message from GetName() Function!

Mr. Bert - Ring Programming Language
Message from SetName() Function!
Message from GetName() Function!

Mr. Marino - Ring Programming Language

```

105.27 Why should a search of global names be made while defining the class attributes?

The question is why we don't avoid conflicts with global variable names when we define the class attributes ?

At first remember that using the optional \$ mark in the global variables names solve the problem. Also using the Main function and avoiding global variables may help.

The Answer:

Ring is a dynamic language

We can in the run-time determine the class attributes (Add/Remove)

We can execute (any code) while defining the class attributes

Example (1)

```

oPerson = new Person
Class Person
  See "Welcome to the Ring language"

```

Example (2)

Customize attributes based on global variable value

```

$debug = true
oPerson = new Person
see oPerson

```

(continues on next page)

(continued from previous page)

```
Class Person
  if $debug  date=date()  time=time()  ok
```

In the previous example when we have the \$debug flag set to true, we will add the Date and Time attributes to the object state.

Example (3)

Store the object index based on global variable

```
$ObjectsCount = 0
oPerson = new Person
see oPerson
oPerson2 = new Person
see oPerson2
Class Person
  $ObjectsCount++
  nIndex = $ObjectsCount
```

Output:

```
nindex: 1.000000
nindex: 2.000000
```

Common Example:

- Connect to the database then get table columns (Using global Variable/Object).
- Create class attributes based on the column names.
- Later when you modify the database - you may don't need to modify your code.

It's flexibility but remember that power comes with great responsibility.

105.28 Why Ring doesn't avoid the conflict between Global Variables and Class Attributes Names?

In this use case we have

- 1 - Global Variable defined without a special mark like \$
- 2 - Class contains Attributes defined using a special syntax (where we type the attribute name directly after the class)
- 3 - The Attributes are defined in the class region that allows writing code and using global variables

If I will accepted your proposal about changing how Ring find variables in the class region I must break one of the previous three features which will lead to more problems that are more important than this problem.

I don't like changing the feature number (1) because I would like to keep Ring code more clean and let the programmer decide when to use \$ or not.

I don't like changing the feature number (2) because I like this feature and I don't like forcing the programmer to type self.attribute

I don't like changing the feature number (3) because it's very important in many applications to access global variables in the class region.

So what was my decision ?

I decided to leave this case for the programmer who will decide what to do to avoid this special case

- 1 - The programmer can avoid using global variables (Better) and can use the Main function (Optional)
- 2 - The programmer can use \$ before the variable name or any mark like **global_** or **g_**
- 3 - The programmer can use self.attribute after the class name to define the attributes

In general, for small programs you can use global variables and functions. For large programs, use classes and objects and small number of global variables or avoid them at all.

105.29 Where can I write a program and execute it?

Run the Ring Notepad where you can write/execute programs.

If you want to run programs using the command line

Add Ring/bin folder to the path then

```
ring <filename.ring>|<filename.ringo>
```

105.30 How to get the file size using **fseek()** and **ftell()** functions?

The next function can be used to get the file size without reading the file!

```
func getFileSize fp
    C_FILESTART = 0
    C_FILEEND = 2
    fseek(fp, 0, C_FILEEND)
    nFileSize = ftell(fp)
    fseek(fp, 0, C_FILESTART)
    return nFileSize
```

Note: The previous function take the fp (file pointer) as parameter, We can get the fp from opening the file using fopen() function.

```
fp = fopen("filename", "r")
see "File Size : " + getFileSize(fp) + nl
```

Another solution (Read the file)

```
see len(read("filename"))
```

105.31 How to get the current source file path?

We can use the next function to get the current source file path then we can add the path variable to the file name

```
cPath = CurrentPath()
func currentpath
    cFileName = filename()
    for x = len(cFileName) to 1 step -1
        if cFileName[x] = "/"
            return left(cFileName, x-1)
        ok
    next
    return cFileName
```

105.32 What about predefined parameters or optional parameters in functions?

if you want to use predefined parameters or optional parameters Just accept a list that works like hash/dictionary

Example

```
sum([ :a = 1, :b = 2])
sum([ :a = 1 ])
sum([ :b = 2 ])
func sum pList
    if plist[:a] = NULL pList[:a] = 4 ok
    if plist[:b] = NULL pList[:b] = 5 ok
    see pList[:a] + pList[:b] + nl
```

Output

```
3
6
6
```

105.33 How to print keys or values only in List/Dictionary?

If you want to print keys only or values only just select the index of the item (one or two).

Example

```
C_COUNTRY = 1
C_CITY = 2
mylist = [
    :KSA = "Riyadh" ,
    :Egypt = "Cairo"
]

for x in mylist
    see x[C_COUNTRY] + nl
next
```

(continues on next page)

(continued from previous page)

```
for x in mylist
    see x[C_CITY] + nl
next
```

Output

```
ksa
egypt
Riyadh
Cairo
```

105.34 Why I get a strange result when printing nl with lists?

In the next code

```
list = 1:5          # list = [1, 2, 3, 4, 5]
see list + nl
```

New Line will be added to the list then the list will be printed, the default print of the lists will print a newline at the end, You added new newline and You have now 2 newlines to be printed.

See <Expr>

The see command just print the final result of the expression, the expression will be evaluated as it

```
nl = char(13) + char(10) # just a variable that you can change to anything !
```

The + is an operator

```
string + string ---> new string
string + number ---> new string
number + number ---> new number
number + string ---> new number
```

list + item —> nothing new will be created but the item will be added to the same list

Exception

number + nl -> New String

This exception is added to easily print numbers then new line.

No need for this with printing lists because after printing the last item we already get a new line.

105.35 Could you explain the output of the StrCmp() function?

At first remember that you can check strings using '=' operator directly.

```
see strcmp("hello", "hello") + nl +
strcmp("abc", "bcd") + nl +
strcmp("bcd", "abc") + nl
```

if the two strings are the same then it returns 0

abc and bcd aren't the same. in the second line it returns -1 and in the third line it returns 1

In the second line we compare between "abc" and "bcd"

Not equal because the first letter in "abc" = "a" and the first letter in "bcd" = "b"

So we have "a" != "b" and "a" < "b"

So we get output = -1

In the third line we have "bcd" and "abc"

the first letter in "bcd" is "b" and the first letter in "abc" is "a"

So we have "b" != "a" and "b" > "a"

So we get output = 1

Note: ASCII("a") = 97 and ASCII("b") = 98 So "a" < "b" because 97 < 98

105.36 How to use many source code files in the project?

Example:

I have the next folder

```
C:\LRing
```

Contains the next files

```
C:\LRing\t1.ring
C:\LRing\mylib.ring
C:\LRing\libs\mylib2.ring
```

The file t1.ring contains the next code

```
load "mylib.ring"
load "libs\mylib2.ring"
myfunc()
test()
```

The file mylib.ring contains the next code

```
func myfunc
    see "message from myfunc"+nl
```

The file libsmylib2.ring contains the next code

```
func test
    see "message from test" + nl
```

from the folder C:LRing

If Ring is not added to the path you can add it or use the next command

```
set path=%path%;c:\ring\bin;
```

Where c:ring is the Ring folder

Now run

```
Ring t1.ring
```

Output

```
message from myfunc
message from test
```

105.37 Why this example use the GetChar() twice?

The GetChar() function accept one character from the keyboard buffer

In this example

```
While True
    See "
        Main Menu
        (1) Say Hello
        (2) Exit
    "
    Option = GetChar()
    GetChar() GetChar() # End of line
    # the previous two lines can be replaced with the next line
    # Give Option

    if Option = 1
        see "Enter your name : " give cName
        see "Hello " + cName
    else
        bye
    ok
End
```

We uses GetChar() Three times

The first time we get the user option

```
Option = GetChar()
```

But in the second and the third times (We accept the new line characters from the buffer)

```
GetChar() GetChar() # End of line
```

Example : when the user select the option number 1 then press ENTER

We have Three Characters

- The first character is : Number 1
- The second character is : CHAR(13)
- The third character is : CHAR(10)

Because Windows uses CHAR(13) and CHAR(10) for each new line (i.e. CR+LF)

105.38 How to use NULL and ISNULL() function?

when we try to use uninitialized variable in the Ring programming language, we get a clear runtime error message

Example

```
See x
```

Output

```
Line 1 Error (R24) : Using uninitialized variable : x
in file tests\seeuninit.ring
```

The same happens when you try to access uninitialized attributes

Example

```
o1 = new point
see o1
see o1.x
class point x y z
```

Output

```
x: NULL
y: NULL
z: NULL
```

```
Line 3 Error (R24) : Using uninitialized variable : x
in file tests\seeuninit2.ring
```

if you want to check for the error, just use Try/Catch/End

```
Try
    see x
Catch
    See "Sorry, We can't use x!" + nl
Done
```

Output

```
Sorry, We can't use x!
```

Now we will talk about NULL and ISNULL()

Since we get error message when we deal with uninitialized variables

We can check these errors using Try/Catch/Done, So we uses NULL and ISNULL() for dealing with Strings.

NULL is a variable contains an empty string

ISNULL() is a function that returns true (1) if the input is an empty string or just a string contains “NULL”

This because we need to test these values (empty strings) and strings contains “NULL” that sometimes come from external resource like DBMS.

Example

```
See IsNull(5) + nl +      # print 0
IsNull("hello") + nl +    # print 0
IsNull([1,3,5]) + nl +    # print 0
IsNull("") + nl +         # print 1
IsNull("NULL")           # print 1
```

105.39 How to print lists that contains objects?

In this example we will see how we can print a list contains objects.

```
aList = [[1,2,3] , new point(1,2,3), new point(1,2,3)]
see "print the list" + nl
see alist
see "print the item (object)" + nl
see alist[2]
class point x y z
    func init p1,p2,p3 x=p1 y=p2 z=p3
```

Output

```
print the list
1
2
3
x: 1.000000
y: 2.000000
z: 3.000000
x: 1.000000
y: 2.000000
z: 3.000000
print the item (object)
x: 1.000000
y: 2.000000
z: 3.000000
```

105.40 How to insert an item to the first position in the list?

To insert an item we can use the insert(aList,nIndex,Value) function.

```
aList = 1:5
insert(aList,0,0)
See aList # print numbers from 0 to 5
```

105.41 How to print new lines and other characters?

To print new line we can use the nl variable.

```
See "Hello" + nl
```

or we can use multi-line literal as in the next example

```
See "Hello
"
"
```

if we want to print other characters we can use the char(nASCII) function

```
See char(109) + nl +      # print m
     char(77)           # print M
```

105.42 Why we don't use () after the QApp class name?

When we use RingQt to create GUI application, we uses () after the class name when we create new objects for example.

```
new QWidget() { setWindowTitle("Hello World") resize(400,400) show() }
```

but before doing that we create an object from the qApp class and we don't use () after that

```
Load "guilib.ring"
app = new qApp
{
    win=new QWidget()
    {
        setWindowTitle(:test)
        show()
    }
    exec()
}
```

Using () after the class name means calling the init() method in the class and passing parameters to this method.

If we used () while no init() method in the class we get the expected error message.

The class qApp don't have this method while the other classes have it because they need it to create an object using a function that return a pointer to that object and this pointer will be stored in an attribute called pObject, for more information see ring_qt.ring file which contains the classes.

105.43 Why the window title bar is going outside the screen?

When we write the next code

```
Load "guilib.ring"
app = new qApp
{
    win=new QWidget()
    {
        setWindowTitle(:test)
        setGeometry(0,0,200,200)
        show()
    }
    exec()
}
```

I would expect that the window will run at the point (0,0) with (200,200) size but the actual result is that the window title bar is going outside the screen.

This is related to the behavior of Qt framework.

The next code will avoid the problem

```
load "guilib.ring"
new qApp {
    new QWidget() {
        move(0,0)
        resize(200,200)
        show()
    }
    exec()
}
```

105.44 How to create an array of buttons in GUI applications?

Check the next example:

```
Load "guilib.ring"

App1 = new qApp {

    win1 = new QWidget() {
        move(0,0)
        resize(500,500)
        new qPushButton(win1)
        {
            settext("OK")
            setclickevent("click()")
        }
        btn1 = new qPushButton(win1)
        {
            setgeometry(100,100,100,30)
            settext("Button1")
        }
    }
}
```

(continues on next page)

(continued from previous page)

```

        btn2 = new qPushButton(win1)
        {
            setgeometry(200,100,100,30)
            settext("Button2")
        }

        button = [btn1, btn2]
        show()
    }

    exec()

}

func click

    button[1] { settext ("Button3") }
    button[2] { settext ("Button4") }

```

105.45 How to Close a window then displaying another one?

This example demonstrates how to close a window and show another one

```

Load "guilib.ring"

app=new qApp
{
    frmBefore=new Qwidget()
    {
        setWindowTitle("before!")
        resize(300,320)
        move(200,200)

        button=new qPushButton(frmBefore)
        {
            setText("Close")
            setClickEvent("frmBefore.close() frmMain.show()")
        }

        show()
    }

    frmMain=new Qwidget()
    {
        setWindowTitle("After!")
        resize(300,320)
        move(200,200)
    }

    exec()
}

```

105.46 How to create a Modal Window?

This example demonstrates how to create a modal window

```

load "guilib.ring"
app=new qApp
{
    frmStart=new QWidget()
    {
        setWindowTitle("The First Window")
        resize(300,320)
        move(200,200)

        button=new QPushButton(frmStart)
        {
            setText("Show Modal Window")
            resize(200,30)
            setClickEvent("frmModal.show()")
        }

        new QPushButton(frmStart)
        {
            setText("Close Window")
            move(0,50)
            resize(200,30)
            setClickEvent("frmStart.Close()")
        }

        show()
    }

    frmModal =new QWidget()
    {
        setWindowTitle("Modal Window")
        resize(300,320)
        move(200,200)
        setparent(frmStart)
        setwindowmodality(true)
        setwindowflags(Qt_Dialog)
    }

    exec()
}

```

Related Documents

- <http://doc.qt.io/qt-5/qtwidgets-widgets-windowflags-example.html>
- <http://doc.qt.io/qt-5/qt.html#WindowType-enum>
- <http://doc.qt.io/qt-5/qwindow.html#setParent>
- <http://doc.qt.io/qt-5/qt.html#WindowModality-enum>

105.47 How can I disable maximize button and resize window?

Use the method setWindowFlags()

```

Load "guilib.ring"
app1 = new qapp {
    win1 = new qwidget() {
        setwindowtitle("First")
        setgeometry(100,100,500,500)

        new qpushbutton(win1) {
            setgeometry(100,100,100,30)
            settext("close")
            setclickevent("app1.quit()")
        }

        new qpushbutton(win1) {
            setgeometry(250,100,100,30)
            settext("Second")
            setclickevent("second()")
        }

        showmaximized()
    }
    exec()
}

func second
    win2 = new qwidget() {
        setwindowtitle("Second")
        setgeometry(100,100,500,500)
        setwindowflags(Qt_dialog)
        show()
}

```

105.48 How to use SQLite using ODBC?

In Ring 1.1 and later versions we have native support for SQLite, so you don't need to use it through ODBC.

Also we can access SQLite through RingQt.

The answer to your question

```

pODBC = odbc_init()
odbc_connect(pODBC, "DRIVER=SQLite3 ODBC Driver;Database=mydb.db;LongNames=0;" +
    "Timeout=1000;NoTXN=0;SyncPragma=NORMAL;StepAPI=0;")
odbc_execute(pODBC, "create table 'tel' ('ID', 'NAME', 'PHONE');")
odbc_execute(pODBC, "insert into 'tel' values ('1', 'Mahmoud', '123456');")
odbc_execute(pODBC, "insert into 'tel' values ('2', 'Ahmed', '123456');")
odbc_execute(pODBC, "insert into 'tel' values ('3', 'Ibrahim', '123456');")
odbc_execute(pODBC, "select * from tel") + nl
nMax = odbc_colcount(pODBC)
See "Columns Count : " + nMax + nl
while odbc_fetch(pODBC)
    See nl

```

(continues on next page)

(continued from previous page)

```

for x = 1 to nMax
    see odbc_getdata(pODBC,x)
    if x != nMax see " - " ok
next
end
odbc_disconnect(pODBC)
odbc_close(pODBC)

```

Output:

```

Columns Count : 3

1 - Mahmoud - 123456
2 - Ahmed - 123456
3 - Ibrahim - 123456

```

The program will create the file : mydb.db

Note : when I print the odbc drivers I see the long list that includes

```

SQLite3 ODBC Driver - UsageCount=1
SQLite ODBC Driver - UsageCount=1
SQLite ODBC (UTF-8) Driver - UsageCount=1

```

And I'm using “SQLite3 ODBC Driver”.

105.49 Can I connect to dbase/harbour database?

You can connect to any database using ODBC

To connect to xbase files (*.DBF)

```

See "Using DBF Files using ODBC" + nl
pODBC = odbc_init()
See "Connect to database" + nl
odbc_connect(pODBC,"Driver={Microsoft dBase Driver (*.dbf)};" +
             "datasource=dBase Files;DriverID=277")
See "Select data" + nl
odbc_execute(pODBC,"select * from tel.dbf")
nMax = odbc_colcount(pODBC)
See "Columns Count : " + nMax + nl
while odbc_fetch(pODBC)
    See "Row data:" + nl
    for x = 1 to nMax
        see odbc_getdata(pODBC,x) + " - "
    next
end
See "Close database..." + nl
odbc_disconnect(pODBC)
odbc_close(pODBC)

```

Output

```

Using DBF Files using ODBC
Connect to database

```

(continues on next page)

(continued from previous page)

```
Select data
Columns Count : 3
Row data:
Ahmad - Egypt - 234567 - Row data:
Fady - Egypt - 345678 - Row data:
Shady - Egypt - 456789 - Row data:
Mahmoud - Egypt - 123456 - Close database...
```

Also you can connect to a Visual FoxPro database (requires installing Visual FoxPro driver)

```
See "ODBC test 6" + nl
pODBC = odbc_init()
See "Connect to database" + nl
odbc_connect(pODBC,"Driver={Microsoft Visual FoxPro Driver};"+
    "SourceType=DBC;SourceDB=C:\PWCT19\ssbuild\PWCTDATA\CH1\Data\mydata.dbc;")
See "Select data" + nl
see odbc_execute(pODBC,"select * from t38") + nl
nMax = odbc_colcount(pODBC)
See "Columns Count : " + nMax + nl
while odbc_fetch(pODBC)
    See "Row data:" + nl
    for x = 1 to nMax
        see odbc_getdata(pODBC,x) + " - "
    next
end
See "Close database..." + nl
odbc_disconnect(pODBC)
odbc_close(pODBC)
```

105.50 Why setClickEvent() doesn't see the object methods directly?

setClickEvent(cCode) take a string contains code. The code will be executed when the event happens.

Ring support Many Programming Paradigms like Procedural, OOP, Functional and others.

But when you support many paradigms at the language level you can't know which paradigm will be used so you have two options

- (1) Provide General Solutions that works with many programming paradigms.
- (2) Provide Many Specific solutions where each one match a specific paradigm.

setClickEvent() and others belong to (General Solutions that works with many programming paradigms).

You just pass a string of code that will be executed without any care about classes and objects.

This code could be anything like calling a function, calling a method and setting variable value.

Some other languages force you to use OOP and call methods for events. Also some other languages uses anonymous functions that may get parameters like the current object.

Now we have the general solution (not restricted with any paradigm), In the future we may add specific solutions that match specific paradigms (OOP, Functional, Declarative and Natural).

105.51 Why I get Calling Function without definition Error?

Each program follow the next order

1 - Loading Files 2 - Global Variables and Statements 3 - Functions 4 - Packages, Classes and Methods

So what does that mean ?

- (1) **** No Functions comes After Classes ****
- (2) **** No command is required to end functions/methods/classes/packages ****

Look at this example

```
See "Hello"
test()
func test
    see "message from the test function!" + nl
class test
```

In the previous example we have a function called test() so we can call it directly using test()

In the next example, test() will become a method

```
See"Hello"
test()      # runtime error message
class test
    func test # Test() now is a method (not a function)
        see "message from the test method!" + nl
```

The errors comes when you define a method then try calling it directly as a function.

The previous program must be

```
See"Hello"
new test { test() }   # now will call the method
class test
    func test # Test() now is a method (not a function)
        see "message from the test method!" + nl
```

105.52 Can Ring work on Windows XP?

Ring can work on Windows XP and load extensions without problems.

Just be sure that the extension can work on Windows XP and your compiler version support that (modern compilers requires some flags to support XP)

Check this topic <https://blogs.msdn.microsoft.com/vcblog/2012/10/08/windows-xp-targeting-with-c-in-visual-studio-2012/>

For example, We added

```
/link /SUBSYSTEM:CONSOLE, "5.01"
```

To the batch file to support Windows XP

See : <https://github.com/ring-lang/ring/blob/master/language/src/buildvc.bat>

105.53 How to extend RingQt and add more classes?

You have many options

In general you can extend Ring using C or C++ code

Ring from Ring code you can call C Functions or use C++ Classes & Methods

This chapter in the documentation explains this part in the language <https://ring-lang.sourceforge.io/doc1.13/extension.html>

For example the next code in .c file can be compiled to a DLL file using the Ring library (.lib)

```
#include "ring.h"

RING_FUNC (ring_ringlib_dlfunc)
{
    printf("Message from dlfunc");
}

RING_API void ringlib_init(RingState *pRingState)
{
    ring_vm_funcregister("dlfunc",ring_ringlib_dlfunc);
}
```

Then from Ring you can load the DLL file using LoadLib() function then call the C function that called dlfunc() as any Ring function.

```
See "Dynamic DLL" + NL
LoadLib("ringlib.dll")
dlfunc()
```

Output

```
Dynamic DLL
Message from dlfunc
```

When you read the documentation you will know about how to get parameters like (strings, numbers, lists and objects)

And how to return a value (any type) from your function.

From experience, when we support a C library or C++ Library

We discovered that a lot of functions share a lot of code

To save our time, and to quickly generate wrappers for C/C++ Libraries to be used in Ring

We have this code generator

<https://github.com/ring-lang/ring/blob/master/extensions/codegen/parsec.ring>

The code generator is just a Ring program < 1200 lines of Ring code

The generator takes as input a configuration file containing the C/C++ library information

like Functions Prototype, Classes and Methods, Constants, Enum, Structures and members , etc.

Then the generator will generate

- *.C File for C libraries (to be able to use the library functions)

- *.CPP File for C++ libraries (to be able to use C++ classes and methods)

- *.Ring File (to be able to use C++ classes as Ring classes)

***.RH file (Constants)**

To understand how the generator work check this extension for the Allegro game programming library

<https://github.com/ring-lang/ring/tree/master/extensions/ringallegro>

At first we have the configuration file

<https://github.com/ring-lang/ring/blob/master/extensions/ringallegro/allegro.cf>

To write this file, i just used the Allegro documentation + the Ring code generator rules

Then after executing the generator using this batch file

<https://github.com/ring-lang/ring/blob/master/extensions/ringallegro/gencode.bat>

or using this script

<https://github.com/ring-lang/ring/blob/master/extensions/ringallegro/gencode.sh>

I get the generated source code file

https://github.com/ring-lang/ring/blob/master/extensions/ringallegro/ring_allegro.c

The generated source code file (ring_allegro.c) is around 12,000 Lines of code (12 KLOC)

While the configuration file is less than 1 KLOC

To build the library (create the DLL files)

<https://github.com/ring-lang/ring/blob/master/extensions/ringallegro/buildvc.bat>

Also you can check this extension for the LibSDL Library

<https://github.com/ring-lang/ring/tree/master/extensions/ringsdl>

After this know you should know about

1 - Writing the configuration file

2 - Using the Code Generator

3 - Building your library/extension

4 - Using your library/extension from Ring code

Let us move now to you question about Qt

We have RingQt which is just an extension to ring (ringqt.dll)

You don't need to modify Ring.

(1) You just need to modify RingQt

(2) Or extend Ring with another extension based on Qt (but the same Qt version)

For the first option see the RingQt extension

<https://github.com/ring-lang/ring/tree/master/extensions/ringqt>

Configuration file

<https://github.com/ring-lang/ring/blob/master/extensions/ringqt/classes/qt.cf>

To generate the source code

<https://github.com/ring-lang/ring/blob/master/extensions/ringqt/gencode.bat>

<https://github.com/ring-lang/ring/blob/master/extensions/ringqt/gencode.sh>

<https://github.com/ring-lang/ring/blob/master/extensions/ringqt/gencodeandroid.bat>

To build the DLL/so/Dylib files

<https://github.com/ring-lang/ring/blob/master/extensions/ringqt/buildmingw32.bat>

<https://github.com/ring-lang/ring/blob/master/extensions/ringqt/buildgcc.sh>

<https://github.com/ring-lang/ring/blob/master/extensions/ringqt/buildclang.sh>

Study RingQt

Learn about the options that you have

(1) wrapping a Qt class directly

(2) Creating a new class then wrapping your new class

For the second option (in the previous two points or in the two points before that)

You will create new classes in C++ code

Then you merge these classes to RingQt or provide special DLL for them (your decision)

If your work is general (will help others) just put it to RingQt.

If your work is special (to specific application) just put it in another extension.

105.54 How to add Combobox and other elements to the cells of a QTableWidget?

Check the next code

```
Load "guilib.ring"
New qApp
{
    win1 = new QMainWindow() {
        setGeometry(100,100,1100,370)
        setWindowTitle("Using QTableWidget")

        Table1 = new QTableWidget(win1) {
            setRowCount(10) setColumnCount(10)
            setGeometry(0,0,800,400)
            setSelectionBehavior(QAbstractItemView_SelectRows)

            for x = 1 to 10
                for y = 1 to 10
                    item1 = new QTableWidgetItem("R"+X+"C"+Y)
                    setItem(x-1,y-1, item1)
                next
            next

            cmb = new QComboBox(Table1) {
                aList = ["one","two","three","four","five"]
                for x in aList additem(x,0) next
            }
            setCellWidget(5, 5, cmb)
        }

        setCentralWidget(table1)
        show()
    }
}
```

(continues on next page)

(continued from previous page)

```
    exec()
}
```

105.55 How to perform some manipulations on selected cells in QTableWidget?

Check the next sample

```
Load "guilib.ring"

New qApp {
    win1 = new qMainWindow() {
        setGeometry(100,100,800,600)
        setWindowTitle("Using QTableWidget")
        Table1 = new qTableWidget(win1) {
            setRowCount(10) setColumnCount(10)
            setGeometry(10,10,400,400)
            for x = 1 to 10
                for y = 1 to 10
                    item1 = new QTableWidgetItem("10")
                    setItem(x-1,y-1,item1)
                next
            next
        }
        btn1 = new QPushButton(win1) {
            setText("Increase")
            setGeometry(510,10,100,30)
            setClickEvent("pClick()")
        }
        show()
    }
    exec()
}

func pClick
    for nRow = 0 to Table1.rowCount() - 1
        for nCol = 0 to Table1.columnCount() - 1
            Table1.item(nRow,nCol) {
                if isSelected()
                    setText( "" + ( 10 + text() ) )
                ok
            }
        next
    next
```

105.56 Which of 3 coding styles are commonly used or recommended by the community?

- (1) Just select any style of them but don't mix between the different styles in the same project or at least in the same context (Implementation, Tests, Scripts, etc)

Note: State the rules in the start of each project and follow it.

- (2) You can create your style (by changing keywords) - The idea is about customization and freedom.

Note: It's better to change keywords and create new style only for a clear reason like using another natural language (Arabic, French, etc.)

- (3) **The First style is better (IMHO) for questions, tutorials and small applications/programs (Less than 5,000 LOC)**
Example : Ring Book, Most of Ring Samples and Applications.

- (4) The Third style is better(IMHO) for large applications and mainstream programmers

Example (Form Designer) : <https://github.com/ring-lang/ring/tree/master/tools/formdesigner>

BUILDING FROM SOURCE CODE

The Ring programming language is a free open source product (MIT License).

You can build Ring using CMake or using Scripts (Batch Files or Shell Scripts).

The next steps explains building using scripts.

106.1 Building using Microsoft Windows

Get the source code

```
git clone http://github.com/ring-lang/ring.git
```

Build Ring (Compiler/VM)

```
cd ring/language/src  
buildvc.bat  
buildvcw.bat
```

Build Ring2EXE

```
cd ../../tools/ring2exe  
buildring2exe.bat
```

Generate RingConsoleColors Source Code and Build

```
cd ../../extensions/ringconsolecolors  
gencode.bat  
buildvc.bat
```

Build RingInternet

```
cd ../../extensions/ringinternet  
buildvc.bat
```

Generate RingLibCurl Source Code and Build

```
cd ../../extensions/ringcurl  
gencode.bat  
buildvc.bat
```

Generate RingZip Source Code and Build

```
cd ../extensions/ringzip  
gencode.bat  
buildvc.bat
```

Build RingPM

```
cd ../tools/ringpm  
buildringpm.bat
```

Build RingODBC

```
cd ../extensions/ringodbc  
buildvc.bat
```

Build RingMySQL

```
cd ../extensions/ringmysql  
buildvc.bat
```

Build RingSQLite

```
cd ../extensions/ringsqlite  
buildvc.bat
```

Build RingPostgreSQL

```
cd ../extensions/ringpostgresql  
gencode.bat  
buildvc.bat
```

Build RingOpenSSL

```
cd ../extensions/ringopenssl  
buildvc.bat
```

Build RingMurmurHash

```
cd ../extensions/ringmurmurhash  
buildvc.bat
```

Generate RingAllegro Source Code and Build

```
cd ../extensions/ringallegro  
gencode.bat  
buildvc.bat
```

Generate RingLibuv Source Code and Build

```
cd ../extensions/ringlibuv  
gencode.bat  
buildvc.bat
```

Generate RingFreeGLUT Source Code and Build

```
cd ../extensions/ringfreeglut  
gencode.bat  
buildvc.bat
```

Generate RingOpenGL Source Code and Build

The ringopengl folder contains many sub folders for different OpenGL versions

Starting from OpenGL 1.1 to OpenGL 4.6

```
cd ../../extensions/ringopengl/opengl21
gencode.bat
buildvc.bat
```

Generate RingPostgreSQL Source Code and Build

```
cd ../../extensions/ringpostgresql
gencode.bat
buildvc.bat
```

Install Qt 5.12 : <https://download.qt.io/archive/qt/5.12/5.12.6/>

Generate RingQt Source Code and Build

```
cd ../../extensions/ringqt
gencodeqt512.bat
buildqt512.bat
```

To be able to call ring from any folder

```
cd ../../bin
install.bat
```

Add Ring/bin to System path

```
Hit "windows key".
Type "Edit the System environment variables"
Select "Advanced" tab.
Click on "Enviroment Variables..."
Double click on "Path"
Add at the end the new path separated by semicolon.
;C:\Ring\Bin
```

Run Ring Notepad

```
cd tools/ringnotepad
ring rnote.ring
```

106.2 Building using Ubuntu Linux

Get the source code

```
git clone http://github.com/ring-lang/ring.git
```

Install Libraries

```
cd ring/language/src
./installdep.sh
```

Build Ring (Compiler/VM)

```
sudo ./buildgcc.sh
```

Build Ring2EXE

```
cd ../../tools/ring2exe  
sudo ./buildring2exe.sh
```

Generate RingConsoleColors Source Code and Build

```
cd ../../extensions/ringconsolecolors  
.gencode.sh  
.buildgcc.sh
```

Build RingInternet

```
cd ../../extensions/ringinternet  
.buildgcc.sh
```

Generate RingLibCurl Source Code and Build

```
cd ../../extensions/ringcurl  
.gencode.sh  
.buildgcc.sh
```

Generate RingZip Source Code and Build

```
cd ../../extensions/ringzip  
.gencode.sh  
.buildgcc.sh
```

Build RingPM

```
cd ../../tools/ringpm  
sudo ./buildringpm.sh
```

Build RingODBC

```
cd ../../extensions/ringodbc  
.buildgcc.sh
```

Build RingMySQL

```
cd ../../extensions/ringmysql  
.buildgcc.sh
```

Build RingSQLite

```
cd ../../extensions/ringsqlite  
.buildgcc.sh
```

Build RingPostgreSQL

```
cd ../../extensions/ringpostgresql  
.gencode.sh  
.buildgcc.sh
```

Build RingOpenSSL

```
cd ../extensions/ringopenssl
./buildgcc.sh
```

Build RingMurmurHash

```
cd ../extensions/ringmurmurhash
./buildgcc.sh
```

Generate RingAllegro Source Code and Build

```
cd ../extensions/ringallegro
./gencode.sh
./buildgcc.sh
```

Generate RingLibuv Source Code and Build

We will build Libuv first

```
cd ../extensions/ringlibuv/libuv
sudo apt-get install libtool m4 automake
sh autogen.sh
./configure
make
make check
sudo make install
```

Then we will build RingLibuv

```
cd ..
./gencode.sh
./buildgcc.sh
```

Generate RingFreeGLUT Source Code and Build

```
cd ../extensions/ringfreeglut
./gencode.sh
./buildgcc.sh
```

Generate RingOpenGL Source Code and Build

The ringopengl folder contains many sub folders for different OpenGL versions

Starting from OpenGL 1.1 to OpenGL 4.6

```
cd ../extensions/ringopengl/opengl21
gencode.sh
buildgcc.sh
```

Generate RingPostgreSQL Source Code and Build

```
cd ../extensions/ringpostgresql
./gencode.sh
./buildgcc.sh
```

Generate RingQt Source Code and Build

```
cd ../extensions/ringqt
./gencode.sh
./buildgcc.sh
```

To be able to call ring from any folder

```
cd ../../bin  
sudo ./install.sh
```

Run Ring Notepad

```
cd tools/ringnotepad  
ring rnote.ring
```

106.3 Building using Fedora Linux

Get the source code

```
git clone http://github.com/ring-lang/ring.git
```

Install Libraries

```
cd ring/language/src  
./installdepfedora.sh
```

Build Ring (Compiler/VM)

```
sudo ./buildgcc.sh
```

Build Ring2EXE

```
cd ../../tools/ring2exe  
sudo ./buildring2exe.sh
```

Generate RingConsoleColors Source Code and Build

```
cd ../../extensions/ringconsolecolors  
./gencode.sh  
./buildgcc.sh
```

Build RingInternet

```
cd ../../extensions/ringinternet  
./buildgcc.sh
```

Generate RingLibCurl Source Code and Build

```
cd ../../extensions/ringcurl  
./gencode.sh  
./buildgcc.sh
```

Generate RingZip Source Code and Build

```
cd ../../extensions/ringzip  
./gencode.sh  
./buildgcc.sh
```

Build RingPM

```
cd ../tools/ringpm  
sudo ./buildringpm.sh
```

Build RingODBC

```
cd ../extensions/ringodbc  
./buildgcc.sh
```

Build RingMySQL

```
cd ../extensions/ringmysql  
./buildgcccfedora.sh
```

Build RingSQLite

```
cd ../extensions/ringsqlite  
./buildgcc.sh
```

Build RingPostgreSQL

```
cd ../extensions/ringpostgresql  
gencode.sh  
buildgcc.sh
```

Build RingOpenSSL

```
cd ../extensions/ringopenssl  
./buildgcc.sh
```

Build RingMurmurHash

```
cd ../extensions/ringmurmurhash  
./buildgcc.sh
```

Generate RingAllegro Source Code and Build

```
cd ../extensions/ringallegro  
./gencode.sh  
./buildgcc.sh
```

Generate RingLibuv Source Code and Build

We will build Libuv first

```
cd ../extensions/ringlibuv/libuv  
sudo dnf install libtool m4 autoconf automake  
sh autogen.sh  
./configure  
make  
make check  
sudo make install
```

Then we will build RingLibuv

```
cd ..  
./gencode.sh  
./buildgcc.sh
```

Generate RingFreeGLUT Source Code and Build

```
cd ../../extensions/ringfreeglut
./gencode.sh
./buildgcc.sh
```

Generate RingOpenGL Source Code and Build

The ringopengl folder contains many sub folders for different OpenGL versions

Starting from OpenGL 1.1 to OpenGL 4.6

```
cd ../../extensions/ringopengl/opengl21
gencode.sh
buildgcc.sh
```

Generate RingPostgreSQL Source Code and Build

```
cd ../../extensions/ringpostgresql
./gencode.sh
./buildgcc.sh
```

Generate RingQt Source Code and Build

```
cd ../../extensions/ringqt
./gencode.sh
./buildgccfedora.sh
```

To be able to call ring from any folder

```
cd ../../bin
sudo ./install.sh
```

Run Ring Notepad

```
cd tools/ringnotepad
ring rnote.ring
```

106.4 Building using MacOS X

Get the source code

```
git clone http://github.com/ring-lang/ring.git
```

Install homebrew (follow the directions on homebrew's homepage). Install Libraries

```
cd ring/language/src
./installdepmac.sh
```

Build Ring (Compiler/VM)

```
./buildclang.sh
```

Build Ring2EXE

```
cd ../../tools/ring2exe  
sudo ./buildring2exe.sh
```

Generate RingConsoleColors Source Code and Build

```
cd ../extensions/ringconsolecolors  
./gencode.sh  
./buildclang.sh
```

Build RingInternet

```
cd ../extensions/ringinternet  
./buildclang.sh
```

Generate RingLibCurl Source Code and Build

```
cd ../extensions/ringcurl  
./gencode.sh  
./buildclang.sh
```

Generate RingZip Source Code and Build

```
cd ../extensions/ringzip  
./gencode.sh  
./buildclang.sh
```

Build RingPM

```
cd ../../tools/ringpm  
sudo ./buildringpm.sh
```

Build RingODBC

```
cd ../extensions/ringodbc  
./buildclang.sh
```

Build RingMySQL

```
cd ../extensions/ringmysql  
./buildclang.sh
```

Build RingSQLite

```
cd ../extensions/ringsqlite  
./buildclang.sh
```

Build RingPostgreSQL

```
cd ../extensions/ringpostgresql  
gencode.sh  
buildclang.sh
```

Build RingOpenSSL

```
cd ../extensions/ringopenssl  
./buildclang.sh
```

Build RingMurmurHash

```
cd ../extensions/ringmurmurhash  
./buildclang.sh
```

Generate RingAllegro Source Code and Build

```
cd ../extensions/ringallegro  
./gencode.sh  
./buildclang.sh
```

Generate RingLibuv Source Code and Build

```
cd ../extensions/ringlibuv  
./gencode.sh  
./buildclang.sh
```

Generate RingFreeGLUT Source Code and Build

```
cd ../extensions/ringfreeglut  
./gencode.sh  
./buildclang.sh
```

Generate RingOpenGL Source Code and Build

The ringopengl folder contains many sub folders for different OpenGL versions Starting from OpenGL 1.1 to OpenGL 4.6

```
cd ../extensions/ringopengl/opengl21  
./gencode.sh  
./buildclang.sh
```

Generate RingPostgreSQL Source Code and Build

```
cd ../extensions/ringpostgresql  
./gencode.sh  
./buildclang.sh
```

Generate RingQt Source Code and Build

```
cd ../extensions/ringqt  
./gencodemac.sh  
./buildclang.sh
```

To be able to call ring from any folder

```
cd ../../bin  
sudo ./install.sh
```

Run Ring Notepad

```
cd tools/ringnotepad  
sudo ring rnote.ring
```

106.5 Building using CMake

Install libraries (MySQL Client, OpenSSL, LibCurl, Allegro 5 and Qt 5.5)

```
cmake .
make
```

HOW TO CONTRIBUTE?

Ring is a free-open source project, Everyone is welcome to contribute to Ring.

Project Home : <https://github.com/ring-lang/ring>

To editing on web browser without Git client, when login GitHub then click pencil icon in target file. Then, sends pull request.

You can help in many parts in the project

- Documentation
- Testing
- Samples
- Applications
- Editors Support
- Libraries in Ring
- Extensions in C/C++
- Compiler and Virtual Machine (VM)
- Ideas and suggestions

107.1 Special thanks to contributors

Throughout the creation of this project, Ring relied heavily on contributions from experts along with college students. Their input was invaluable, and we want to take a moment to thank them and recognize them for all of their hard work.

Ring Team: <http://ring-lang.sf.net/team.html>

107.2 Documentation

You can modify anything in the documentation, by updating the text files (*.txt) in this folder : <https://github.com/ring-lang/ring/tree/master/documents/source>

The documentation is created using Sphinx : <http://www.sphinx-doc.org/en/stable/>

107.3 Testing

You can write new tests in this folder

<https://github.com/ring-lang/ring/tree/master/language/tests/scripts>

107.4 Samples

You can add new samples to this folder

<https://github.com/ring-lang/ring/tree/master/samples>

107.5 Applications

You can add new applications to this folder

<https://github.com/ring-lang/ring/tree/master/applications>

107.6 Editors Support

You can help in supporting Ring in different code editors

Check the next folder

<https://github.com/ring-lang/ring/tree/master/tools/editors>

107.7 Libraries in Ring

You can update and add libraries to this folder

<https://github.com/ring-lang/ring/tree/master/libraries>

107.8 Extensions in C/C++

You can add and update extensions in this folder

<https://github.com/ring-lang/ring/tree/master/extensions>

107.9 Compiler and Virtual Machine (VM)

- Source Code (C Language) : <https://github.com/ring-lang/ring/tree/master/language/src>
- Visual Source (PWCT) : <https://github.com/ring-lang/ring/tree/master/language/visualsrc>

CHAPTER
EIGHT

LANGUAGE SPECIFICATION

In this chapter we will learn about

- Language keywords
- Language Functions
- Compiler Errors
- Runtime Errors
- Environment Errors
- Language Grammar
- Virtual Machine (VM) Instructions

108.1 Language Keywords

Keywords Count : 49

- again
- and
- but
- bye
- call
- case
- catch
- changingkeyword
- changingoperator
- class
- def
- do
- done
- else
- elseif
- end

- exit
- for
- from
- func
- get
- give
- if
- import
- in
- load
- loadsyntax
- loop
- new
- next
- not
- off
- ok
- on
- or
- other
- package
- private
- put
- return
- see
- step
- switch
- to
- try
- while
- endfunc
- endclass
- endpackage

108.2 Language Functions

Functions Count : 228

```
acos()
add()
addattribute()
adddays()
addmethod()
addsublistsbyfastcopy()
addsublistsbymove()
ascii()
asin()
assert()
atan()
atan2()
attributes()
binarysearch()
bytes2double()
bytes2float()
bytes2int()
callgarbagecollector()
callgc()
ceil()
cfunctions()
char()
chdir()
checkoverflow()
classes()
classname()
clearerr()
clock()
clockspersisecond()
closelib()
copy()
cos()
cosh()
currentdir()
date()
dec()
decimals()
del()
diffdays()
dir()
double2bytes()
eval()
exefilename()
exefolder()
exp()
fabs()
fclose()
feof()
ferror()
fexists()
fflush()
fgetc()
fgetpos()
```

(continues on next page)

(continued from previous page)

```
fgets()
filename()
find()
float2bytes()
floor()
fopen()
fputc()
fputs()
fread()
freopen()
fseek()
fsetpos()
ftell()
functions()
fwrite()
getattribute()
getchar()
getpointer()
getptr()
globals()
hex()
hex2str()
input()
insert()
int2bytes()
intvalue()
isalnum()
isalpha()
isandroid()
isattribute()
iscfunction()
isclass()
iscntrl()
isdigit()
isfreebsd()
isfunction()
isglobal()
isgraph()
islinux()
islist()
islocal()
islower()
ismacosx()
ismethod()
ismsdos()
isnull()
isnumber()
isobject()
ispackage()
ispackageclass()
isppointer()
isprint()
isprivateattribute()
isprivatemethod()
ispunct()
isspace()
isstring()
```

(continues on next page)

(continued from previous page)

```
isunix()
isupper()
iswindows()
iswindows64()
isxdigit()
left()
len()
lines()
list()
list2str()
loadlib()
locals()
log()
log10()
lower()
max()
memcpy()
memorycopy()
mergemethods()
methods()
min()
murmur3hash()
newlist()
nullpointer()
nullptr()
number()
obj2ptr()
object2pointer()
objectid()
packageclasses()
packagename()
packages()
perror()
pointer2object()
pointer2string()
pointercompare()
pow()
prevfilename()
ptr2obj()
ptr2str()
ptrcmp()
raise()
random()
read()
remove()
rename()
reverse()
rewind()
right()
ring_give()
ring_see()
ring_state_delete()
ring_state_filetokens()
ring_state_findvar()
ring_state_init()
ring_state_main()
ring_state_mainfile()
```

(continues on next page)

(continued from previous page)

```
ring_state_new()
ring_state_newvar()
ring_state_runcode()
ring_state_runfile()
ring_state_runobjectfile()
ring_state_setvar()
ringvm_callfunc()
ringvm_calllist()
ringvm_cfunctionslist()
ringvm_classeslist()
ringvm_evalinscope()
ringvm_fileslist()
ringvm_functionslist()
ringvm_genarray()
ringvm_give()
ringvm_hideerrmsg()
ringvm_info()
ringvm_memorylist()
ringvm_packageslist()
ringvm_passerror()
ringvm_scopescount()
ringvm_see()
ringvm_settrace()
ringvm_tracedata()
ringvm_traceevent()
ringvm_tracefunc()
setattribute()
setpointer()
setptr()
shutdown()
sin()
sinh()
sort()
space()
sqrt()
srandom()
str2hex()
str2hexcstyle()
str2list()
strcmp()
string()
substr()
swap()
sysget()
system()
tan()
tanh()
tempfile()
tempname()
time()
timelist()
trim()
type()
ungetc()
unsigned()
upper()
variablepointer()
```

(continues on next page)

(continued from previous page)

```
varptr()
version()
windowsnl()
write()
```

108.3 Compiler Errors

- Error (C1) : Error in parameters list, expected identifier
- Error (C2) : Error in class name
- Error (C3) : Unclosed control strucutre, ‘ok’ is missing
- Error (C4) : Unclosed control strucutre, ‘end’ is missing
- Error (C5) : Unclosed control strucutre, next is missing
- Error (C6) : Error in function name
- Error (C7) : Error in list items
- Error (C8) : Parentheses ‘)’ is missing
- Error (C9) : Brackets ‘]’ is missing
- Error (C10) : Error in parent class name
- Error (C11) : Error in expression operator
- Error (C12) : No class definition
- Error (C13) : Error in variable name
- Error (C14) : Try/Catch miss the Catch keyword!
- Error (C15) : Try/Catch miss the Done keyword!
- Error (C16) : Error in Switch statement expression!
- Error (C17) : Switch statement without OFF
- Error (C18) : Missing closing brace for the block opened!
- Error (C19) : Numeric Overflow!
- Error (C20) : Error in package name
- Error (C21) : Unclosed control strucutre, ‘again’ is missing
- Error (C22) : Function redefinition, function is already defined!
- Error (C23) : Using ‘(‘ after number!
- Error (C24) : The parent class name is identical to the subclass name
- Error (C25) : Trying to access the self reference after the object name
- Error (C26) : Class redefinition, class is already defined!
- Warning (W1) : Duplication in file name
- Warning (W2) : The Compiler command ChangeRingKeyword requires two words as parameters
- Warning (W3) : Compiler command ChangeRingKeyword - Keyword not found !

- Warning (W4) : The Compiler command ChangeRingOperator requires two words as parameters
- Warning (W5) : Compiler command ChangeRingOperator - Operator not found !
- Warning (W6) : Using the EXIT command outside loop!"
- Warning (W7) : Using the LOOP command outside loop!"

108.4 Runtime Errors

- Error (R1) : Can't divide by zero !
- Error (R2) : Array Access (Index out of range) !
- Error (R3) : Calling Function without definition !
- Error (R4) : Stack Overflow !
- Error (R5) : Can't access the list item, Object is not list !
- Error (R6) : Variable is required
- Error (R7) : Can't assign to a string letter more than one character
- Error (R8) : Variable is not a string
- Error (R9) : Using exit command outside loops
- Error (R10) : Using exit command with number outside the range
- Error (R11) : Error in class name, class not found!
- Error (R12) : Error in property name, property not found!
- Error (R13) : Object is required
- Error (R14) : Calling Method without definition !
- Error (R15) : Error in parent class name, class not found!
- Error (R16) : Using braces to access unknown object !
- Error (R17) : Error, using 'Super' without parent class!
- Error (R18) : Numeric Overflow!
- Error (R19) : Calling function with less number of parameters!
- Error (R20) : Calling function with extra number of parameters!
- Error (R21) : Using operator with values of incorrect type
- Error (R22) : Using loop command outside loops
- Error (R23) : Using loop command with number outside the range
- Error (R24) : Using uninitialized variable
- Error (R25) : Error in package name, Package not found!
- Error (R26) : Calling private method from outside the class
- Error (R27) : Using private attribute from outside the class
- Error (R28) : Using bad data type as step value
- Error (R29) : Using bad data type in for loop

- Error (R30) : Parent class name is identical to child class name
- Error (R31) : Trying to destroy the object using the self reference
- Error (R32) : The CALL command expect a variable contains string!
- Error (R33) : Bad decimals number (correct range >= 0 and <=14) !
- Error (R34) : Variable is required for the assignment operation
- Error (R35) : Can't create/open the file!
- Error (R36) : The column number is not correct! It's greater than the number of columns in the list
- Error (R37) : Sorry, The command is not supported in this context
- Error (R38) : Runtime Error in loading the dynamic library!
- Error (R39) : Error occurred creating unique filename

108.5 Environment Errors

- Error (E1) : Caught SegFault
- Error (E2) : Out of Memory
- Error (E3) : Deleting scope while no scope!
- Error (E4) : Long VM Instruction!
- Error (E5) : The file type is not correct - the VM expect a ring object file
- Error (E6) : The Ring Object File version is not correct!
- Error (E7) : Internal error in using sscanf() function!
- Error (E8) : Internal error in using fscanf() function!

108.6 Language Grammar

```

Program —> {statement}

Statement —> ‘package’ <Identifier> { ‘.’ <Identifier> } [‘{‘ {statement} ‘}’] [‘end’]’endpackage’]

Statement —> ‘class’ <Identifier> [ ‘from’]’:’<’ <Identifier> ] [‘{‘ {statement} ‘}’][‘end’]’endclass’]

Statement —> ‘func’]’def’ <Identifier> [ParaList] [‘{‘ {statement} ‘}’][‘end’]’endfunc’]

Statement —> ‘import’ <Identifier> { ‘.’ <Identifier> }

Statement —> ‘private’

Statement —> ‘load’ [‘package’]’again’] <Literal>

Statement —> ‘loadsyntax’ <Literal>

Statement —> ‘changeringkeyword’ <OldKeyword> <NewKeyword>

Statement —> ‘changeringoperator’ <OldOperator> <NewOperator>

Statement —> ‘see’]’put’ <Expr>

Statement —> ‘give’]’get’ <Identifier>

```

Statement → ‘if’ <Expr> [‘{’ {statement} [{‘but’}|‘elseif’ <Expr> {Statement} }] [‘else’ {Statement}] ‘ok’|‘end’|‘}’]
 Statement → ‘Switch’ <Expr> [‘[’ {‘on’}|‘case’ <Expr> {statement} } [‘other’ {Statement}] ‘off’|‘end’|‘}’]
 Statement → ‘for’ <Identifier> ‘=’ <Expr> ‘to’ <Expr> [‘step’ <Expr>] [‘[’ {Statement} ‘next’|‘end’|‘}’]
 Statement → ‘for’ <Identifier> ‘in’ <Expr> [‘step’ <Expr>] [‘{’ {statement} ‘next’|‘end’|‘}’]
 Statement → ‘while’ <Expr> [‘{’ {statement} ‘end’|‘}’]
 Statement → ‘do’ {statement} ‘again’ <Expr>
 Statement → ‘try’ {statement} [‘[’ ‘catch’ {statement} ‘done’|‘end’|‘}’]
 Statement → ‘return’ <Expr>
 Statement → ‘bye’
 Statement → ‘exit’
 Statement → ‘loop’
 Statement → <Expr>
 Statement → epsilon
 ParaList → epsilon
 ParaList → [‘[’ <Identifier> [{ ‘,’ <Identifier> }] ‘]’]
 Expr → <LogicNot> [{ ‘and’}|‘or’ <LogicNot> }]
 LogicNot → [‘not’] <EqualOrNot>
 EqualOrNot → [‘=’|‘!=’] <Compare>
 Compare → <BitOrXor> [{ ‘<’ | ‘>’ | ‘<=’ | ‘>=’ } <BitOrXor> }]
 BitOrXor → <BitAnd> [{ ‘|’ | ‘^’ <BitAnd> }]
 BitAnd → <BitShift> [{ ‘&’ <BitShift> }]
 BitShift → <Arithmetic> [{ ‘<<’ | ‘>>’ } <Arithmetic> }]
 Arithmetic → <Term> [{ ‘+’ | ‘-’ } <Term> }]
 Term → <Range> [{ ‘*’ | ‘/’ | ‘%’ } <Range> }]
 Range → <Factor> [‘:’ <Factor>]
 Factor → <Identifier> [{Mixer}] [‘=’ <Expr>]
 Factor → <Number>
 Factor → <Literal>
 Factor → ‘:’ <Identifier>
 Factor → ‘-’ <Factor>
 Factor → ‘(’ <Expr> ‘)’
 Factor → <List>
 Factor → ‘new’ <Identifier>
 Factor → <AnonymousFunction>
 Factor → ‘call’ <identifier> { ‘.’ <Identifier> } ‘(’ <Parameters> ‘)’

List → '[' [<Expr> { ';' <Expr> }] ']

Mixer → { '.' <Identifier> }

Mixer → '[' <Expr> ']

Mixer → '(' [<Expr> [{ ';' <Expr> }]] ')

Mixer → '{' { Statement } '}'

AnonymousFunction → 'func'|'def'| [<ParaList>] '{' { Statement } '}'

108.7 Virtual Machine (VM) Instructions

Definitions :-

- VM : Virtual Machine
- Stack : VM Stack
- IR : Instruction Register
- PC : Program Counter
- VP : Variable Pointer
- Stack[nSize] : Last Item in the Stack (Last In - First Out)
- VV : Variable Value (We have a Pointer to a variable, And we access this variable value)

(Stack and Variables)

Operation	Description
• ICO_PUSHC	Add string from the IR to the stack
• ICO_PUSHN	Add number from the IR to the stack
• ICO_PUSHV	Replace VP in the stack[nSize] with the variable value
• ICO_LOADADDRESS	Read variable name from the IR, push VP to the stack
• ICO_ASSIGNMENT	Stack[nSize-1] VV = Stack[nSize] VV , POP Stack[nSize]
• ICO_INC	Increment Number in Stack[nSize] by 1
• ICO_LOADAPUSHV	The same as ICO_LOADADDRESS then ICO_PUSHV
• ICO_NEWLINE	Store new line number (debug info)
• ICO_FREESTACK	Remove all items from the stack , nSize = 0
• ICO_FILENAME	Store the source code file name (debug info)
• ICO_FREELOADASCOPE	Free the Scope List of the current Expression

(Jump)

Operation	Description
• ICO_JUMP	Set PC to new value from the IR
• ICO_JUMPZERO	If Stack[nSize] is a number = 0 then Set PC to new value from the IR
• ICO_JUMPFOR	End of for loop
• ICO_JUMPONE	If Stack[nSize] is a number = 1 then Set PC to new value from the IR
• ICO_JUMPZERO2	As ICO_JUMPZERO but add 1 to the stack (required for many 'AND' conditions)
• ICO_JUMPONE2	As ICO_JUMPONE but add 1 to the stack (required for many 'OR' conditions)

(Compare)

Operation	Description
• ICO_LESSEQUAL	If stack[nSize-1] <= stack[nSize] , POP stack[nSize], set Stack[nSize-1] = 1 else set Stack[nSize-1] = 0
• ICO_EQUAL	If stack[nSize-1] = stack[nSize] , POP stack[nSize], set Stack[nSize-1] = 1 else set Stack[nSize-1] = 0
• ICO_LESS	If stack[nSize-1] < stack[nSize] , POP stack[nSize], set Stack[nSize-1] = 1 else set Stack[nSize-1] = 0
• ICO_GREATER	If stack[nSize-1] > stack[nSize] , POP stack[nSize], set Stack[nSize-1] = 1 else set Stack[nSize-1] = 0
• ICO_GREATEREQUAL	If stack[nSize-1] >= stack[nSize] , POP stack[nSize], set Stack[nSize-1] = 1 else set Stack[nSize-1] = 0
• ICO_NOTEQUAL	If stack[nSize-1] != stack[nSize] , POP stack[nSize], set Stack[nSize-1] = 1 else set Stack[nSize-1] = 0

(Math)

Operation	Description
• ICO_SUM	Stack[nSize-1] = Stack[nSize-1] + Stack[nSize] , POP stack[nSize]
• ICO_SUB	Stack[nSize-1] = Stack[nSize-1] - Stack[nSize] , POP stack[nSize]
• ICO_MUL	Stack[nSize-1] = Stack[nSize-1] * Stack[nSize] , POP stack[nSize]
• ICO_DIV	Stack[nSize-1] = Stack[nSize-1] / Stack[nSize] , POP stack[nSize]
• ICO_MOD	Stack[nSize-1] = Stack[nSize-1] % Stack[nSize] , POP stack[nSize]
• ICO_NEG	Stack[nSize] = - Stack[nSize-1]
• ICO_PLUSPLUS	Stack[nSize] = Stack[nSize] + 1
• ICO_MINUSMINUS	Stack[nSize] = Stack[nSize] - 1

(Logic)

Operation	Description
• ICO_AND	Stack[nSize-1] = Stack[nSize-1] && Stack[nSize] , POP stack[nSize]
• ICO_OR	Stack[nSize-1] = Stack[nSize-1] Stack[nSize] , POP stack[nSize]
• ICO_NOT	Stack[nSize] = ! Stack[nSize]

(Lists)

Operation	Description
• ICO_LISTSTART	Start New List in Temp. Memory
• ICO_LISTITEM	Add List Item
• ICO_LISTEND	End List
• ICO_LOADINDEXADDRESS	Stack[nSize-1] = Stack[nSize-1] VV [Stack[nSize]] , POP stack[nSize]

(Functions)

Operation	Description
• ICO_LOADFUNC	Find function
• ICO_CALL	Call function
• ICO_RETURN	Return from function
• ICO_RETNULL	Return NULI from function
• ICO_RETFROMEVAL	Return after eval()
• ICO_RETITEMREF	Return the list item reference - not the value
• ICO_NEWFUNC	Start new function
• ICO_BLOCKFLAG	Flag to determine where to jump later (after ICO_RETURN)
• ICO_FUNCEXE	Start executing function
• ICO_ENDFUNCEXE	End function execution
• ICO_ANONYMOUS	Anonymous function

(User Interface)

Operation	Description
• ICO_PRINT	Print value to the standard output
• ICO_GIVE	Get input from the keyboard

(End Program/Loop)

Operation	Description
• ICO_BYE	End execution of VM
• ICO_EXITMARK	Place to exit to from a loop
• ICO_POPEXITMARK	Remove exit mark
• ICO_EXIT	Break from one loop or more
• ICO_LOOP	Continue to next loop

(For Better Performance)

Operation	Description
• ICO_PUSHP	Push pointer to the stack
• ICO_INCP	Increment variable value using pointer
• ICO_PUSHPV	Push value of variable using variable pointer
• ICO_INCJUMP	Increment then jump
• ICO_INCPJUMP	Increment using pointer then jump
• ICO_JUMPVARLENUM	Jump if variable value is <= numeric value
• ICO_JUMPVARPLENUM	Jump if variable value (using pointer) <= numeric value
• ICO_LOADFUNCP	Push function pointer
• ICO_PUSHPLOCAL	Push pointer to local variable
• ICO_INCLPJUMP	Increment value using pointer to local variable then jump
• ICO_JUMPVARLPLENUM	Jump if the variable value (using pointer) <= numeric value
• ICO_INCPJUMPSTEP1	Increment value using variable pointer then jump (for loop step = 1)
• ICO_JUMPVARPLENUMSTEP1	Increment value using variable pointer then jump (for loop step = 1)

(Try-Catch-Done)

Operation	Description
• ICO_TRY	Start try region
• ICO_DONE	End try region

(Duplicate and Range)

Operation	Description
• ICO_DUPLICATE	Duplicate stack value
• ICO_RANGE	Create list from value to value

(OOP)

Operation	Description
• ICO_NEWOBJ	Create new object, get class name from the IR, push object pointer to the stack.
• ICO_SETSCOPE	Called after creating new object, set the active scope to be the object scope.
• ICO_LOADSUBADDRESS	Get object attribute, push the pointer to the stack.
• ICO_LOADMETHOD	Find object method
• ICO_AFTERCALLMETHOD	Used after calling a method - normal case
• ICO_AFTERCALLMETHOD2	Used after calling a method - second case
• ICO_NEWCLASS	Start new class region
• ICO_BRACESTART	Open brace
• ICO_BRACEEND	End brace
• ICO_IMPORT	Import package
• ICO_PRIVATE	start private attributes region
• ICO_SETPROPERTY	set attribute value - check for setter.
• ICO_CALLCLASSINIT	call class init() method.

(Other)

Operation	Description
• ICO_SETREFERENCE	Copy by reference
• ICO_KILLREFERENCE	Remove reference
• ICO_ASSIGNMENTPOINTER	Determine the left side variable
• ICO_BEFOREEQUAL	Determine operators like +=, -=, ... etc

(Bitwise Operators)

Operation	Description
• ICO_BITAND	Stack[nSize-1] = Stack[nSize-1] & Stack[nSize] , POP stack[nSize]
• ICO_BITOR	Stack[nSize-1] = Stack[nSize-1] Stack[nSize] , POP stack[nSize]
• ICO_BITXOR	Stack[nSize-1] = Stack[nSize-1] ^ Stack[nSize] , POP stack[nSize]
• ICO_BITNOT	Stack[nSize] = ! Stack[nSize]
• ICO_BITSHL	Stack[nSize-1] = Stack[nSize-1] << Stack[nSize] , POP stack[nSize]
• ICO_BITSHR	Stack[nSize-1] = Stack[nSize-1] >> Stack[nSize] , POP stack[nSize]

(For Step)

Operation	Description
• ICO_STEPMNUMBER	Determine step number in for loop
• ICO_POPSTEP	POP step number from steps stack
• ICO_LOADAFIRST	Load the first address of variable name

(Custom Global Scope)

Operation	Description
• ICO_NEWTGLOBALSCOPE	Start new custom global scope - used by 'load package' command
• ICO_ENDGLOBALSCOPE	End of custom global scope - used by 'load package' command
• ICO_SETGLOBALSCOPE	Set the current global scope

RESOURCES

In this section you will find resources about the language

109.1 Ring Language Website

For news about the language check the website

<http://ring-lang.net>

109.2 Source Code

Ring is Free-Open Source (MIT License)

Source Code : <https://github.com/ring-lang/ring>

109.3 Ring Team

URL : <http://ring-lang.net/team.html>

INDEX

- 3D Camera
 - Using RingRayLib, 656
- 3D Camera Free
 - Using RingRayLib, 657
- 3D Cube and Texture
 - Using RingOpenGL and RingAllegro for 3D Graphics, 755
- 3D Picking
 - Using RingRayLib, 664
- AbstractAxis Class
 - RingQt Classes Reference, 999
- AbstractBarSeries Class
 - RingQt Classes Reference, 1002
- Access List Items by String Index
 - Lists, 96
- Access Objects Using Braces
 - Object Oriented Programming, 193
- Access String Letters
 - Strings, 102
- Accessing the class attributes from braces inside class methods
 - Scope Rules, 264
- Add Items
 - Lists, 90
- addattribute()
 - Reflection and Meta-programming, 225
- AddDays()
 - Date and Time, 112
- Adding code to the generated code
 - Code Generator, 1355
- Adding Hyperlink to QLabel
 - Desktop, WebAssembly and Mobile Development, 381
- addmethod()
 - Reflection and Meta-programming, 226
- Analog Clock
 - Applications developed in a few hours, 11
- Animate Class
 - Game Engine for 2D Games, 603
- Animate Events
 - Game Engine for 2D Games, 615
- Animation
 - Game Engine for 2D Games, 608
- Animation and Functions
 - Game Engine for 2D Games, 609
- Anonymous and Nested Functions
 - Functional Programming, 210
- Application Class
 - Web DevelopmentCGI Library, 575
- Application Database
 - Deploying Web Applications in the Cloud, 583
- Applications
 - How to contribute?, 1643
- Applications developed in a few hours
 - Analog Clock, 11
 - FetchStockData Application, 8
 - Fifteen Puzzle Game, 10
 - Google API Shortener Application, 8
 - Innovative, 20
 - Introduction, 1
 - Practical, 21
 - Quotes about Ring, 1
 - Samples in this book, 13
 - Squares Puzzle Game, 12
 - Video-Music-Player Application, 9
- apppath()
 - Stdlib Functions, 304
- Arithmetic Operations
 - Performance Tips, 785
- Arithmetic Operators
 - Operators, 54
- ASCII Table application
 - What is new in Ring 1.12?, 1556
- Ascii()
 - Data Type, 120
- ASCIIList2Str()
 - Stdlib Functions, 322
- Assert()
 - Eval() and Debugging, 150
- Assignment Operators
 - Operators, 55
- attributes()
 - Reflection and Meta-programming, 222
- Basic Shapes

- Using RingRayLib, 670
- Basic Window
 - Using RingRayLib, 653
- Better Call Command
 - What is new in Ring 1.2?, 1402
- Better Cards Game
 - What is new in Ring 1.8?, 1506
- Better Code Generator For Extensions
 - What is new in Ring 1.8?, 1507
- Better Code Generator for Extensions
 - What is new in Ring 1.1?, 1396
 - What is new in Ring 1.5?, 1456
 - What is new in Ring 1.9?, 1525
- Better Documentation
 - What is new in Ring 1.11?, 1553
 - What is new in Ring 1.1?, 1397
 - What is new in Ring 1.7?, 1492
- Better Documentation Generator for Extensions
 - What is new in Ring 1.5?, 1457
- Better Form Designer
 - What is new in Ring 1.8?, 1505
- Better Functions
 - What is new in Ring 1.2?, 1399
- Better LoopExit Command
 - What is new in Ring 1.3?, 1412
- Better Memory Management
 - What is new in Ring 1.9?, 1524
- Better Natural Language Programming Support
 - What is new in Ring 1.1?, 1388
- Better Objects Library
 - What is new in Ring 1.5?, 1443
- Better Organization
 - What is new in Ring 1.13?, 1582
- Better Performance
 - What is new in Ring 1.11?, 1553
 - What is new in Ring 1.8?, 1496
- Better Quality
 - What is new in Ring 1.2?, 1403
 - What is new in Ring 1.5?, 1466
- Better Ring Compiler and VM
 - What is new in Ring 1.8?, 1507
- Better Ring For Android
 - What is new in Ring 1.6?, 1478
- Better Ring Notepad
 - What is new in Ring 1.2?, 1399
 - What is new in Ring 1.3?, 1408
 - What is new in Ring 1.5?, 1434
 - What is new in Ring 1.6?, 1481
 - What is new in Ring 1.7?, 1491
 - What is new in Ring 1.9?, 1515
- Better Ring VM
 - What is new in Ring 1.7?, 1492
- Better Ring2EXE
 - What is new in Ring 1.7?, 1492
- Better RingQt
 - What is new in Ring 1.11?, 1551
 - What is new in Ring 1.13?, 1577
 - What is new in Ring 1.2?, 1400
 - What is new in Ring 1.3?, 1404
 - What is new in Ring 1.4?, 1426
 - What is new in Ring 1.5?, 1441
 - What is new in Ring 1.6?, 1483
 - What is new in Ring 1.7?, 1491
 - What is new in Ring 1.8?, 1506
 - What is new in Ring 1.9?, 1521
- Better RingRayLib
 - What is new in Ring 1.12?, 1562
 - What is new in Ring 1.13?, 1580
- Better RingREPL
 - What is new in Ring 1.6?, 1484
- Better RingVM
 - What is new in Ring 1.6?, 1484
- Better RingZip
 - What is new in Ring 1.7?, 1492
- Better Scripts for building Ring
 - What is new in Ring 1.6?, 1480
- Better StdLib
 - What is new in Ring 1.3?, 1412
 - What is new in Ring 1.4?, 1424
 - What is new in Ring 1.5?, 1437
 - What is new in Ring 1.6?, 1484
 - What is new in Ring 1.9?, 1516
- Better Tests
 - What is new in Ring 1.10?, 1536
- Better Threads Support
 - What is new in Ring 1.13?, 1568
- Better Trace Library
 - What is new in Ring 1.7?, 1490
- Better WebLib
 - What is new in Ring 1.4?, 1424
 - What is new in Ring 1.5?, 1438
- Bezier Lines
 - Using RingRayLib, 673
- bignum
 - BigNumber Class, 846
 - BigNumber Functions, 845
 - Examples, 844
 - Introduction, 843
 - Library Source Code, 846
 - Loading the library, 844
- BigNumber Class
 - bignum, 846
- BigNumber Functions
 - bignum, 845
- BigNumber Library
 - What is new in Ring 1.9?, 1517
- binarydigits()
 - Stdlib Functions, 314

Bitwise Operators	Distributing Ring Application using Ring2EXE, 813
Operators, 55	
BMI Calculator application	Building the project
What is new in Ring 1.12?, 1556	Building Games For Android, 651
BraceError() Method	Building the Weight History Application for Mobile using
Natural Language Programming, 245	RingQt
BraceExprEval Method	Distributing Ring Application using Ring2EXE, 812
Natural Language Programming, 244	
BraceStart and BraceEnd Methods	Building using CMake
Natural Language Programming, 243	Building From Source Code, 1640
Branching	Building using Fedora Linux
Control Structures, 57	Building From Source Code, 1636
Control Structures - Second Style, 64	Building using MacOS X
Control Structures - Third Style, 68	Building From Source Code, 1638
BreakPoint	Building using Microsoft Windows
The Trace Library and the Interactive Debugger, 294	Building From Source Code, 1631
Build the extension on different platforms	Building using Ubuntu Linux
Tutorial: Ring Extensions in C/C++, 1315	Building From Source Code, 1633
Building From Source Code	Calculator Application
Building using CMake, 1640	What is new in Ring 1.5?, 1433
Building using Fedora Linux, 1636	Calendar application
Building using MacOS X, 1638	What is new in Ring 1.12?, 1557
Building using Microsoft Windows, 1631	Call Functions
Building using Ubuntu Linux, 1633	Functions - First Style, 75
Introduction, 1630	Functions - Second Style, 79
Building Games For Android	Functions - Third Style, 83
Building the project, 651	callgc()
Download Requirements and Update the Android	Low Level Functions, 1288
SDK, 650	Calling a function sharing the name with a method in the
Introduction, 649	current class
Project Folder, 650	Scope Rules for Functions and Methods, 276
Building RingQt Applications for Mobile	Calling Functions and Methods
Comments about developing for Android using	Performance Tips, 786
RingQt, 518	Camera
Download Requirements, 517	Using Qt3D, 499
Install Qt for Android, 517	Camera First Person
Introduction, 516	Using RingRayLib, 662
The Qt project for your Ring application, 518	Can I connect to dbase/harbour database?
Update the Android SDK, 517	Frequently Asked Questions, 1623
Using Ring2EXE, 518	Can Ring work on Windows XP?
Building RingQt Applications for WebAssembly	Frequently Asked Questions, 1625
Comments about developing for WebAssembly us-	capitalized()
ing RingQt, 522	Stdlib Functions, 307
Dialogs, 523	cfunctions()
Download Requirements, 521	Reflection and Meta-programming, 215
Introduction, 520	CGI Support
Online Applications, 523	Command Line Options, 801
The Qt project for your Ring application, 522	Change Focus
Using Ring2EXE, 521	Desktop, WebAssembly and Mobile Development,
Building standalone console application	419
Distributing Ring Application using Ring2EXE, 809	Change Language Keywords
Building the Cards Game for Mobile using RingQt	Syntax Flexibility, 278
Distributing Ring Application using Ring2EXE, 811	Change Language Operators
Building the Form Designer for Mobile using RingQt	Syntax Flexibility, 279
	Change the '=' operator to 'is'

- Natural Language Programming, 241
- Change the Ring Keyword 'And'
 - Natural Language Programming, 239
- Change the Ring Operator '+'
 - Natural Language Programming, 240
- Change: Basic Extensions are separated from RingVM
 - What is new in Ring 1.4?, 1418
- changestring()
 - Stdlib Functions, 317
- Char()
 - Data Type, 120
- ChDir() Function
 - System Functions, 146
- Check Character
 - Data Type, 116
- Check Data Type
 - Data Type, 114
- Check Parameters Count
 - Extension, 1340
- Check Parameters Type
 - Extension, 1341
- Checkers Game
 - What is new in Ring 1.11?, 1540
- Chess Game
 - What is new in Ring 1.10?, 1528
- Classes and Objects
 - Object Oriented Programming, 191
- Classes and their Methods to use the default events
 - Desktop, WebAssembly and Mobile Development, 450
- classes()
 - Reflection and Meta-programming, 219
- classname()
 - Reflection and Meta-programming, 221
- Clean Natural Code
 - Natural Language Programming, 246
- Clearerr()
 - Files, 134
- Client Example
 - RingLibuv, 923
- Client Example - Using Classes
 - RingLibuv, 925
- clock()
 - Date and Time, 109
- Close Window Event
 - RingLibSDL, 892
- ClosPerSecond()
 - Date and Time, 109
- Code Generator
 - Adding code to the generated code, 1355
 - Comments in configuration file, 1357
 - Configuration file, 1353
 - Configuration file for the Allegro library, 1358
 - Configuration Files Examples, 1373
- Constants Type, 1358
- Defining Constants, 1356
- Determine Structure Members Types, 1356
- Enum and Numbers, 1357
- Executing code during code generation, 1357
- Filtering using Expressions, 1358
- function prototype, 1353
- Introduction, 1352
- Loading Files, 1373
- Managed Classes, 1373
- Prefix for Functions Names, 1355
- Qt configuration file, 1362
- Register New Functions, 1356
- Static Methods, 1372
- Threads Support, 1360
- Using configuration file that wrap C++ library, 1362
- Using the tool, 1353
- Wrap structures, 1355
- Wrapping C++ Classes, 1361
- CodeEditor Class
 - RingQt Classes Reference, 1003
- Collision Area
 - Using RingRayLib, 675
- Colors Palette
 - Using RingRayLib, 679
- Command Line Options
 - CGI Support, 801
 - Generate Embedded Object File, 803
 - Generate Object File, 803
 - Introduction, 787
 - No Run, 801
 - Performance, 802
 - Printing Final Intermediate Code, 797
 - Printing Instruction Operation Code, 802
 - Printing Intermediate Code, 795
 - Printing Rules, 790
 - Printing Tokens, 788
- Comments about developing for Android using RingQt
 - Building RingQt Applications for Mobile, 518
- Comments about developing for WebAssembly using RingQt
 - Building RingQt Applications for WebAssembly, 522
- Comments about evaluation
 - Control Structures - First Style, 62
- Comments in configuration file
 - Code Generator, 1357
- Compact Syntax
 - Language Design, 1379
- Compiler and Virtual MachineVM
 - How to contribute?, 1643
- Compiler Errors
 - Language Specification, 1651
- Compiling on Manjaro Linux

- What is new in Ring 1.8?, [1501](#)
- Composition
 - Object Oriented Programming, [194](#)
- Configuration file
 - Code Generator, [1353](#)
- Configuration file for the Allegro library
 - Code Generator, [1358](#)
- Configuration Files Examples
 - Code Generator, [1373](#)
- Configure the Apache web server
 - Web DevelopmentCGI Library, [525](#)
- Conflict between Class Attributes and Local Variables
 - Scope Rules, [260](#)
- Conflict between Global Variables and Class Attributes
 - Frequently Asked Questions, [1610](#)
 - Scope Rules, [259](#)
- Conflict between self inside braces and self in the class region
 - Scope Rules, [266](#)
- Constants Type
 - Code Generator, [1358](#)
- Constructor methods in Ring
 - Frequently Asked Questions, [1606](#)
- Context Menu
 - Desktop, WebAssembly and Mobile Development, [363](#)
- Control Structures
 - Branching, [57](#)
 - Looping, [69](#)
- Control Structures - First Style
 - Comments about evaluation, [62](#)
 - Do Again Loop, [60](#)
 - Exit, [60](#)
 - Exit from two loops, [61](#)
 - For In Loop, [59](#)
 - for in to modify lists, [60](#)
 - For Loop, [58](#)
 - Introduction, [56](#)
 - Loop Command, [61](#)
 - Looping, [58](#)
 - Short-circuit evaluation, [61](#)
 - Step Option, [59](#)
 - Switch Statement, [57](#)
 - While Loop, [58](#)
- Control Structures - Second Style
 - Branching, [64](#)
 - Exceptions, [66](#)
 - For In Loop, [66](#)
 - For Loop, [66](#)
 - If Statement, [64](#)
 - Introduction, [63](#)
 - Looping, [65](#)
 - Switch Statement, [64](#)
- Control Structures - Third Style
- Branching, [68](#)
- Exceptions, [72](#)
- For In Loop, [71](#)
- For Loop, [70](#)
- If Statement, [68](#)
- Introduction, [67](#)
- Switch Statement, [68](#)
- While Loop, [69](#)
- Conversion
 - Data Type, [119](#)
- Conversion Class
 - Stdlib Classes, [342](#)
- Convert between Numbers and Bytes
 - What is new in Ring 1.4?, [1423](#)
- Convert Letters Case
 - Strings, [102](#)
- Cookies
 - Web DevelopmentCGI Library, [537](#)
- Copy Lists
 - Lists, [95](#)
- Copy()
 - Strings, [104](#)
- Could you explain the output of the StrCmp() function?
 - Frequently Asked Questions, [1613](#)
- Create Database
 - MySQL Functions, [166](#)
- Create Executable File
 - Getting Started - First Style, [43](#)
 - Getting Started - Second Style, [46](#)
 - Getting Started - Third Style, [49](#)
- Create Lists
 - Lists, [90](#)
- Create Multi Dimension Array Using List and Recursion
 - Lists, [99](#)
- Create Package in the Current Folder
 - Ring Package ManagerRingPM, [822](#)
- Create Table
 - Tutorial: Ring Extensions in C/C++, [1333](#)
- Create Table and Insert Data
 - MySQL Functions, [166](#)
- Create Window
 - RingLibSDL, [888](#)
- Create your first extension
 - Introduction, [1374](#)
 - Location, [1375](#)
 - Steps to create the extension, [1375](#)
 - Testing the extension, [1376](#)
- Create Zip File
 - RingZip, [860](#)
- Creating a Class for each Window in GUI applications
 - Scope Rules, [265](#)
- Creating Lists
 - Performance Tips, [784](#)
- Creating Menubar

Desktop, WebAssembly and Mobile Development, 361	Number(), 120 Str2Hex(), 121 String(), 120 Type(), 115
Creating more than one window	Database, ModelBase & ControllerBase classes Web DevelopmentCGI Library, 569
Desktop, WebAssembly and Mobile Development, 401	DataType Class Stdlib Classes, 341
Creating New Package	Date and Time AddDays(), 112 clock(), 109 ClosPerSecond(), 109 Date(), 110 DiffDays(), 112 EpochTime(), 112 Introduction, 108 Time(), 109 TimeList(), 110
Ring Package ManagerRingPM, 819	Date() Date and Time, 110
Creating Reports using the WebLib and the GUILib	DateTime Class Stdlib Classes, 337
Desktop, WebAssembly and Mobile Development, 456	dayofweek() Stdlib Functions, 315
Creating StatusBar	Debug Class Stdlib Classes, 340
Desktop, WebAssembly and Mobile Development, 365	Dec() Data Type, 121
Creating the Game Window	Decimals() Mathematical Functions, 127
Game Engine for 2D Games, 604	Declarative Programming Declarative programming on the top of Object-Oriented, 235
Creating the Qt resource file using Folder2qrc	executing code after the end of object access, 235
Distributing Ring Application using Ring2EXE, 815	Introduction, 231 More Beautiful Code, 236 Objects inside lists, 232 Return object by reference, 233
Creating Toolbar	Declarative programming on the top of Object-Oriented Declarative Programming, 235
Desktop, WebAssembly and Mobile Development, 364	Declare parameters Functions - First Style, 76 Functions - Second Style, 80 Functions - Third Style, 84
Creating Windows Installer	Decrypt() Security and Internet Functions, 188
Distributing Ring Application, 805	Deep Copy Variables, 52
CRUD Example using MVC	Default value for object attributes Object Oriented Programming, 207
Web DevelopmentCGI Library, 560	Default value for object attributes is NULL What is new in Ring 1.8?, 1502
Cubic Map	Define Declarative Languages Language Design, 1382
Using RingRayLib, 694	
CurrentDir() Function	
System Functions, 145	
Data Type	
Ascii(), 120	
Char(), 120	
Check Character, 116	
Check Data Type, 114	
Conversion, 119	
Dec(), 121	
Hex(), 121	
Hex2str(), 121	
Introduction, 113	
IsAlNum(), 116	
IsAlpha(), 116	
IsCntrl(), 117	
IsDigit(), 117	
IsGraph(), 117	
IsList(), 115	
IsLower(), 118	
IsNULL(), 115	
IsNumber(), 114	
IsPrint(), 118	
IsPunct(), 118	
IsSpace(), 118	
IsString(), 114	
IsUpper(), 119	
IsXdigit(), 119	

- Define Functions
 - Functions - First Style, 75
 - Functions - Second Style, 79
 - Functions - Third Style, 83
- Define Natural Statements
 - Language Design, 1380
- Defining Commands
 - Using the Natural Library, 251
- Defining commands using classes
 - Using the Natural Library, 254
- Defining Constants
 - Code Generator, 1356
- Defining Variables and Variables Access
 - Scope Rules, 257
- Delete Item From List
 - Lists, 91
- Deleting All Packages
 - Ring Package ManagerRingPM, 819
- Demo Programs
 - Introduction, 150
 - Language Shell, 151
 - Main Menu, 151
 - The Cards Game, 444
- Deploying after updates
 - Deploying Web Applications in the Cloud, 583
- Deploying Web Applications in the Cloud
 - Application Database, 583
 - Deploying after updates, 583
 - Hello World program, 583
 - Introduction, 580, 581
 - Local Tests, 584
 - Ring source code files and permissions, 582
 - Usage, 581
- Deploying Web applications in the Cloud
 - What is new in Ring 1.9?, 1520
- Designed for a clear goal
 - Language Design, 1377
- Desktop Screen Shot Application
 - What is new in Ring 1.11?, 1545
- Desktop, WebAssembly and Mobile Development
 - Adding Hyperlink to QLabel, 381
 - Change Focus, 419
 - Classes and their Methods to use the default events, 450
 - Context Menu, 363
 - Creating Menubar, 361
 - Creating more than one window, 401
 - Creating Reports using the WebLib and the GUILib, 456
 - Creating StatusBar, 365
 - Creating Toolbar, 364
 - Dialog Functions, 409
 - Display Image using QLabel, 385
 - Display Scaled Image using QLabel, 394
- Drawing using QPainter, 396
- Dynamic Objects, 423
- Inheritance from GUI Classes, 415
- KeyPress and Mouse Move Events, 410
- Menubar and StyleSheet Example, 386
- Methods to use Events with Events Filter, 453
- Movable Label Example, 405
- Moving Objects using the Mouse, 411
- New Classes names - Index Start from 1, 455
- Notepad Application, 428
- Other Widgets Events, 390
- Playing Sound, 403
- Printing using QPrinter, 398
- QLineEdit Events and QMessageBox, 388
- QMessageBox Example, 406
- QVideoWidget and QMediaPlayer, 382
- Regular Expressions, 420
- RingQt Classes and their Qt Documentation, 455
- Rotate Text, 417
- Simple Client and Server Example, 421
- The Cards Game, 444
- The Difference between Qt and RingQt, 454
- The Events Loop, 351
- The First GUI Application, 350
- Using Layout, 352
- Using QCheckBox, 378
- Using QComboBox Class, 360
- Using QDateEdit, 373
- Using QDesktopWidget Class, 416
- Using QDial, 374
- Using QDockWidget, 366
- Using QFrame, 384
- Using QInputDialog Class, 408
- Using qLCDNumber, 404
- Using QPrintPreviewDialog, 399
- Using QProgressBar, 370
- Using QProgressBar and Timer, 393
- Using QRadioButton and QButtonGroup, 379
- Using QSlider, 372
- Using QSpinBox, 371
- Using QTableWidget, 369
- Using QTabWidget, 368
- Using QTreeView and QFileSystemModel, 357
- Using QTreeWidget and QTreeWidgetItem, 358
- Using QWebView, 377
- Using the QColorDialog Class, 403
- Using the QFileDialog Class, 395
- Using the QListWidget Class, 354
- Using the QTextEdit Class, 353
- Using the QTimer Class, 392
- Weight History Application, 424
- Determine Structure Members Types
 - Code Generator, 1356
- Dialog Functions

- Desktop, WebAssembly and Mobile Development, 409
- Dialogs
 - Building RingQt Applications for WebAssembly, 523
- DiffDays()
 - Date and Time, 112
- Dir()
 - Files, 130
- direxists()
 - Stdlib Functions, 318
- Disable BreakPoints
 - The Trace Library and the Interactive Debugger, 294
- Discovering Packages
 - Ring Package ManagerRingPM, 816
- Display Error Message
 - Extension, 1341
- Display Image
 - RingLibSDL, 888
- Display Image using QLabel
 - Desktop, WebAssembly and Mobile Development, 385
- Display List
 - Tutorial: Ring Extensions in C/C++, 1327
- Display PNG Images
 - RingLibSDL, 890
- Display Scaled Image using QLabel
 - Desktop, WebAssembly and Mobile Development, 394
- Display Transparent Images
 - RingLibSDL, 891
- Display Warnings Option
 - What is new in Ring 1.2?, 1402
- Distributing Applications and Games for Mobile
 - Distributing Ring Application, 805
- Distributing Applications for Microsoft Windows
 - Distributing Ring Application, 804
- Distributing Applications for Mobile using RingQt
 - Distributing Ring Application using Ring2EXE, 810
- Distributing Applications for WebAssembly using RingQt
 - Distributing Ring Application using Ring2EXE, 811
- Distributing Ring Application
 - Creating Windows Installer, 805
 - Distributing Applications and Games for Mobile, 805
 - Distributing Applications for Microsoft Windows, 804
 - Introduction, 803
 - Protecting the Source Code, 804
 - The files ring.ring and ring.ringo, 805
 - Using C/C++ Compiler and Linker, 805
- Distributing Ring Application using Ring2EXE
 - Building standalone console application, 809
- Building the Cards Game for Mobile using RingQt, 811
- Building the Form Designer for Mobile using RingQt, 813
- Building the Weight History Application for Mobile using RingQt, 812
- Creating the Qt resource file using Folder2qrc, 815
- Distributing Applications for Mobile using RingQt, 810
- Distributing Applications for WebAssembly using RingQt, 811
- Distributing RingAllegro Applications, 809, 810
 - Example, 808
 - How Ring2EXE works?, 807
 - Important Information about Ring2EXE, 815
 - Introduction, 806
 - Options, 808
 - Using Ring2EXE, 807
- Distributing RingAllegro Applications
 - Distributing Ring Application using Ring2EXE, 809, 810
- Do Again Loop
 - Control Structures - First Style, 60
- Documentation
 - How to contribute?, 1642
- Download Requirements
 - Building RingQt Applications for Mobile, 517
 - Building RingQt Applications for WebAssembly, 521
- Download Requirements and Update the Android SDK
 - Building Games For Android, 650
- Download()
 - Security and Internet Functions, 190
- Draw Office
 - Using Qt3D, 495
- Draw Rectangle
 - RingLibSDL, 889
- Draw Ring
 - Using RingRayLib, 671
- Drawing Cone
 - Using Qt3D, 474
- Drawing Cube
 - Using Qt3D, 467
- Drawing Cylinder
 - Using Qt3D, 472
- Drawing Plane
 - Using Qt3D, 476
- Drawing Sphere
 - Using Qt3D, 470
- Drawing Text
 - Game Engine for 2D Games, 605
- Drawing Torus
 - Using Qt3D, 468
- Drawing using QPainter

Desktop, WebAssembly and Mobile Development, 396	What is new in Ring 1.13?, 1575
Drawing using RingOpenGL	Eval()
Using RingOpenGL and RingFreeGLUT for 3D Graphics, 708	Eval() and Debugging, 148
Drawing, Animation and Input	Eval() and Debugging
Graphics and Game Programming, 585	Assert(), 150
Dynamic Attributes	Eval(), 148
Object Oriented Programming, 200	Introduction, 147
Dynamic Objects	Raise(), 149
Desktop, WebAssembly and Mobile Development, 423	Try/Catch/Done, 148
Dynamic Typing	evenorodd()
Variables, 52	Stdlib Functions, 313
Editors Support	Events Code
How to contribute?, 1643	Form Designer, 461
Embedding Ring in Ring	Example
Embedding Ring in Ring, 296	Distributing Ring Application using Ring2EXE, 808
Embedding Ring in Ring without sharing the State, 297	Files, 137
ring_state_filetokens() function, 300	FoxRing Functions Reference, 841
ring_state_new() and ring_state_mainfile(), 299	Mathematical Functions, 123
ring_state_setvar(), 298	Natural Language Programming, 238
Runtime Errors when Embedding Ring in Ring, 300	Objects Library for RingQt Application, 508
Serial Execution of Programs, 298	RingMurmurHash Functions Reference, 864
Embedding Ring in Ring without sharing the State	Security and Internet Functions, 188
Embedding Ring in Ring, 297	System Functions, 143
What is new in Ring 1.3?, 1414	The Type Hints Library, 289
Embedding Ring Language in C/C++ Programs	Example - The Trace Library
Introduction, 1349	Low Level Functions, 1309
Ring State, 1350	Example - Using the Trace Functions
Ring State Functions, 1350	Low Level Functions, 1305
Ring State Variables, 1351	Example about Sharing Names between Functions and Methods
Employee Application	Scope Rules for Functions and Methods, 275
What is new in Ring 1.6?, 1477	Examples
Encourage Organization	bignum, 844
Language Design, 1379	PostgreSQL, 177
Encrypt()	Exceptions
Security and Internet Functions, 188	Control Structures - Second Style, 66
endswith()	Control Structures - Third Style, 72
Stdlib Functions, 311	Execute Program Line by Line
Entering Items	The Trace Library and the Interactive Debugger, 293
Form Designer, 465	Execute Query and Print Result
Enum and Numbers	ODBC Functions, 159
Code Generator, 1357	executing code after the end of object access
Environment Errors	Declarative Programming, 235
Language Specification, 1653	Executing code during code generation
EpochTime()	Code Generator, 1357
Date and Time, 112	ExeFileName() Function
Stdlib Functions, 319	System Functions, 146
Equality of functions	ExeFolder() Function
Functional Programming, 212	System Functions, 146
Escape Game	Exit
	Control Structures - First Style, 60
	Exit from two loops
	Control Structures - First Style, 61
	Extension

Check Parameters Count, 1340
 Check Parameters Type, 1341
 Display Error Message, 1341
 Fopen() and Fclose() Implementation, 1343
 Function Prototype, 1342
 Function Structure, 1340
 Get Parameters Values, 1342
 Introduction, 1337
 Module Organization, 1339
 MySQL_Columns() Implementation, 1346
 Return Value, 1342
 RING API - list Functions, 1344
 RING API - String Functions, 1345
 ring_ext.c, 1338
 ring_ext.h, 1338
 Shared Libraries, 1347
 Sin() Implementation, 1342
 Using RING_API_RETMANAGEDCPOINTER(), 1348
 Extensions in C/C++
 How to contribute?, 1643
 Extract Zip File
 RingZip, 860
 Extruded Text
 Using Qt3D, 489
 Facebook Login
 RingLibCurl, 847
 factorial()
 Stdlib Functions, 309
 factors()
 Stdlib Functions, 313
 Fast Enough For Many Applications
 Language Design, 1386
 Fclose()
 Files, 132
 Features
 Introduction, 25
 Ring Package ManagerRingPM, 816
 Feof()
 Files, 134
 Ferror()
 Files, 135
 FetchStockData Application
 Applications developed in a few hours, 8
 Fexists()
 Files, 136
 Fflush()
 Files, 132
 Fgetc()
 Files, 135
 Fgetpos()
 Files, 134
 Fgets()

Files, 135
 fibonacci()
 Stdlib Functions, 309
 Fifteen Puzzle Game
 Applications developed in a few hours, 10
 File Class
 Stdlib Classes, 338
 File Hash
 Security and Internet Functions, 189
 file2list()
 Stdlib Functions, 310
 Files
 Clearerr(), 134
 Dir(), 130
 Example, 137
 Fclose(), 132
 Feof(), 134
 Ferror(), 135
 Fexists(), 136
 Fflush(), 132
 Fgetc(), 135
 Fgetpos(), 134
 Fgets(), 135
 Fopen(), 131
 Fputc(), 135
 Fputs(), 136
 Fread(), 136
 Freopen(), 132
 Fseek(), 133
 Fsetpos(), 134
 Ftell(), 133
 Fwrite(), 136
 Introduction, 128
 Numbers and Bytes, 138
 Perror(), 135
 Read File using Read(), 130
 Remove(), 131
 Rename(), 131
 Rewind(), 134
 Tempfile(), 133
 Tempname(), 133
 Ungetc(), 136
 Write file using Write(), 130
 Filter List Items
 Tutorial: Ring Extensions in C/C++, 1321
 filter()
 Stdlib Functions, 306
 Filtering using Expressions
 Code Generator, 1358
 Find in files Application
 What is new in Ring 1.8?, 1497
 Find SubString
 Strings, 105
 Find() and List of Objects

- Object Oriented Programming, 202
- First Application using RingLibuv
 - RingLibuv, 920
- First-Class Functions
 - Functional Programming, 209
- First-Class Lists
 - Lists, 95
- Flappy Bird 3000 Game
 - Game Engine for 2D Games, 631
- Following Eyes
 - Using RingRayLib, 677
- Fopen()
 - Files, 131
- Fopen() and Fclose() Implementation Extension, 1343
- For In Loop
 - Control Structures - First Style, 59
 - Control Structures - Second Style, 66
 - Control Structures - Third Style, 71
- for in to modify lists
 - Control Structures - First Style, 60
- For Loop
 - Control Structures - First Style, 58
 - Control Structures - Second Style, 66
 - Control Structures - Third Style, 70
- Form Designer
 - Entering Items, 465
 - Events Code, 461
 - Introduction, 458
 - Keyboard Shortcuts, 464
 - Menubar Designer, 464
 - More Samples and Tests, 466
 - Running Forms, 461
 - The Designer Windows, 460
 - The Properties, 460
 - Using Layouts, 466
 - What is new in Ring 1.3?, 1416
 - Window Flags, 465
- Form Designer Translation
 - Multi-language applications, 514
- Forms Translation
 - Multi-language applications, 515
- FoxRing functions
 - FoxRing Functions Reference, 829
- FoxRing Functions Reference
 - Example, 841
 - FoxRing functions, 829
 - frAbs() function, 830
 - frAddBs() function, 831
 - frALines() function, 837
 - frAllTrim() function, 836
 - frAsc() function, 830
 - frAt() function, 831
 - frAtC() function, 831
 - frBetween() function, 840
 - frChr() function, 832
 - frEmpty() function, 832
 - frFile() function, 833
 - frFileToStr() function, 833
 - frForceExt() function, 837
 - frForcePath() function, 835
 - frIf() function, 839
 - frInList() function, 835
 - frInt() function, 839
 - frJustDrive() function, 836
 - frJustExt() function, 836
 - frJustFName() function, 837
 - frJustPath() function, 837
 - frJustStem() function, 836
 - frLen() function, 838
 - frListToString() function, 839
 - frLTrim() function, 836
 - frPadL() function, 837
 - frPadR() function, 837
 - frProper() function, 838
 - frReplicate() function, 838
 - frRTrim() function, 837
 - frSetIsEmpty() function, 834
 - frSetSeparatorTo() function, 840
 - frSpace() function, 835
 - frStr() function, 833
 - frStringToList() function, 839
 - frStrTran() function, 839
 - frStuff() function, 838
 - frSubStr() function, 839
 - frTransform() function, 840
 - frVal() function, 839
 - frVarType() function, 841
 - Introduction, 828
- FoxRing Library
 - What is new in Ring 1.8?, 1505
- Fputc()
 - Files, 135
- Fputs()
 - Files, 136
- frAbs() function
 - FoxRing Functions Reference, 830
- frAddBs()
 - FoxRing Functions Reference, 831
- frALines()
 - FoxRing Functions Reference, 837
- frAllTrim()
 - FoxRing Functions Reference, 836
- Frame Action
 - Using Qt3D, 485
- Frames Per Second
 - Using RingOpenGL and RingFreeGLUT for 3D Graphics, 741

- frAsc() function
 FoxRing Functions Reference, 830
- frAt() function
 FoxRing Functions Reference, 831
- frAtC() function
 FoxRing Functions Reference, 831
- frBetween() function
 FoxRing Functions Reference, 840
- frChr() function
 FoxRing Functions Reference, 832
- Fread()
 Files, 136
- frEmpty() function
 FoxRing Functions Reference, 832
- Freopen()
 Files, 132
- Frequently Asked Questions
- Can I connect to dbase/harbour database?, 1623
 - Can Ring work on Windows XP?, 1625
 - Conflict between Global Variables and Class Attributes, 1610
 - Constructor methods in Ring, 1606
 - Could you explain the output of the StrCmp() function?, 1613
 - Getter and Setter Methods, 1608
 - Goal of including the "Main" function in Ring, 1604
 - How can I disable maximize button and resize window?, 1621
 - How to add Combobox and other elements to the cells of a QTableWidget?, 1628
 - How to Close a window then displaying another one?, 1620
 - How to create a Modal Window?, 1620
 - How to create an array of buttons in GUI applications?, 1619
 - How to extend RingQt and add more classes?, 1625
 - How to get the current source file path?, 1611
 - How to get the file size using ftell() and fseek() functions?, 1611
 - How to insert an item to the first position in the list?, 1617
 - How to perform some manipulations on selected cells in QTableWidget?, 1629
 - How to print keys or values only in List/Dictionary?, 1612
 - How to print lists that contains objects?, 1617
 - How to print new lines and other characters?, 1617
 - How to use many source code files in the project?, 1614
 - How to use NULL and ISNULL() function?, 1615
 - How to use SQLite using ODBC?, 1622
 - Introduction, 1592
 - Is Ring some sort of an improvement of PHP?, 1598
 - List index start from 1, 1604
 - Philosophy behind data types in Ring, 1602
 - Search of global names while defining the class attributes, 1609
 - The documentation says functional programming is supported, but then this happens?, 1600
 - What about Data Representation in Ring?, 1595
 - What about Memory Management in Ring?, 1594
 - What about predefined parameters or optional parameters in functions?, 1612
 - What about the Boolean values in Ring?, 1603
 - What are the advantages of using Ring over native C or C++, 1598
 - What are the advantages to using Ring over C# or Java?, 1600
 - What are the advantages to using Ring over Lisp or Smalltalk?, 1598
 - What are the advantages to using Ring over Python and Ruby?, 1600
 - What are the advantages to using Ring over Tcl and Lua?, 1600
 - What happens when we create a new object?, 1607
 - What is the difference between Ring and Python?
 And is Ring Open Source?, 1599
 - What is the Ring Architecture?, 1594
 - Where can I write a program and execute it?, 1611
 - Which of 3 coding styles are commonly used or recommended by the community?, 1629
 - Why do we need Yet Another Programming Language (YAPL)?, 1593
 - Why I get a strange result when printing nl with lists?, 1613
 - Why I get Calling Function without definition Error?, 1624
 - Why is Ring largely focussed on UI creation?, 1598
 - Why is Ring weakly typed?, 1597
 - Why Ring is not case-sensitive, 1605
 - Why Ring uses 'See', 'Give', 'But' and 'Ok' Keywords?, 1602
 - Why setClickEvent() doesn't see the object methods directly?, 1624
 - Why the ability to define your own languages Instead of just handing over the syntax so you can parse it using whatever code you like?, 1601
 - Why the Assignment operator uses Deep copy?, 1606
 - Why the window title bar is going outside the screen?, 1618
 - Why this example use the GetChar() twice?, 1615
 - Why we don't use () after the QApp class name?, 1618
 - Why you can specify the number of loops you want to break out of?, 1601
- frFile() function
 FoxRing Functions Reference, 833

frFileToStr() function
 FoxRing Functions Reference, 833

frForceExt() function
 FoxRing Functions Reference, 837

frForcePath() function
 FoxRing Functions Reference, 835

frIf() function
 FoxRing Functions Reference, 839

frInList() function
 FoxRing Functions Reference, 835

frInt() function
 FoxRing Functions Reference, 839

frJustDrive() function
 FoxRing Functions Reference, 836

frJustExt() function
 FoxRing Functions Reference, 836

frJustFName() function
 FoxRing Functions Reference, 837

frJustPath() function
 FoxRing Functions Reference, 837

frJustStem() function
 FoxRing Functions Reference, 836

frLen() function
 FoxRing Functions Reference, 838

frListToString() function
 FoxRing Functions Reference, 839

frLTrim() function
 FoxRing Functions Reference, 836

frPadL() function
 FoxRing Functions Reference, 837

frPadR() function
 FoxRing Functions Reference, 837

frProper() function
 FoxRing Functions Reference, 838

frReplicate() function
 FoxRing Functions Reference, 838

frRTrim() function
 FoxRing Functions Reference, 837

frSetIsEmpty() function
 FoxRing Functions Reference, 834

frSetSeparatorTo() function
 FoxRing Functions Reference, 840

frSpace() function
 FoxRing Functions Reference, 835

frStr() function
 FoxRing Functions Reference, 833

frStringToList() function
 FoxRing Functions Reference, 839

frStrTran() function
 FoxRing Functions Reference, 839

frStuff() function
 FoxRing Functions Reference, 838

frSubStr() function
 FoxRing Functions Reference, 839

frTransform() function
 FoxRing Functions Reference, 840

frVal() function
 FoxRing Functions Reference, 839

frVarType() function
 FoxRing Functions Reference, 841

Fseek()
 Files, 133

Fsetpos()
 Files, 134

FSize()
 Stdlib Functions, 318

Ftell()
 Files, 133

Full Screen
 Using RingRayLib, 666

Function Prototype
 Extension, 1342

function prototype
 Code Generator, 1353

Function Structure
 Extension, 1340

Functional Programming
 Anonymous and Nested Functions, 210
 Equality of functions, 212
 First-Class Functions, 209
 Higher-order Functions, 209
 Introduction, 207
 Pure Functions, 208

Functions
 Using RingRayLib, 696

Functions - First Style
 Call Functions, 75
 Declare parameters, 76
 Define Functions, 75
 Introduction, 74
 Main Function, 76
 Recursion, 78
 Return Value, 77
 Send Parameters, 76
 Variables Scope, 77

Functions - Second Style
 Call Functions, 79
 Declare parameters, 80
 Define Functions, 79
 Introduction, 78
 Main Function, 80
 Recursion, 82
 Return Value, 81
 Send Parameters, 80
 Variables Scope, 81

Functions - Third Style
 Call Functions, 83
 Declare parameters, 84

Define Functions, 83
 Introduction, 82
 Main Function, 85
 Recursion, 86
 Return Value, 86
 Send Parameters, 84
 Variables Scope, 85
functions()
 Reflection and Meta-programming, 215
Fwrite()
 Files, 136

Game Class
 Game Engine for 2D Games, 601
Game Engine Classes
 Game Engine for 2D Games, 600
Game Engine for 2D Games
 Animate Class, 603
 Animate Events, 615
 Animation, 608
 Animation and Functions, 609
 Creating the Game Window, 604
 Drawing Text, 605
 Flappy Bird 3000 Game, 631
 Game Class, 601
 Game Engine Classes, 600
 GameObject Class, 602
 Games Layer, 600
 Graphics Library Bindings, 599
 Interface to graphics library, 599
 Introduction, 598
 Map, 616
 Map Class, 604
 Map Events, 618
 Moving Text, 606
 Object and Drawing, 620
 Playing Sound, 607
 Project Layers, 599
 Sound Class, 603
 Sprite Automatic Movement, 611
 Sprite Class, 602
 Sprite Keypress Event, 612
 Sprite Mouse Event, 613
 Sprite State Event, 614
 Stars Fighter Game, 623
 Super Man 2016 Game, 638
 Text Class, 603
 What is new in Ring 1.1?, 1394
Game of Life Game
 What is new in Ring 1.10?, 1531
GameObject Class
 Game Engine for 2D Games, 602
Games Layer
 Game Engine for 2D Games, 600

gcd()
 Stdlib Functions, 311
Generate Embedded Object File
 Command Line Options, 803
 What is new in Ring 1.12?, 1562
Generate List
 Tutorial: Ring Extensions in C/C++, 1325
Generate Object File
 Command Line Options, 803
Generate/Execute Ring Object Files*.ringo
 What is new in Ring 1.1?, 1389
Generating Pages using Objects
 Web DevelopmentCGI Library, 550
Geometric Shapes
 Using RingRayLib, 692
Get Active Source File Name
 System Functions, 144
Get Command Line Arguments
 System Functions, 144
Get List Item
 Lists, 91
Get List Size
 Lists, 91
Get Number of Characters from position
 Strings, 105
Get Parameters Values
 Extension, 1342
Get Request
 RingLibCurl, 847
Get Stock Data From Yahoo
 RingLibCurl, 849
Get String Length
 Strings, 102
Get Substring from position to end
 Strings, 105
getattribute()
 Reflection and Meta-programming, 227
GetChar()
 Getting Input, 73
getnumber()
 Stdlib Functions, 304
getpointer()
 Low Level Functions, 1294
getstring()
 Stdlib Functions, 304
Getter and Setter Methods
 Frequently Asked Questions, 1608
Getting Input
 GetChar(), 73
 Getting Started - First Style, 44
 Getting Started - Second Style, 47
 Getting Started - Third Style, 50
 Give Command, 73
 Input(), 74

Introduction, 72

Getting Started - First Style

- Create Executable File, 43
- Getting Input, 44
- Hello World, 43
- Introduction, 42
- Multi-Line literals, 43
- No Explicit End For Statements, 44
- Not Case-Sensitive, 43
- Run the program, 43
- Using ? to print expression then new line, 44
- Writing Comments, 45

Getting Started - Second Style

- Create Executable File, 46
- Getting Input, 47
- Hello World, 46
- Introduction, 45
- Multi-Line literals, 46
- No Explicit End For Statements, 47
- Not Case-Sensitive, 46
- Run the program, 46
- Writing Comments, 47

Getting Started - Third Style

- Create Executable File, 49
- Getting Input, 50
- Hello World, 49
- Introduction, 48
- Multi-Line literals, 50
- No Explicit End For Statements, 50
- Not Case-Sensitive, 50
- Run the program, 49
- Writing Comments, 51

Give Command

- Getting Input, 73

globals()

- Reflection and Meta-programming, 214

Go Game

- What is new in Ring 1.12?, 1555

Goal of including the "Main" function in Ring

- Frequently Asked Questions, 1604

Google API Shortener Application

- Applications developed in a few hours, 8

Gradient

- Web DevelopmentCGI Library, 549

Graphics and Game Programming

- Drawing, Animation and Input, 585
- Introduction, 584
- Playing Sound, 593
- Scaling and Rotating Images, 594
- Threads, 596
- Transparent Image, 595
- TrueType Fonts, 592

Graphics Library Bindings

- Game Engine for 2D Games, 599

Hash Functions

- Web DevelopmentCGI Library, 543

HashTable Class

- Stdlib Classes, 331

Hassouna Course Samples

- What is new in Ring 1.13?, 1576

Hello World

- Getting Started - First Style, 43
- Getting Started - Second Style, 46
- Getting Started - Third Style, 49
- Tutorial: Ring Extensions in C/C++, 1314

Hello World program

- Deploying Web Applications in the Cloud, 583

Hello World Program using the Web Library

- Web DevelopmentCGI Library, 526

Hex()

- Data Type, 121

Hex2str()

- Data Type, 121

Higher-order Functions

- Functional Programming, 209

History

- Introduction, 24
- Natural Language Programming, 238

How can I disable maximize button and resize window?

- Frequently Asked Questions, 1621

How Ring find a functions and methods?

- Scope Rules for Functions and Methods, 274

How Ring find the Variable?

- Scope Rules, 258

How Ring2EXE works?

- Distributing Ring Application using Ring2EXE, 807

How to add Combobox and other elements to the cells of a QTableWidget?

- Frequently Asked Questions, 1628

How to Close a window then displaying another one?

- Frequently Asked Questions, 1620

How to contribute?

- Applications, 1643
- Compiler and Virtual MachineVM, 1643
- Documentation, 1642
- Editors Support, 1643
- Extensions in C/C++, 1643
- Ideas and suggestions, 1644
- Introduction, 1641
- Libraries in Ring, 1643
- Samples, 1643
- Special thanks to contributors, 1642
- Testing, 1642

How to create a Modal Window?

- Frequently Asked Questions, 1620

How to create an array of buttons in GUI applications?

- Frequently Asked Questions, 1619

How to extend RingQt and add more classes?

Frequently Asked Questions, 1625
How to get the current source file path?
Frequently Asked Questions, 1611
How to get the file size using ftell() and fseek() functions?
Frequently Asked Questions, 1611
How to insert an item to the first position in the list?
Frequently Asked Questions, 1617
How to perform some manipulations on selected cells in QTableWidget?
Frequently Asked Questions, 1629
How to play?
The Gold Magic 800 Game, 778
How to print keys or values only in List/Dictionary?
Frequently Asked Questions, 1612
How to print lists that contains objects?
Frequently Asked Questions, 1617
How to print new lines and other characters?
Frequently Asked Questions, 1617
How to use many source code files in the project?
Frequently Asked Questions, 1614
How to use NULL and ISNULL() function?
Frequently Asked Questions, 1615
How to use SQLite using ODBC?
Frequently Asked Questions, 1622
HTML Lists
Web DevelopmentCGI Library, 546
HTML Special Characters
Web DevelopmentCGI Library, 542
HTML Tables
Web DevelopmentCGI Library, 548
HtmlPage Class
Web DevelopmentCGI Library, 555, 580
HTTP Get Example
Web DevelopmentCGI Library, 527
HTTP POST Example
Web DevelopmentCGI Library, 532
Ideas and suggestions
How to contribute?, 1644
If Statement
Control Structures - Second Style, 64
Control Structures - Third Style, 68
Ignore new lines after keywords
Syntax Flexibility, 287
Image Drawing
Using RingRayLib, 686
Image Generation
Using RingRayLib, 688
Implicit Conversion
Variables, 53
Important Information about Ring2EXE
Distributing Ring Application using Ring2EXE, 815
Increment List Items
Tutorial: Ring Extensions in C/C++, 1319
Inheritance
Object Oriented Programming, 199
Inheritance from GUI Classes
Desktop, WebAssembly and Mobile Development, 415
Innovative
Applications developed in a few hours, 20
Input Keys
Using RingRayLib, 654
Input Mouse
Using RingRayLib, 655
Input Multi-touch
Using RingRayLib, 660
Input()
Getting Input, 74
Insert()
Lists, 94
Install Qt for Android
Building RingQt Applications for Mobile, 517
Installing Packages
Ring Package ManagerRingPM, 817
Interactive Debugger
The Trace Library and the Interactive Debugger, 293
Interface to graphics library
Game Engine for 2D Games, 599
Internet Class
Stdlib Classes, 349
Introduction
Deploying Web Applications in the Cloud, 581
Features, 25
History, 24
Introduction, 22
Motivation, 23
Performance Tips, 782
Ring and other languages, 23
Using RingRayLib, 653
Using ZeroLib, 826
Is Ring some sort of an improvement of PHP?
Frequently Asked Questions, 1598
IsAInNum()
Data Type, 116
IsAlpha()
Data Type, 116
IsAndroid() Function
System Functions, 142
isattribute()
Reflection and Meta-programming, 223
IsBetween()
Stdlib Functions, 323
iscfunction()
Reflection and Meta-programming, 217
isclass()
Reflection and Meta-programming, 219
IsCntrl()

Data Type, 117
IsDigit()
 Data Type, 117
IsFreeBSD() Function
 System Functions, 142
isfunction()
 Reflection and Meta-programming, 217
isglobal()
 Reflection and Meta-programming, 216
IsGraph()
 Data Type, 117
isleapyear()
 Stdlib Functions, 314
IsLinux() Function
 System Functions, 142
IsList()
 Data Type, 115
IsListContainsItems()
 Stdlib Functions, 323
islocal()
 Reflection and Meta-programming, 216
IsLower()
 Data Type, 118
IsMacOSX() Function
 System Functions, 142
ismainsourcefile()
 Stdlib Functions, 317
ismethod()
 Reflection and Meta-programming, 224
IsMSDOS() Function
 System Functions, 141
IsNULL()
 Data Type, 115
IsNumber()
 Data Type, 114
isobject()
 Reflection and Meta-programming, 222
ispackage()
 Reflection and Meta-programming, 218
ispackagesclass()
 Reflection and Meta-programming, 221
ispalindrome()
 Stdlib Functions, 313
ispoiner()
 Low Level Functions, 1292
isprime()
 Stdlib Functions, 309
IsPrint()
 Data Type, 118
isprivateattribute()
 Reflection and Meta-programming, 224
isprivatemethod()
 Reflection and Meta-programming, 225
IsPunct()

Data Type, 118
IsSpace()
 Data Type, 118
isspecial()
 Stdlib Functions, 308
IsString()
 Data Type, 114
IsUnix() Function
 System Functions, 142
IsUpper()
 Data Type, 119
isvowel()
 Stdlib Functions, 308
IsWindows() Function
 System Functions, 141
IsWindows64() Function
 System Functions, 141
IsXdigit()
 Data Type, 119

Julian Day Calendar application
 What is new in Ring 1.12?, 1558
JustFileName()
 Stdlib Functions, 305
JustFilePath()
 Stdlib Functions, 305

Key Press
 Using Qt3D, 480
Keyboard Events and Colors
 Using RingOpenGL and RingFreeGLUT for 3D Graphics, 713
Keyboard Shortcuts
 Form Designer, 464
KeyPress and Mouse Move Events
 Desktop, WebAssembly and Mobile Development, 410
Knight Tour Game
 What is new in Ring 1.10?, 1530

Language Design
 Compact Syntax, 1379
 Define Declarative Languages, 1382
 Define Natural Statements, 1380
 Designed for a clear goal, 1377
 Encourage Organization, 1379
 Fast Enough For Many Applications, 1386
 Introduction, 1376
 No Global Interpreter (VM) Lock - No GIL, 1386
 Simple, 1377
 Smart Garbage Collector, 1385
 Transparent Implementation, 1383
 Trying to be natural, 1378
 Visual Implementation, 1384
 Why Ring?, 1377

Language Functions
 Language Specification, 1646

Language Grammar
 Language Specification, 1653

Language Keywords
 Language Specification, 1645

Language Shell
 Demo Programs, 151

Language Specification
 Compiler Errors, 1651
 Environment Errors, 1653
 Introduction, 1644
 Language Functions, 1646
 Language Grammar, 1653
 Language Keywords, 1645
 Runtime Errors, 1652
 Virtual Machine Instructions, 1655

Laser Game
 What is new in Ring 1.13?, 1568

lcm()
 Stdlib Functions, 312

Left()
 Strings, 103

Libraries in Ring
 How to contribute?, 1643

Library Source Code
 bignum, 846

Library Usage with GUI Applications
 Objects Library for RingQt Application, 507

linecount()
 Stdlib Functions, 308

Lines()
 Strings, 104

List Class
 Stdlib Classes, 328

List index start from 1
 Frequently Asked Questions, 1604

List of changes and new features
 What is new in Ring 1.10?, 1528
 What is new in Ring 1.11?, 1539
 What is new in Ring 1.12?, 1555
 What is new in Ring 1.13?, 1566
 What is new in Ring 1.1?, 1388
 What is new in Ring 1.2?, 1398
 What is new in Ring 1.3?, 1404
 What is new in Ring 1.4?, 1418
 What is new in Ring 1.5?, 1431
 What is new in Ring 1.6?, 1477
 What is new in Ring 1.7?, 1488
 What is new in Ring 1.8?, 1496
 What is new in Ring 1.9?, 1510

list of functions
 Mathematical Functions, 123

List2Code() Function

 Stdlib Functions, 321

list2file()
 Stdlib Functions, 310

ListAllFiles() Function
 Stdlib Functions, 320

Lists
 Access List Items by String Index, 96
 Add Items, 90
 Copy Lists, 95
 Create Lists, 90
 Create Multi Dimension Array Using List and Recursion, 99
 Delete Item From List, 91
 First-Class Lists, 95
 Get List Item, 91
 Get List Size, 91
 Insert(), 94
 Introduction, 89
 Nested Lists, 94
 Passing Lists to Functions, 96
 Passing Parameters Arguments Using List Array, 98
 Passing Parameters or Arguments Using List, 97
 Return as List or Hash Table, 98
 Reverse(), 94
 Search, 92
 Set List Item, 92
 Sort(), 93
 Swap Items, 100
 Using Lists during definition, 96

Load Again
 Program Structure, 88

Load Again Command
 What is new in Ring 1.12?, 1560

Load Package
 Program Structure, 88

Load Syntax Files
 Syntax Flexibility, 280

Loading Files
 Code Generator, 1373

Loading the library
 bignum, 844
 PostgreSQL, 177

Loading the Trace library
 The Trace Library and the Interactive Debugger, 292

Local Tests
 Deploying Web Applications in the Cloud, 584

locals()
 Reflection and Meta-programming, 214

Location
 Create your first extension, 1375

Logical Operators
 Operators, 54

Loop Command
 Control Structures - First Style, 61

Looping
 Control Structures, 69
 Control Structures - First Style, 58
 Control Structures - Second Style, 65

Low Level Functions
 callgc(), 1288
 Example - The Trace Library, 1309
 Example - Using the Trace Functions, 1305
 getpointer(), 1294
 Introduction, 1287
 ispointer(), 1292
 memcpy(), 1295
 nullpointer(), 1290
 object2pointer(), 1291
 pointer2object(), 1291
 pointer2string(), 1295
 ptrcmp(), 1293
 ringvm_callfunc(), 1304
 RingVM_CallList(), 1301
 RingVM_CFunctionsList(), 1296
 RingVM_ClassesList(), 1297
 ringvm_evalinscope(), 1304
 RingVM_FilesList(), 1301
 RingVM_FunctionsList(), 1296
 ringvm_give() function, 1313
 ringvm_hideerrorMsg(), 1304
 ringvm_info(), 1313
 RingVM_MemoryList(), 1299
 RingVM_PackagesList(), 1298
 ringvm_passerror(), 1304
 ringvm_scopescount(), 1303
 ringvm_see() function, 1312
 ringvm_settrace(), 1302
 ringvm_tracedata(), 1302
 ringvm_traceevent(), 1303
 ringvm_tracefunc(), 1303
 setpointer(), 1293
 space(), 1290
 varptr(), 1289

Magic Balls Game
 What is new in Ring 1.13?, 1569

Main Function
 Functions - First Style, 76
 Functions - Second Style, 80
 Functions - Third Style, 85

Main Menu
 Demo Programs, 151

Make a Cube using RingOpenGL and RingFreeGLUT
 Using RingOpenGL and RingFreeGLUT for 3D Graphics, 751

makedir()
 Stlbin Functions, 318

Managed Classes

Code Generator, 1373

Many Cubes
 Using RingOpenGL and RingAllegro for 3D Graphics, 759

Many Objects
 Using Qt3D, 497

Map
 Game Engine for 2D Games, 616

Map Class
 Game Engine for 2D Games, 604

Map Events
 Game Engine for 2D Games, 618

map()
 Stdlib Functions, 306

Matching Game
 What is new in Ring 1.13?, 1571

Math Class
 Stdlib Classes, 334

Mathematical Functions
 Decimals(), 127
 Example, 123
 Introduction, 122
 list of functions, 123
 Random(), 125
 SRandom(), 126
 Unsigned(), 126
 Using _ in numbers, 127
 Using f after numbers, 128

matrixmulti()
 Stdlib Functions, 314

matrixtrans()
 Stdlib Functions, 315

Maze Game
 What is new in Ring 1.11?, 1542

MD5()
 Security and Internet Functions, 185

memcpy()
 Low Level Functions, 1295

Menu Events
 Using RingOpenGL and RingFreeGLUT for 3D Graphics, 726

Menubar and StyleSheet Example
 Desktop, WebAssembly and Mobile Development, 386

Menubar Designer
 Form Designer, 464

Merge binary characters
 Strings, 107
 What is new in Ring 1.8?, 1504

mergemethods()
 Reflection and Meta-programming, 230

Methods to use Events with Events Filter
 Desktop, WebAssembly and Mobile Development, 453

methods()
 Reflection and Meta-programming, 223

Minesweeper Game
 What is new in Ring 1.10?, 1529

Misc Operators
 Operators, 56

Model
 Using Qt3D, 491

Model Texture
 Using Qt3D, 493

Module Organization
 Extension, 1339

MoneyBoxes Game
 What is new in Ring 1.13?, 1570

More 3D Samples
 Using RingOpenGL and RingAllegro for 3D Graphics, 775
 What is new in Ring 1.11?, 1539
 What is new in Ring 1.8?, 1499

More Beatiful Code
 Declarative Programming, 236

More Games
 What is new in Ring 1.10?, 1534
 What is new in Ring 1.9?, 1512

More Improvements
 What is new in Ring 1.10?, 1537
 What is new in Ring 1.11?, 1553
 What is new in Ring 1.12?, 1563
 What is new in Ring 1.13?, 1582
 What is new in Ring 1.9?, 1526

More Low Level Functions
 What is new in Ring 1.13?, 1581

More Samples and Tests
 Form Designer, 466

More Syntax Flexibility
 What is new in Ring 1.5?, 1463

Motivation
 Introduction, 23

Mouse Events
 RingLibSDL, 892
 Using RingOpenGL and RingFreeGLUT for 3D Graphics, 723

Mouse Wheel
 Using RingRayLib, 659

Movable Label Example
 Desktop, WebAssembly and Mobile Development, 405

Moving Objects using the Mouse
 Desktop, WebAssembly and Mobile Development, 411

Moving Text
 Game Engine for 2D Games, 606

Multi-language applications
 Form Designer Translation, 514

Forms Translation, 515
 Introduction, 512
 Using String2Constant, 513

Multi-Line literals
 Getting Started - First Style, 43
 Getting Started - Second Style, 46
 Getting Started - Third Style, 50

MurmurHash1 functions
 RingMurmurHash Functions Reference, 864

MurmurHash2 functions
 RingMurmurHash Functions Reference, 864

MurmurHash3 functions
 RingMurmurHash Functions Reference, 864

Music Playing
 Using RingRayLib, 683

MySQL Class
 Stdlib Classes, 344

MySQL Functions
 Create Database, 166
 Create Table and Insert Data, 166
 Introduction, 163
 MySQL_AutoCommit(), 171
 MySQL_Close(), 165
 MySQL_Columns(), 169
 MySQL_Commit(), 172
 MySQL_Connect(), 165
 MySQL_Error(), 165
 MySQL_Escape_String(), 170
 MySQL_Info(), 164
 MySQL_Init(), 165
 MySQL_Inser_ID(), 167
 MySQL_Next_Result(), 168
 MySQL_Query(), 165
 MySQL_Result(), 168
 MySQL_Result2(), 169
 MySQL_Rollback(), 172
 Print Query Result, 168
 Restore Image From The Database, 171
 Save Image Inside the Database, 170
 Transaction Example, 172

MySQL_AutoCommit()
 MySQL Functions, 171

MySQL_Close()
 MySQL Functions, 165

MySQL_Columns()
 MySQL Functions, 169

MySQL_Columns() Implementation
 Extension, 1346

MySQL_Commit()
 MySQL Functions, 172

MySQL_Connect()
 MySQL Functions, 165

MySQL_Error()
 MySQL Functions, 165

MySQL_Escape_String()
 MySQL Functions, 170

MySQL_Info()
 MySQL Functions, 164

MySQL_Init()
 MySQL Functions, 165

MySQL_Inser_ID()
 MySQL Functions, 167

MySQL_Next_Result()
 MySQL Functions, 168

MySQL_Query()
 MySQL Functions, 165

MySQL_Result()
 MySQL Functions, 168

MySQL_Result2()
 MySQL Functions, 169

MySQL_Rollback()
 MySQL Functions, 172

Natural Language Programming
 BraceError() Method, 245
 BraceExprEval Method, 244
 BraceStart and BraceEnd Methods, 243
 Change the '=' operator to 'is', 241
 Change the Ring Keyword 'And', 239
 Change the Ring Operator '+', 240
 Clean Natural Code, 246
 Example, 238
 History, 238
 Introduction, 237
 Real Natual Code, 244
 Using Eval() with our Natural Code, 242

Natural Library - Demo Program
 Using the Natural Library, 249

Nested Lists
 Lists, 94

New Book by Apress
 What is new in Ring 1.13?, 1566

New Classes names - Index Start from 1
 Desktop, WebAssembly and Mobile Development, 455

New Command: Load Package
 What is new in Ring 1.7?, 1488

New Functions
 What is new in Ring 1.2?, 1398
 What is new in Ring 1.3?, 1413

New Functions and Changes
 What is new in Ring 1.1?, 1391

New Game : Gold Magic 800
 What is new in Ring 1.9?, 1510

New Style to Ring Notepad
 What is new in Ring 1.4?, 1421

New Tool: Folder2qrc
 What is new in Ring 1.6?, 1479

New Tool: Ring2EXE
 What is new in Ring 1.6?, 1478

No Explicit End For Statements
 Getting Started - First Style, 44
 Getting Started - Second Style, 47
 Getting Started - Third Style, 50

No Global Interpreter (VM) Lock - No GIL
 Language Design, 1386

No Run
 Command Line Options, 801

Not Case-Sensitive
 Getting Started - First Style, 43
 Getting Started - Second Style, 46
 Getting Started - Third Style, 50

Notepad Application
 Desktop, WebAssembly and Mobile Development, 428

Notes to extensions creators
 What is new in Ring 1.8?, 1509

nullpointer()
 Low Level Functions, 1290

Number()
 Data Type, 120

Numbers and Bytes
 Files, 138

Object and Drawing
 Game Engine for 2D Games, 620

Object Library Source Code
 Objects Library for RingQt Application, 511

Object Oriented Programming
 Access Objects Using Braces, 193
 Classes and Objects, 191
 Composition, 194
 Default value for object attributes, 207
 Dynamic Attributes, 200
 Find() and List of Objects, 202
 Inheritance, 199
 Introduction, 190
 Operator Overloading, 197
 Packages, 201
 Printing Objects, 201
 Private Attributes and Methods, 196
 Setter and Getter, 195
 Sort() and List of Objects, 203
 Using Self.Attribute, 204
 Using This in the class region as Self, 206
 Using This.Attribute and This.Method(), 205

Object Picker
 Using Qt3D, 482

object2pointer()
 Low Level Functions, 1291

objectid()
 Reflection and Meta-programming, 222

Objects inside lists
 Declarative Programming, 232

Objects Library for RingQt
 What is new in Ring 1.2?, 1400

Objects Library for RingQt Application
 Example, 508
 Introduction, 506
 Library Usage with GUI Applications, 507
 Object Library Source Code, 511
 openWindowAndLink() Function, 510, 512
 openWindowInPackages() Function, 511

ODBC Class
 Stdlib Classes, 343

ODBC Functions
 Execute Query and Print Result, 159
 Introduction, 154
 odbc_autocommit(), 161
 odbc_close(), 156
 odbc_colcount(), 159
 odbc_columns(), 160
 odbc_commit(), 161
 odbc_connect(), 158
 odbc_datasources(), 156
 odbc_disconnect(), 158
 odbc_drivers(), 155
 odbc_execute(), 158
 odbc_fetch(), 159
 odbc_getdata(), 159
 odbc_init(), 155
 odbc_rollback(), 162
 odbc_tables(), 160
 Open and Close Connection, 158
 Print List of ODBC Data Sources, 157
 Print List of ODBC Drivers, 156
 Save and Restore Images, 162
 Transactions and Using Commit and Rollback, 162

odbc_autocommit()
 ODBC Functions, 161

odbc_close()
 ODBC Functions, 156

odbc_colcount()
 ODBC Functions, 159

odbc_columns()
 ODBC Functions, 160

odbc_commit()
 ODBC Functions, 161

odbc_connect()
 ODBC Functions, 158

odbc_datasources()
 ODBC Functions, 156

odbc_disconnect()
 ODBC Functions, 158

odbc_drivers()
 ODBC Functions, 155

odbc_execute()
 ODBC Functions, 158

odbc_fetch()
 ODBC Functions, 159

odbc_getdata()
 ODBC Functions, 159

odbc_init()
 ODBC Functions, 155

odbc_rollback()
 ODBC Functions, 162

odbc_tables()
 ODBC Functions, 160

Online Applications
 Building RingQt Applications for WebAssembly, 523

Open and Close Connection
 ODBC Functions, 158

openWindowAndLink() Function
 Objects Library for RingQt Application, 510, 512

openWindowInPackages() Function
 Objects Library for RingQt Application, 511

Operator Overloading
 Object Oriented Programming, 197

Operators
 Arithmetic Operators, 54
 Assignment Operators, 55
 Bitwise Operators, 55
 Introduction, 53
 Logical Operators, 54
 Misc Operators, 56
 Operators Precedence, 56
 Relational Operators, 54
 Using the Natural Library, 254

Operators Precedence
 Operators, 56

Options
 Distributing Ring Application using Ring2EXE, 808

OSCopyFile() Function
 Stdlib Functions, 321

OSCopyFolder() Function
 Stdlib Functions, 320

OSCreateOpenFolder() Function
 Stdlib Functions, 320

OSDeleteFile() Function
 Stdlib Functions, 321

OSDeleteFolder() Function
 Stdlib Functions, 321

OSRenameFile() Function
 Stdlib Functions, 321

Other Widgets Events
 Desktop, WebAssembly and Mobile Development, 390

packagename()

Reflection and Meta-programming, 231
 Packages
 Object Oriented Programming, 201
 packages()
 Reflection and Meta-programming, 218
 packagesclasses()
 Reflection and Meta-programming, 220
 Page Class
 Web DevelopmentCGI Library, 576
 Pairs Game
 What is new in Ring 1.13?, 1572
 Pass Error
 The Trace Library and the Interactive Debugger, 293
 Passing Lists to Functions
 Lists, 96
 Passing Parameters Arguments Using List Array
 Lists, 98
 Passing Parameters or Arguments Using List
 Lists, 97
 Performance
 Command Line Options, 802
 Performance Tips
 Arithmetic Operations, 785
 Calling Functions and Methods, 786
 Creating Lists, 784
 Introduction, 781, 782
 Using len() and For Loops, 785
 permutation()
 Stdlib Functions, 315
 perror()
 Files, 135
 Philosophy behind data types in Ring
 Frequently Asked Questions, 1602
 Play Sound
 RingLibSDL, 893
 Playing Sound
 Desktop, WebAssembly and Mobile Development, 403
 Game Engine for 2D Games, 607
 Graphics and Game Programming, 593
 pointer2object()
 Low Level Functions, 1291
 pointer2string()
 Low Level Functions, 1295
 Pong Game
 What is new in Ring 1.10?, 1532
 Post Request
 RingLibCurl, 847
 PostgreSQL
 Examples, 177
 Introduction, 176
 Loading the library, 177
 RingPostgreSQL Constants, 180
 RingPostgreSQL Functions, 181
 PostgreSQL Class
 Stdlib Classes, 347
 Practical
 Applications developed in a few hours, 21
 Prefix for Functions Names
 Code Generator, 1355
 PrevFileName() Function
 System Functions, 145
 Print files in Zip file
 RingZip, 860
 Print List of ODBC Data Sources
 ODBC Functions, 157
 Print List of ODBC Drivers
 ODBC Functions, 156
 Print Query Result
 MySQL Functions, 168
 print()
 Stdlib Functions, 303
 Print2Str() Function
 Stdlib Functions, 304
 Printing Final Intermediate Code
 Command Line Options, 797
 Printing Instruction Operation Code
 Command Line Options, 802
 Printing Intermediate Code
 Command Line Options, 795
 Printing List of Installed Packages
 Ring Package ManagerRingPM, 818
 Printing Objects
 Object Oriented Programming, 201
 Printing Rules
 Command Line Options, 790
 Printing Tokens
 Command Line Options, 788
 Printing using QPrinter
 Desktop, WebAssembly and Mobile Development, 398
 Private Attributes and Methods
 Object Oriented Programming, 196
 prolist()
 Stdlib Functions, 312
 Program Structure
 Introduction, 86
 Load Again, 88
 Load Package, 88
 Source Code File Sections, 87
 Using Many Source Code Files, 87
 Project Folder
 Building Games For Android, 650
 Project Layers
 Game Engine for 2D Games, 599
 Protecting the Source Code
 Distributing Ring Application, 804
 ptrcmp()

- Low Level Functions, 1293
- Pure Functions
 - Functional Programming, 208
- puts()
 - Stdlib Functions, 303
- QAbstractAspect Class**
 - RingQt Classes Reference, 1003
- QAbstractButton Class**
 - RingQt Classes Reference, 1004
- QAbstractCameraController Class**
 - RingQt Classes Reference, 1005
- QAbstractItemView Class**
 - RingQt Classes Reference, 1005
- QAbstractPrintDialog Class**
 - RingQt Classes Reference, 1007
- QAbstractScrollArea Class**
 - RingQt Classes Reference, 1007
- QAbstractSeries Class**
 - RingQt Classes Reference, 1008
- QAbstractSlider Class**
 - RingQt Classes Reference, 1009
- QAbstractSocket Class**
 - RingQt Classes Reference, 1009
- QAbstractSpinBox Class**
 - RingQt Classes Reference, 1011
- QAction Class**
 - RingQt Classes Reference, 1012
- QAllEvents Class**
 - RingQt Classes Reference, 1013
- QApp Class**
 - RingQt Classes Reference, 1018
- QAreaLegendMarker Class**
 - RingQt Classes Reference, 1018
- QAreaSeries Class**
 - RingQt Classes Reference, 1018
- QAspectEngine Class**
 - RingQt Classes Reference, 1020
- QAxBase Class**
 - RingQt Classes Reference, 1020
- QAxObject Class**
 - RingQt Classes Reference, 1021
- QAxWidget Class**
 - RingQt Classes Reference, 1021
- QAxWidget2 Class**
 - RingQt Classes Reference, 1021
- QBarCategoryAxis Class**
 - RingQt Classes Reference, 1022
- QBarLegendMarker Class**
 - RingQt Classes Reference, 1022
- QBarSeries Class**
 - RingQt Classes Reference, 1023
- QBarSet Class**
 - RingQt Classes Reference, 1023
- QBitmap Class**
 - RingQt Classes Reference, 1025
- QBluetoothAddress Class**
 - RingQt Classes Reference, 1025
- QBluetoothDeviceDiscoveryAgent Class**
 - RingQt Classes Reference, 1025
- QBluetoothDeviceInfo Class**
 - RingQt Classes Reference, 1026
- QBluetoothHostInfo Class**
 - RingQt Classes Reference, 1026
- QBluetoothLocalDevice Class**
 - RingQt Classes Reference, 1026
- QBluetoothServer Class**
 - RingQt Classes Reference, 1027
- QBluetoothServiceDiscoveryAgent Class**
 - RingQt Classes Reference, 1028
- QBluetoothServiceInfo Class**
 - RingQt Classes Reference, 1029
- QBluetoothSocket Class**
 - RingQt Classes Reference, 1030
- QBluetoothTransferManager Class**
 - RingQt Classes Reference, 1030
- QBluetoothTransferReply Class**
 - RingQt Classes Reference, 1031
- QBluetoothTransferRequest Class**
 - RingQt Classes Reference, 1031
- QBluetoothUuid Class**
 - RingQt Classes Reference, 1031
- QBoxLayout Class**
 - RingQt Classes Reference, 1032
- QBoxPlotLegendMarker Class**
 - RingQt Classes Reference, 1032
- QBoxPlotSeries Class**
 - RingQt Classes Reference, 1033
- QBoxSet Class**
 - RingQt Classes Reference, 1034
- QBrush Class**
 - RingQt Classes Reference, 1035
- QBuffer Class**
 - RingQt Classes Reference, 1036
- QButtonGroup Class**
 - RingQt Classes Reference, 1036
- QByteArray Class**
 - RingQt Classes Reference, 1036
- QCalendarWidget Class**
 - RingQt Classes Reference, 1038
- QCamera Class**
 - RingQt Classes Reference, 1040
- QCameraImageCapture Class**
 - RingQt Classes Reference, 1041
- QCameraLens Class**
 - RingQt Classes Reference, 1041
- QCameraSelector Class**
 - RingQt Classes Reference, 1042

- QCameraViewfinder Class
 - RingQt Classes Reference, 1042
- QCandlestickLegendMarker Class
 - RingQt Classes Reference, 1042
- QCandlestickModelMapper Class
 - RingQt Classes Reference, 1043
- QCandlestickSeries Class
 - RingQt Classes Reference, 1043
- QCandlestickSet Class
 - RingQt Classes Reference, 1045
- QCategoryAxis Class
 - RingQt Classes Reference, 1046
- QChar Class
 - RingQt Classes Reference, 1047
- QChart Class
 - RingQt Classes Reference, 1049
- QChartView Class
 - RingQt Classes Reference, 1051
- QCheckBox Class
 - RingQt Classes Reference, 1051
- QChildEvent Class
 - RingQt Classes Reference, 1052
- QClipboard Class
 - RingQt Classes Reference, 1052
- QColor Class
 - RingQt Classes Reference, 1052
- QColorDialog Class
 - RingQt Classes Reference, 1055
- QComboBox Class
 - RingQt Classes Reference, 1056
- QCompleter Class
 - RingQt Classes Reference, 1057
- QCompleter2 Class
 - RingQt Classes Reference, 1058
- QCompleter3 Class
 - RingQt Classes Reference, 1058
- QConeGeometry Class
 - RingQt Classes Reference, 1059
- QConeMesh Class
 - RingQt Classes Reference, 1059
- QCoreApplication Class
 - RingQt Classes Reference, 1060
- QCuboidMesh Class
 - RingQt Classes Reference, 1061
- QCullFace Class
 - RingQt Classes Reference, 1062
- QCursor Class
 - RingQt Classes Reference, 1062
- QCylinderMesh Class
 - RingQt Classes Reference, 1062
- QDate Class
 - RingQt Classes Reference, 1063
- QDateEdit Class
 - RingQt Classes Reference, 1064
- QDateTime Class
 - RingQt Classes Reference, 1064
- QDateTimeAxis Class
 - RingQt Classes Reference, 1065
- QDateTimeEdit Class
 - RingQt Classes Reference, 1066
- QDepthTest Class
 - RingQt Classes Reference, 1067
- QDesktopServices Class
 - RingQt Classes Reference, 1067
- QDesktopWidget Class
 - RingQt Classes Reference, 1067
- QDial Class
 - RingQt Classes Reference, 1068
- QDialog Class
 - RingQt Classes Reference, 1069
- QDiffuseSpecularMaterial Class
 - RingQt Classes Reference, 1069
- QDir Class
 - RingQt Classes Reference, 1069
- QDirModel Class
 - RingQt Classes Reference, 1071
- QDockWidget Class
 - RingQt Classes Reference, 1072
- QDrag Class
 - RingQt Classes Reference, 1073
- QDragEnterEvent Class
 - RingQt Classes Reference, 1074
- QDragLeaveEvent Class
 - RingQt Classes Reference, 1074
- QDragMoveEvent Class
 - RingQt Classes Reference, 1074
- QDropEvent Class
 - RingQt Classes Reference, 1074
- QEffect Class
 - RingQt Classes Reference, 1075
- QEntity Class
 - RingQt Classes Reference, 1075
- QEvent Class
 - RingQt Classes Reference, 1075
- QExtrudedTextMesh Class
 - RingQt Classes Reference, 1076
- QFile Class
 - RingQt Classes Reference, 1076
- QFile2 Class
 - RingQt Classes Reference, 1077
- QFileDevice Class
 - RingQt Classes Reference, 1077
- QFileInfo Class
 - RingQt Classes Reference, 1079
- QFileSystemModel Class
 - RingQt Classes Reference, 1081

- QFirstPersonCameraController Class
 - RingQt Classes Reference, 1082
- QFont Class
 - RingQt Classes Reference, 1082
- QFontDialog Class
 - RingQt Classes Reference, 1084
- QFontMetrics Class
 - RingQt Classes Reference, 1085
- QForwardRenderer Class
 - RingQt Classes Reference, 1086
- QFrame Class
 - RingQt Classes Reference, 1086
- QFrame2 Class
 - RingQt Classes Reference, 1087
- QFrame3 Class
 - RingQt Classes Reference, 1087
- QFrameAction Class
 - RingQt Classes Reference, 1087
- QGeoAddress Class
 - RingQt Classes Reference, 1087
- QGeoAreaMonitorInfo Class
 - RingQt Classes Reference, 1088
- QGeoAreaMonitorSource Class
 - RingQt Classes Reference, 1089
- QGeoCircle Class
 - RingQt Classes Reference, 1089
- QGeoCoordinate Class
 - RingQt Classes Reference, 1089
- QGeoPositionInfo Class
 - RingQt Classes Reference, 1090
- QGeoPositionInfoSource Class
 - RingQt Classes Reference, 1090
- QGeoRectangle Class
 - RingQt Classes Reference, 1091
- QGeoSatelliteInfo Class
 - RingQt Classes Reference, 1091
- QGeoSatelliteInfoSource Class
 - RingQt Classes Reference, 1092
- QGeoShape Class
 - RingQt Classes Reference, 1092
- QGoochMaterial Class
 - RingQt Classes Reference, 1092
- QGradient Class
 - RingQt Classes Reference, 1092
- QGraphicsScene Class
 - RingQt Classes Reference, 1093
- QGraphicsVideoItem Class
 - RingQt Classes Reference, 1095
- QGraphicsView Class
 - RingQt Classes Reference, 1096
- QGridLayout Class
 - RingQt Classes Reference, 1098
- QGuiApplication Class
 - RingQt Classes Reference, 1099
- QHBarModelMapper Class
 - RingQt Classes Reference, 1101
- QHBoxLayout Class
 - RingQt Classes Reference, 1102
- QHBoxPlotModelMapper Class
 - RingQt Classes Reference, 1102
- QHCandlestickModelMapper Class
 - RingQt Classes Reference, 1103
- QHeaderView Class
 - RingQt Classes Reference, 1106
- QHorizontalBarSeries Class
 - RingQt Classes Reference, 1108
- QHorizontalPercentBarSeries Class
 - RingQt Classes Reference, 1108
- QHorizontalStackedBarSeries Class
 - RingQt Classes Reference, 1108
- QHostAddress Class
 - RingQt Classes Reference, 1109
- QHostInfo Class
 - RingQt Classes Reference, 1109
- QHPieModelMapper Class
 - RingQt Classes Reference, 1104
- QHXYModelMapper Class
 - RingQt Classes Reference, 1105
- QIcon Class
 - RingQt Classes Reference, 1110
- QImage Class
 - RingQt Classes Reference, 1111
- QInputAspect Class
 - RingQt Classes Reference, 1112
- QInputDialog Class
 - RingQt Classes Reference, 1112
- QIODevice Class
 - RingQt Classes Reference, 1109
- QJsonArray Class
 - RingQt Classes Reference, 1114
- QJsonDocument Class
 - RingQt Classes Reference, 1115
- QJsonObject Class
 - RingQt Classes Reference, 1115
- QJsonParseError Class
 - RingQt Classes Reference, 1116
- QJsonValue Class
 - RingQt Classes Reference, 1116
- QKeySequence Class
 - RingQt Classes Reference, 1116
- QLabel Class
 - RingQt Classes Reference, 1117
- QLayout Class
 - RingQt Classes Reference, 1118
- QLCDNumber Class
 - RingQt Classes Reference, 1117
- QLegend Class
 - RingQt Classes Reference, 1119

- QLegendMarker Class
 - RingQt Classes Reference, 1120
- QLinearGradient Class
 - RingQt Classes Reference, 1123
- QLineEdit Class
 - RingQt Classes Reference, 1121
- QLineEdit Events and QMessageBox
 - Desktop, WebAssembly and Mobile Development, 388
- QLineSeries Class
 - RingQt Classes Reference, 1123
- QListView Class
 - RingQt Classes Reference, 1124
- QListWidget Class
 - RingQt Classes Reference, 1125
- QListWidgetItem Class
 - RingQt Classes Reference, 1126
- QLogicAspect Class
 - RingQt Classes Reference, 1128
- QLogValueAxis Class
 - RingQt Classes Reference, 1127
- QMainWindow Class
 - RingQt Classes Reference, 1128
- QMaterial Class
 - RingQt Classes Reference, 1129
- QMatrix4x4 Class
 - RingQt Classes Reference, 1130
- QMdiArea Class
 - RingQt Classes Reference, 1131
- QMdiSubWindow Class
 - RingQt Classes Reference, 1132
- QMediaObject Class
 - RingQt Classes Reference, 1133
- QMediaPlayer Class
 - RingQt Classes Reference, 1133
- QMediaPlaylist Class
 - RingQt Classes Reference, 1134
- QMenu Class
 - RingQt Classes Reference, 1134
- QMenuBar Class
 - RingQt Classes Reference, 1135
- QMesh Class
 - RingQt Classes Reference, 1136
- QMessageBox Class
 - RingQt Classes Reference, 1136
- QMessagebox Example
 - Desktop, WebAssembly and Mobile Development, 406
- QMetalRoughMaterial Class
 - RingQt Classes Reference, 1137
- QMimeType Class
 - RingQt Classes Reference, 1137
- QMorphPhongMaterial Class
 - RingQt Classes Reference, 1138
- QMovie Class
 - RingQt Classes Reference, 1139
- QMutex Class
 - RingQt Classes Reference, 1140
- QMutexLocker Class
 - RingQt Classes Reference, 1140
- QNetworkAccessManager Class
 - RingQt Classes Reference, 1140
- QNetworkProxy Class
 - RingQt Classes Reference, 1141
- QNetworkReply Class
 - RingQt Classes Reference, 1142
- QNetworkRequest Class
 - RingQt Classes Reference, 1143
- QNmeaPositionInfoSource Class
 - RingQt Classes Reference, 1143
- QNode Class
 - RingQt Classes Reference, 1143
- QObject Class
 - RingQt Classes Reference, 1144
- QObjectPicker Class
 - RingQt Classes Reference, 1145
- QOpenGLBuffer Class
 - RingQt Classes Reference, 1146
- QOpenGLContext Class
 - RingQt Classes Reference, 1146
- QOpenGLDebugLogger Class
 - RingQt Classes Reference, 1147
- QOpenGLFramebufferObject Class
 - RingQt Classes Reference, 1148
- QOpenGLFunctions Class
 - RingQt Classes Reference, 1149
- QOpenGLFunctions_3_2_Core Class
 - RingQt Classes Reference, 1153
- QOpenGLPaintDevice Class
 - RingQt Classes Reference, 1161
- QOpenGLShader Class
 - RingQt Classes Reference, 1161
- QOpenGLShaderProgram Class
 - RingQt Classes Reference, 1162
- QOpenGLTexture Class
 - RingQt Classes Reference, 1165
- QOpenGLTimerQuery Class
 - RingQt Classes Reference, 1167
- QOpenGLVersionProfile Class
 - RingQt Classes Reference, 1168
- QOpenGLVertexArrayObject Class
 - RingQt Classes Reference, 1168
- QOpenGLWidget Class
 - RingQt Classes Reference, 1168
- QOrbitCameraController Class
 - RingQt Classes Reference, 1169
- QPageSetupDialog Class
 - RingQt Classes Reference, 1169

- QPaintDevice Class
 - RingQt Classes Reference, 1170
- QPainter Class
 - RingQt Classes Reference, 1170
- QPainter2 Class
 - RingQt Classes Reference, 1173
- QPainterPath Class
 - RingQt Classes Reference, 1173
- QPen Class
 - RingQt Classes Reference, 1174
- QPercentBarSeries Class
 - RingQt Classes Reference, 1175
- QPerVertexColorMaterial Class
 - RingQt Classes Reference, 1175
- QPhongMaterial Class
 - RingQt Classes Reference, 1175
- QPicture Class
 - RingQt Classes Reference, 1175
- QPieLegendMarker Class
 - RingQt Classes Reference, 1176
- QPieSeries Class
 - RingQt Classes Reference, 1176
- QPieSlice Class
 - RingQt Classes Reference, 1177
- QPixmap Class
 - RingQt Classes Reference, 1180
- QPixmap2 Class
 - RingQt Classes Reference, 1181
- QPlainTextEdit Class
 - RingQt Classes Reference, 1181
- QPlaneMesh Class
 - RingQt Classes Reference, 1183
- QPoint Class
 - RingQt Classes Reference, 1184
- QPointF Class
 - RingQt Classes Reference, 1184
- QPointLight Class
 - RingQt Classes Reference, 1185
- QPolarChart Class
 - RingQt Classes Reference, 1185
- QPrintDialog Class
 - RingQt Classes Reference, 1185
- QPrinter Class
 - RingQt Classes Reference, 1187
- QPrinterInfo Class
 - RingQt Classes Reference, 1188
- QPrintPreviewDialog Class
 - RingQt Classes Reference, 1185
- QPrintPreviewWidget Class
 - RingQt Classes Reference, 1186
- QProcess Class
 - RingQt Classes Reference, 1188
- QProgressBar Class
 - RingQt Classes Reference, 1190
- QPushButton Class
 - RingQt Classes Reference, 1190
- QQmlEngine Class
 - RingQt Classes Reference, 1191
- QQmlError Class
 - RingQt Classes Reference, 1192
- QQuaternion Class
 - RingQt Classes Reference, 1192
- QQuickView Class
 - RingQt Classes Reference, 1193
- QQuickWidget Class
 - RingQt Classes Reference, 1193
- QRadioButton Class
 - RingQt Classes Reference, 1194
- QRect Class
 - RingQt Classes Reference, 1195
- QRegion Class
 - RingQt Classes Reference, 1196
- QRegularExpression Class
 - RingQt Classes Reference, 1197
- QRegularExpressionMatch Class
 - RingQt Classes Reference, 1197
- QRegularExpressionMatchIterator Class
 - RingQt Classes Reference, 1198
- QRenderAspect Class
 - RingQt Classes Reference, 1198
- QRenderPass Class
 - RingQt Classes Reference, 1199
- QScatterSeries Class
 - RingQt Classes Reference, 1199
- QSceneLoader Class
 - RingQt Classes Reference, 1200
- QScreen Class
 - RingQt Classes Reference, 1200
- QScrollArea Class
 - RingQt Classes Reference, 1201
- QScrollBar Class
 - RingQt Classes Reference, 1201
- QSerialPort Class
 - RingQt Classes Reference, 1201
- QSerialPortInfo Class
 - RingQt Classes Reference, 1203
- QSize Class
 - RingQt Classes Reference, 1203
- QSkyboxEntity Class
 - RingQt Classes Reference, 1204
- QSlider Class
 - RingQt Classes Reference, 1204
- QSphereMesh Class
 - RingQt Classes Reference, 1205
- QSpinBox Class
 - RingQt Classes Reference, 1205
- QSplashScreen Class
 - RingQt Classes Reference, 1206

- QSplineSeries Class
 - RingQt Classes Reference, 1206
- QSplitter Class
 - RingQt Classes Reference, 1206
- QSqlDatabase Class
 - RingQt Classes Reference, 1207
- QSqlDriver Class
 - RingQt Classes Reference, 1208
- QSqlDriverCreatorBase Class
 - RingQt Classes Reference, 1208
- QSqlError Class
 - RingQt Classes Reference, 1209
- QSqlField Class
 - RingQt Classes Reference, 1209
- QSqlIndex Class
 - RingQt Classes Reference, 1210
- QSqlQuery Class
 - RingQt Classes Reference, 1210
- QSqlRecord Class
 - RingQt Classes Reference, 1211
- QStackedBarSeries Class
 - RingQt Classes Reference, 1212
- QStackedWidget Class
 - RingQt Classes Reference, 1212
- QStandardPaths Class
 - RingQt Classes Reference, 1213
- QStatusBar Class
 - RingQt Classes Reference, 1213
- QString2 Class
 - RingQt Classes Reference, 1213
- QStringList Class
 - RingQt Classes Reference, 1214
- QStringRef Class
 - RingQt Classes Reference, 1216
- QSurfaceFormat Class
 - RingQt Classes Reference, 1217
- QSystemTrayIcon Class
 - RingQt Classes Reference, 1218
- Qt Class Convertor
 - What is new in Ring 1.4?, 1426
- Qt configuration file
 - Code Generator, 1362
- Qt3DCamera Class
 - RingQt Classes Reference, 1285
- Qt3DWindow Class
 - RingQt Classes Reference, 1287
- QTabBar Class
 - RingQt Classes Reference, 1219
- QTableView Class
 - RingQt Classes Reference, 1222
- QTableWidget Class
 - RingQt Classes Reference, 1223
- QTableWidgetItem Class
 - RingQt Classes Reference, 1225
- QTabWidget Class
 - RingQt Classes Reference, 1221
- QTcpServer Class
 - RingQt Classes Reference, 1227
- QTcpSocket Class
 - RingQt Classes Reference, 1227
- QTechnique Class
 - RingQt Classes Reference, 1228
- QTest Class
 - RingQt Classes Reference, 1229
- QText2DEntity Class
 - RingQt Classes Reference, 1229
- QTextBlock Class
 - RingQt Classes Reference, 1229
- QTextBrowser Class
 - RingQt Classes Reference, 1230
- QTextCharFormat Class
 - RingQt Classes Reference, 1231
- QTextCodec Class
 - RingQt Classes Reference, 1232
- QTextCursor Class
 - RingQt Classes Reference, 1233
- QTextDocument Class
 - RingQt Classes Reference, 1234
- QTextEdit Class
 - RingQt Classes Reference, 1236
- QTextStream Class
 - RingQt Classes Reference, 1239
- QTextStream2 Class
 - RingQt Classes Reference, 1240
- QTextStream3 Class
 - RingQt Classes Reference, 1241
- QTextStream4 Class
 - RingQt Classes Reference, 1241
- QTextStream5 Class
 - RingQt Classes Reference, 1241
- QTextToSpeech Class
 - RingQt Classes Reference, 1241
- QTextureLoader Class
 - RingQt Classes Reference, 1242
- QTextureMaterial Class
 - RingQt Classes Reference, 1242
- QThread Class
 - RingQt Classes Reference, 1243
- QThreadPool Class
 - RingQt Classes Reference, 1243
- QTime Class
 - RingQt Classes Reference, 1244
- QTimer Class
 - RingQt Classes Reference, 1245
- QToolBar Class
 - RingQt Classes Reference, 1245
- QToolButton Class
 - RingQt Classes Reference, 1246

- QTorusMesh Class
 RingQt Classes Reference, 1246
- QTransform Class
 RingQt Classes Reference, 1247
- QTreeView Class
 RingQt Classes Reference, 1248
- QTreeWidget Class
 RingQt Classes Reference, 1250
- QTreeWidgetItem Class
 RingQt Classes Reference, 1252
- Queue Class
 Stdlib Classes, 331
- Quotes about Ring
 Applications developed in a few hours, 1
- QUrl Class
 RingQt Classes Reference, 1254
- QUuid Class
 RingQt Classes Reference, 1255
- QValueAxis Class
 RingQt Classes Reference, 1259
- QVariant Class
 RingQt Classes Reference, 1261
- QVariant2 Class
 RingQt Classes Reference, 1262
- QVariant3 Class
 RingQt Classes Reference, 1262
- QVariant4 Class
 RingQt Classes Reference, 1262
- QVariant5 Class
 RingQt Classes Reference, 1262
- QVariantDouble Class
 RingQt Classes Reference, 1263
- QVariantFloat Class
 RingQt Classes Reference, 1263
- QVariantInt Class
 RingQt Classes Reference, 1263
- QVariantString Class
 RingQt Classes Reference, 1263
- QVBarModelMapper Class
 RingQt Classes Reference, 1255
- QVBoxLayout Class
 RingQt Classes Reference, 1256
- QVBoxLayoutModelMapper Class
 RingQt Classes Reference, 1256
- QVCandlestickModelMapper Class
 RingQt Classes Reference, 1257
- QVector2D Class
 RingQt Classes Reference, 1263
- QVector3D Class
 RingQt Classes Reference, 1264
- QVector4D Class
 RingQt Classes Reference, 1265
- QVectorQVoice Class
 RingQt Classes Reference, 1265
- QVideoWidget and QMediaPlayer
 Desktop, WebAssembly and Mobile Development, 382
- QVideoWidget Class
 RingQt Classes Reference, 1265
- QVideoWidgetControl Class
 RingQt Classes Reference, 1266
- QViewport Class
 RingQt Classes Reference, 1266
- QVoice Class
 RingQt Classes Reference, 1267
- QVPieModelMapper Class
 RingQt Classes Reference, 1258
- QVXYModelMapper Class
 RingQt Classes Reference, 1258
- QWebEngineView Class
 RingQt Classes Reference, 1267
- QWebView Class
 RingQt Classes Reference, 1268
- QWidget Class
 RingQt Classes Reference, 1269
- QWindow Class
 RingQt Classes Reference, 1275
- QXmlStreamAttribute Class
 RingQt Classes Reference, 1281
- QXmlStreamAttributes Class
 RingQt Classes Reference, 1281
- QXmlStreamEntityDeclaration Class
 RingQt Classes Reference, 1282
- QXmlStreamEntityResolver Class
 RingQt Classes Reference, 1282
- QXmlStreamNamespaceDeclaration Class
 RingQt Classes Reference, 1282
- QXmlStreamNotationDeclaration Class
 RingQt Classes Reference, 1282
- QXmlStreamReader Class
 RingQt Classes Reference, 1282
- QXmlStreamWriter Class
 RingQt Classes Reference, 1284
- QXYLegendMarker Class
 RingQt Classes Reference, 1279
- QXYSeries Class
 RingQt Classes Reference, 1279
- Raise()
 Eval() and Debugging, 149
- RandBytes()
 Security and Internet Functions, 189
- Random Image
 Web DevelopmentCGI Library, 545
- Random()
 Mathematical Functions, 125
- Read File using Read()
 Files, 130

readline()
 Stdlib Functions, 316

Real Natural Code
 Natural Language Programming, 244

Rectangle Scaling
 Using RingRayLib, 681

Recursion
 Functions - First Style, 78
 Functions - Second Style, 82
 Functions - Third Style, 86

Reflection and Meta-programming
 addattribute(), 225
 addmethod(), 226
 attributes(), 222
 cfunctions(), 215
 classes(), 219
 classname(), 221
 functions(), 215
 getattribute(), 227
 globals(), 214
 Introduction, 212
 isattribute(), 223
 iscfunction(), 217
 isclass(), 219
 isfunction(), 217
 isglobal(), 216
 islocal(), 216
 ismethod(), 224
 isobject(), 222
 ispackage(), 218
 ispackagesclass(), 221
 isprivateattribute(), 224
 isprivatemethod(), 225
 locals(), 214
 mergemethods(), 230
 methods(), 223
 objectid(), 222
 packagename(), 231
 packages(), 218
 packagesclasses(), 220
 setattribute(), 229

Register New Functions
 Code Generator, 1356

Regular Expressions
 Desktop, WebAssembly and Mobile Development, 420

Relational Operators
 Operators, 54

Remove Package
 Ring Package ManagerRingPM, 819

Remove()
 Files, 131

Rename()
 Files, 131

Replicate List Items
 Tutorial: Ring Extensions in C/C++, 1323

Resources
 Introduction, 1663
 Ring Language Website, 1664
 Ring Team, 1664
 Source Code, 1664

Restore Image From The Database
 MySQL Functions, 171

Return as List or Hash Table
 Lists, 98

Return object by reference
 Declarative Programming, 233

Return Self by Reference
 What is new in Ring 1.3?, 1413

Return Value
 Extension, 1342
 Functions - First Style, 77
 Functions - Second Style, 81
 Functions - Third Style, 86

Reverse()
 Lists, 94

Rewind()
 Files, 134

Right()
 Strings, 103

Ring and other languages
 Introduction, 23

RING API - list Functions
 Extension, 1344

RING API - String Functions
 Extension, 1345

Ring CGI Hello World Program
 Web DevelopmentCGI Library, 526

Ring Extension for Visual Studio Code
 What is new in Ring 1.10?, 1535

Ring for WebAssembly
 What is new in Ring 1.13?, 1567

Ring Language Website
 Resources, 1664

Ring mode for Emacs Editor
 What is new in Ring 1.3?, 1411

Ring Notepad
 Introduction, 28
 Ring Notepad - Creating and running your first console application, 29
 Ring Notepad - Creating and running your first game, 35
 Ring Notepad - Creating and running your first GUI/WebAssembly/Mobile application, 32
 Ring Notepad - Creating and running your first Web application, 33
 Ring Notepad - Main Window, 29
 The Browser Menu, 40

The Distribute Menu, 41
The Edit Menu, 38
The File Menu, 37
The Help Menu, 41
The Main File in the Project, 36
The Program Menu, 40
The Tools Menu, 41
The View Menu, 38
Ring Notepad - Creating and running your first console application
 Ring Notepad, 29
Ring Notepad - Creating and running your first game
 Ring Notepad, 35
Ring Notepad - Creating and running your first GUI/WebAssembly/Mobile application
 Ring Notepad, 32
Ring Notepad - Creating and running your first Web application
 Ring Notepad, 33
Ring Notepad - Main Window
 Ring Notepad, 29
Ring Package ManagerRingPM
 Create Package in the Current Folder, 822
 Creating New Package, 819
 Deleting All Packages, 819
 Discovering Packages, 816
 Features, 816
 Installing Packages, 817
 Introduction, 815
 Printing List of Installed Packages, 818
 Remove Package, 819
 Run Package, 818
 The Package Description File, 821
 The RingPM Registry File, 824
 Update Package, 819
 Updating the RingPM Registry, 817
Ring source code files and permissions
 Deploying Web Applications in the Cloud, 582
Ring State
 Embedding Ring Language in C/C++ Programs, 1350
Ring State Functions
 Embedding Ring Language in C/C++ Programs, 1350
Ring State Variables
 Embedding Ring Language in C/C++ Programs, 1351
Ring support in SpaceVim
 What is new in Ring 1.13?, 1577
Ring Team
 Resources, 1664
Ring VM - Tracing Functions
 What is new in Ring 1.5?, 1457
ring_ext.c
 Extension, 1338
ring_ext.h
 Extension, 1338
ring_state_filetokens() function
 Embedding Ring in Ring, 300
 What is new in Ring 1.12?, 1561
ring_state_new() and ring_state_mainfile()
 Embedding Ring in Ring, 299
ring_state_new() and ring_state_mainfile() functions
 What is new in Ring 1.7?, 1490
ring_state_setvar()
 Embedding Ring in Ring, 298
RingAllegro Functions Reference
 Introduction, 867
RingCodeHighlighter Class
 RingQt Classes Reference, 1287
RingConsoleColors Extension
 What is new in Ring 1.6?, 1480
RingConsoleColors Functions Reference
 Introduction, 865
RingFreeGLUT Extension
 What is new in Ring 1.5?, 1444
RingFreeGLUT Functions Reference
 Introduction, 937
RingLibCurl
 Facebook Login, 847
 Get Request, 847
 Get Stock Data From Yahoo, 849
 Introduction, 846
 Post Request, 847
 Save output to string, 848
 What is new in Ring 1.2?, 1401
RingLibCurl Functions Reference
 Introduction, 850
RingLibSDL
 Close Window Event, 892
 Create Window, 888
 Display Image, 888
 Display PNG Images, 890
 Display Transparent Images, 891
 Draw Rectangle, 889
 Introduction, 887
 Mouse Events, 892
 Play Sound, 893
 Switch Between Two Images, 889
 Use TTF Fonts, 890
 What is new in Ring 1.1?, 1394
RingLibSDL Functions Reference
 Introduction, 894
RingLibuv
 Client Example, 923
 Client Example - Using Classes, 925
 First Application using RingLibuv, 920
 Introduction, 919

- Server Example, [921](#)
- Server Example using Classes, [924](#)
- The Events Loop, [921](#)
- Threads Example, [927](#)
- Threads Example - Using Classes, [927](#)
- RingLibuv Extension
 - What is new in Ring 1.7?, [1493](#)
- RingLibuv Functions Reference
 - Introduction, [928](#)
- RingLibZip Functions Reference
 - Introduction, [862](#)
- RingMurmurHash Extension
 - What is new in Ring 1.6?, [1480](#)
- RingMurmurHash Functions Reference
 - Example, [864](#)
 - Introduction, [863](#)
 - MurmurHash1 functions, [864](#)
 - MurmurHash2 functions, [864](#)
 - MurmurHash3 functions, [864](#)
- RingOpenGL (OpenGL 3.2) Functions Reference
 - Introduction, [951](#)
- RingOpenGL Extension
 - What is new in Ring 1.5?, [1453](#)
- RingPostgreSQL Constants
 - PostgreSQL, [180](#)
- RingPostgreSQL Extension
 - What is new in Ring 1.9?, [1518](#)
- RingPostgreSQL Functions
 - PostgreSQL, [181](#)
- RingQt Classes and their Qt Documentation
 - Desktop, WebAssembly and Mobile Development, [455](#)
- RingQt Classes Reference
 - AbstractAxis Class, [999](#)
 - AbstractBarSeries Class, [1002](#)
 - CodeEditor Class, [1003](#)
 - Introduction, [998](#)
 - QAbstractAspect Class, [1003](#)
 - QAbstractButton Class, [1004](#)
 - QAbstractCameraController Class, [1005](#)
 - QAbstractItemView Class, [1005](#)
 - QAbstractPrintDialog Class, [1007](#)
 - QAbstractScrollArea Class, [1007](#)
 - QAbstractSeries Class, [1008](#)
 - QAbstractSlider Class, [1009](#)
 - QAbstractSocket Class, [1009](#)
 - QAbstractSpinBox Class, [1011](#)
 - QAction Class, [1012](#)
 - QAllEvents Class, [1013](#)
 - QApp Class, [1018](#)
 - QAreaLegendMarker Class, [1018](#)
 - QAreaSeries Class, [1018](#)
 - QAspectEngine Class, [1020](#)
 - QAxBase Class, [1020](#)
 - QAxObject Class, [1021](#)
 - QAxWidget Class, [1021](#)
 - QAxWidget2 Class, [1021](#)
 - QBarCategoryAxis Class, [1022](#)
 - QBarLegendMarker Class, [1022](#)
 - QBarSeries Class, [1023](#)
 - QBarSet Class, [1023](#)
 - QBitmap Class, [1025](#)
 - QBluetoothAddress Class, [1025](#)
 - QBluetoothDeviceDiscoveryAgent Class, [1025](#)
 - QBluetoothDeviceInfo Class, [1026](#)
 - QBluetoothHostInfo Class, [1026](#)
 - QBluetoothLocalDevice Class, [1026](#)
 - QBluetoothServer Class, [1027](#)
 - QBluetoothServiceDiscoveryAgent Class, [1028](#)
 - QBluetoothServiceInfo Class, [1029](#)
 - QBluetoothSocket Class, [1030](#)
 - QBluetoothTransferManager Class, [1030](#)
 - QBluetoothTransferReply Class, [1031](#)
 - QBluetoothTransferRequest Class, [1031](#)
 - QBluetoothUuid Class, [1031](#)
 - QBoxLayout Class, [1032](#)
 - QBoxPlotLegendMarker Class, [1032](#)
 - QBoxPlotSeries Class, [1033](#)
 - QBoxSet Class, [1034](#)
 - QBrush Class, [1035](#)
 - QBuffer Class, [1036](#)
 - QPushButtonGroup Class, [1036](#)
 - QByteArray Class, [1036](#)
 - QCalendarWidget Class, [1038](#)
 - QCamera Class, [1040](#)
 - QCameraImageCapture Class, [1041](#)
 - QCameraLens Class, [1041](#)
 - QCameraSelector Class, [1042](#)
 - QCameraViewfinder Class, [1042](#)
 - QCandlestickLegendMarker Class, [1042](#)
 - QCandlestickModelMapper Class, [1043](#)
 - QCandlestickSeries Class, [1043](#)
 - QCandlestickSet Class, [1045](#)
 - QCategoryAxis Class, [1046](#)
 - QChar Class, [1047](#)
 - QChart Class, [1049](#)
 - QChartView Class, [1051](#)
 - QCheckBox Class, [1051](#)
 - QChildEvent Class, [1052](#)
 - QClipboard Class, [1052](#)
 - QColor Class, [1052](#)
 - QColorDialog Class, [1055](#)
 - QComboBox Class, [1056](#)
 - QCompleter Class, [1057](#)
 - QCompleter2 Class, [1058](#)
 - QCompleter3 Class, [1058](#)
 - QConeGeometry Class, [1059](#)
 - QConeMesh Class, [1059](#)

QCoreApplication Class, 1060
QCuboidMesh Class, 1061
QCullFace Class, 1062
QCursor Class, 1062
QCylinderMesh Class, 1062
QDate Class, 1063
QDateEdit Class, 1064
QDateTime Class, 1064
QDateTimeAxis Class, 1065
QDateTimeEdit Class, 1066
QDepthTest Class, 1067
QDesktopServices Class, 1067
QDesktopWidget Class, 1067
QDial Class, 1068
QDialog Class, 1069
QDiffuseSpecularMaterial Class, 1069
QDir Class, 1069
QDirModel Class, 1071
QDockWidget Class, 1072
QDrag Class, 1073
QDragEnterEvent Class, 1074
QDragLeaveEvent Class, 1074
QDragMoveEvent Class, 1074
QDropEvent Class, 1074
QEffect Class, 1075
QEntity Class, 1075
QEvent Class, 1075
QExtrudedTextMesh Class, 1076
QFile Class, 1076
QFile2 Class, 1077
QFileDevice Class, 1077
QFileDialog Class, 1077
QFileInfo Class, 1079
QFileSystemModel Class, 1081
QFirstPersonCameraController Class, 1082
QFont Class, 1082
QFontDialog Class, 1084
QFontMetrics Class, 1085
QForwardRenderer Class, 1086
QFrame Class, 1086
QFrame2 Class, 1087
QFrame3 Class, 1087
QFrameAction Class, 1087
QGeoAddress Class, 1087
QGeoAreaMonitorInfo Class, 1088
QGeoAreaMonitorSource Class, 1089
QGeoCircle Class, 1089
QGeoCoordinate Class, 1089
QGeoPositionInfo Class, 1090
QGeoPositionInfoSource Class, 1090
QGeoRectangle Class, 1091
QGeoSatelliteInfo Class, 1091
QGeoSatelliteInfoSource Class, 1092
QGeoShape Class, 1092
QGoochMaterial Class, 1092
QGradient Class, 1092
QGraphicsScene Class, 1093
QGraphicsVideoItem Class, 1095
QGraphicsView Class, 1096
QGridLayout Class, 1098
QGuiApplication Class, 1099
QHBarModelMapper Class, 1101
QHBoxLayout Class, 1102
QHBoxPlotModelMapper Class, 1102
QHCandlestickModelMapper Class, 1103
QHeaderView Class, 1106
QHorizontalBarSeries Class, 1108
QHorizontalPercentBarSeries Class, 1108
QHorizontalStackedBarSeries Class, 1108
QHostAddress Class, 1109
QHostInfo Class, 1109
QHPieModelMapper Class, 1104
QHXYModelMapper Class, 1105
QIcon Class, 1110
QImage Class, 1111
QInputAspect Class, 1112
QInputDialog Class, 1112
QIODevice Class, 1109
QJsonArray Class, 1114
QJsonDocument Class, 1115
QJsonObject Class, 1115
QJsonParseError Class, 1116
QJsonValue Class, 1116
QKeySequence Class, 1116
QLabel Class, 1117
QLayout Class, 1118
QLCDNumber Class, 1117
QLegend Class, 1119
QLegendMarker Class, 1120
QLinearGradient Class, 1123
QLineEdit Class, 1121
QLineSeries Class, 1123
QListView Class, 1124
QListWidget Class, 1125
QListWidgetItem Class, 1126
QLogicAspect Class, 1128
QLogValueAxis Class, 1127
QMainWindow Class, 1128
QMaterial Class, 1129
QMatrix4x4 Class, 1130
QMdiArea Class, 1131
QMdiSubWindow Class, 1132
QMediaObject Class, 1133
QMediaPlayer Class, 1133
QMediaPlaylist Class, 1134
QMenu Class, 1134
QMenuBar Class, 1135
QMesh Class, 1136

QMessageBox Class, 1136
QMetalRoughMaterial Class, 1137
QMimeType Class, 1137
QMorphPhongMaterial Class, 1138
QMovie Class, 1139
QMutex Class, 1140
QMutexLocker Class, 1140
QNetworkAccessManager Class, 1140
QNetworkProxy Class, 1141
QNetworkReply Class, 1142
QNetworkRequest Class, 1143
QNmeaPositionInfoSource Class, 1143
QNode Class, 1143
QObject Class, 1144
QObjectPicker Class, 1145
QOpenGLBuffer Class, 1146
QOpenGLContext Class, 1146
QOpenGLDebugLogger Class, 1147
QOpenGLFramebufferObject Class, 1148
QOpenGLFunctions Class, 1149
QOpenGLFunctions_3_2_Core Class, 1153
QOpenGLPaintDevice Class, 1161
QOpenGLShader Class, 1161
QOpenGLShaderProgram Class, 1162
QOpenGLTexture Class, 1165
QOpenGLTimerQuery Class, 1167
QOpenGLVersionProfile Class, 1168
QOpenGLVertexArrayObject Class, 1168
QOpenGLWidget Class, 1168
QOrbitCameraController Class, 1169
QPageSetupDialog Class, 1169
QPaintDevice Class, 1170
QPainter Class, 1170
QPainter2 Class, 1173
QPainterPath Class, 1173
QPen Class, 1174
QPercentBarSeries Class, 1175
QPerVertexColorMaterial Class, 1175
QPhongMaterial Class, 1175
QPicture Class, 1175
QPieLegendMarker Class, 1176
QPieSeries Class, 1176
QPieSlice Class, 1177
QPixmap Class, 1180
QPixmap2 Class, 1181
QPlainTextEdit Class, 1181
QPlaneMesh Class, 1183
QPoint Class, 1184
QPointF Class, 1184
QPointLight Class, 1185
QPolarChart Class, 1185
QPrintDialog Class, 1185
QPrinter Class, 1187
QPrinterInfo Class, 1188
QPrintPreviewDialog Class, 1185
QPrintPreviewWidget Class, 1186
QProcess Class, 1188
QProgressBar Class, 1190
QPushButton Class, 1190
QXmlEngine Class, 1191
QQmlError Class, 1192
QQuaternion Class, 1192
QQuickView Class, 1193
QQuickWidget Class, 1193
QRadioButton Class, 1194
QRect Class, 1195
QRegion Class, 1196
QRegularExpression Class, 1197
QRegularExpressionMatch Class, 1197
QRegularExpressionMatchIterator Class, 1198
QRenderAspect Class, 1198
QRenderPass Class, 1199
QScatterSeries Class, 1199
QSceneLoader Class, 1200
QScreen Class, 1200
QScrollArea Class, 1201
QScrollBar Class, 1201
QSerialPort Class, 1201
QSerialPortInfo Class, 1203
QSize Class, 1203
QSkyboxEntity Class, 1204
QSlider Class, 1204
QSphereMesh Class, 1205
QSpinBox Class, 1205
QSplashScreen Class, 1206
QSplineSeries Class, 1206
QSplitter Class, 1206
QSqlDatabase Class, 1207
QSqlDriver Class, 1208
QSqlDriverCreatorBase Class, 1208
QSqlError Class, 1209
QSqlField Class, 1209
QSqlIndex Class, 1210
QSqlQuery Class, 1210
QSqlRecord Class, 1211
QStackedBarSeries Class, 1212
QStackedWidget Class, 1212
QStandardPaths Class, 1213
QStatusBar Class, 1213
QString2 Class, 1213
QStringList Class, 1214
QStringRef Class, 1216
QSurfaceFormat Class, 1217
QSystemTrayIcon Class, 1218
Qt3DCamera Class, 1285
Qt3DWindow Class, 1287
QTabBar Class, 1219
QTableView Class, 1222

QTableWidget Class, 1223
 QTableWidgetItem Class, 1225
 QTabWidget Class, 1221
 QTcpServer Class, 1227
 QTcpSocket Class, 1227
 QTechnique Class, 1228
 QTest Class, 1229
 QText2DEntity Class, 1229
 QTextBlock Class, 1229
 QTextBrowser Class, 1230
 QTextCharFormat Class, 1231
 QTextCodec Class, 1232
 QTextCursor Class, 1233
 QTextDocument Class, 1234
 QTextEdit Class, 1236
 QTextStream Class, 1239
 QTextStream2 Class, 1240
 QTextStream3 Class, 1241
 QTextStream4 Class, 1241
 QTextStream5 Class, 1241
 QTextToSpeech Class, 1241
 QTextureLoader Class, 1242
 QTextureMaterial Class, 1242
 QThread Class, 1243
 QThreadPool Class, 1243
 QTime Class, 1244
 QTimer Class, 1245
 QToolBar Class, 1245
 QToolButton Class, 1246
 QTorusMesh Class, 1246
 QTransform Class, 1247
 QTreeView Class, 1248
 QTreeWidget Class, 1250
 QTreeWidgetItem Class, 1252
 QUrl Class, 1254
 QUuid Class, 1255
 QValueAxis Class, 1259
 QVariant Class, 1261
 QVariant2 Class, 1262
 QVariant3 Class, 1262
 QVariant4 Class, 1262
 QVariant5 Class, 1262
 QVariantDouble Class, 1263
 QVariantFloat Class, 1263
 QVariantInt Class, 1263
 QVariantString Class, 1263
 QVBarModelMapper Class, 1255
 QVBoxLayout Class, 1256
 QVBoxPlotModelMapper Class, 1256
 QVCandlestickModelMapper Class, 1257
 QVector2D Class, 1263
 QVector3D Class, 1264
 QVector4D Class, 1265
 QVectorVoice Class, 1265
 QVideoWidget Class, 1265
 QVideoWidgetControl Class, 1266
 QViewport Class, 1266
 QVoice Class, 1267
 QVPieModelMapper Class, 1258
 QVXYModelMapper Class, 1258
 QWebEngineView Class, 1267
 QWebView Class, 1268
 QWidget Class, 1269
 QWindow Class, 1275
 QDomStreamAttribute Class, 1281
 QDomStreamAttributes Class, 1281
 QDomStreamEntityDeclaration Class, 1282
 QDomStreamEntityResolver Class, 1282
 QDomStreamNamespaceDeclaration Class, 1282
 QDomStreamNotationDeclaration Class, 1282
 QDomStreamReader Class, 1282
 QDomStreamWriter Class, 1284
 QXYLegendMarker Class, 1279
 QXYSeries Class, 1279
 RingCodeHighlighter Class, 1287
 RingRayLib Extension
 What is new in Ring 1.11?, 1546
 RingREPL
 What is new in Ring 1.4?, 1422
 RingSQLite
 What is new in Ring 1.1?, 1395
 RingStbImage Extension
 What is new in Ring 1.13?, 1581
 RingStbImage Functions Reference
 Introduction, 948
 ringvm_callfunc()
 Low Level Functions, 1304
 RingVM_CallList()
 Low Level Functions, 1301
 RingVM_CFunctionsList()
 Low Level Functions, 1296
 RingVM_ClassesList()
 Low Level Functions, 1297
 ringvm_evalinscope()
 Low Level Functions, 1304
 RingVM_FilesList()
 Low Level Functions, 1301
 RingVM_FunctionsList()
 Low Level Functions, 1296
 ringvm_give() function
 Low Level Functions, 1313
 ringvm_hideerrorMsg()
 Low Level Functions, 1304
 ringvm_info()
 Low Level Functions, 1313
 RingVM_MemoryList()
 Low Level Functions, 1299
 RingVM_PackagesList()

Low Level Functions, 1298	Save Image Inside the Database
ringvm_passerror()	MySQL Functions, 170
Low Level Functions, 1304	Save output to string
ringvm_scopescount()	RingLibCurl, 848
Low Level Functions, 1303	Say Hello
ringvm_see() and ringvm_give() functions	Tutorial: Ring Extensions in C/C++, 1317
What is new in Ring 1.7?, 1489	Scaling and Rotating Images
ringvm_see() function	Graphics and Game Programming, 594
Low Level Functions, 1312	Scene
ringvm_settrace()	Using Qt3D, 502
Low Level Functions, 1302	Scope Rules
ringvm_tracedata()	Accessing the class attributes from braces inside
Low Level Functions, 1302	class methods, 264
ringvm_traceevent()	Conflict between Class Attributes and Local Vari-
Low Level Functions, 1303	ables, 260
ringvm_tracefunc()	Conflict between Global Variables and Class At-
Low Level Functions, 1303	tributes, 259
RingZip	Conflict between self inside braces and self in the
Create Zip File, 860	class region, 266
Extract Zip File, 860	Creating a Class for each Window in GUI applica-
Introduction, 859	tions, 265
Print files in Zip file, 860	Defining Variables and Variables Access, 257
Using RingZip Classes, 860	How Ring find the Variable?, 258
Zip Class Reference, 862	Introduction, 256
ZipEntry Class Reference, 862	Summary of Scope Rules, 271
RingZip Library	The For Loops uses the local scope, 270
What is new in Ring 1.3?, 1415	The Self Object, 258
Rotate Text	Three Scopes, 257
Desktop, WebAssembly and Mobile Development,	Using Braces to access objects inside Class Methods,
417	261
Rules	Using braces to escape from the current object scope,
The Type Hints Library, 290	269
Run Package	Using Object.Attribute, 258
Ring Package ManagerRingPM, 818	Scope Rules for Functions and Methods
Run the program	Calling a function sharing the name with a method in
Getting Started - First Style, 43	the current class, 276
Getting Started - Second Style, 46	Example about Sharing Names between Functions
Getting Started - Third Style, 49	and Methods, 275
Running Forms	How Ring find a functions and methods?, 274
Form Designer, 461	Introduction, 273
Runtime Errors	Screen Shots
Language Specification, 1652	The Gold Magic 800 Game, 778
Runtime Errors when Embedding Ring in Ring	ScriptFunctions Class
Embedding Ring in Ring, 300	Web DevelopmentCGI Library, 578
Samples	Search
How to contribute?, 1643	Lists, 92
Samples in this book	Search of global names while defining the class attributes
Applications developed in a few hours, 13	Frequently Asked Questions, 1609
Samples SourceAuthors	Security and Internet Functions
Using RingOpenGL and RingFreeGLUT for 3D	Decrypt(), 188
Graphics, 706	Download(), 190
Save and Restore Images	Encrypt(), 188
ODBC Functions, 162	Example, 188
	File Hash, 189

Introduction, 184
MD5(), 185
RandBytes(), 189
SendEmail(), 190
SHA1(), 186
SHA224(), 187
SHA256(), 186
SHA384(), 187
SHA512(), 186
Security Class
 Stdlib Classes, 348
Send Parameters
 Functions - First Style, 76
 Functions - Second Style, 80
 Functions - Third Style, 84
SendEmail()
 Security and Internet Functions, 190
Serial Execution of Programs
 Embedding Ring in Ring, 298
Server Example
 RingLibuv, 921
Server Example using Classes
 RingLibuv, 924
Set List Item
 Lists, 92
setAttribute()
 Reflection and Meta-programming, 229
setpointer()
 Low Level Functions, 1293
Setter and Getter
 Object Oriented Programming, 195
SHA1()
 Security and Internet Functions, 186
SHA224()
 Security and Internet Functions, 187
SHA256()
 Security and Internet Functions, 186
SHA384()
 Security and Internet Functions, 187
SHA512()
 Security and Internet Functions, 186
Shared Libraries
 Extension, 1347
Short-circuit evaluation
 Control Structures - First Style, 61
Shutdown() Function
 System Functions, 146
sign()
 Stdlib Functions, 310
Simple
 Language Design, 1377
Simple Client and Server Example
 Desktop, WebAssembly and Mobile Development, 421
Sin() Implementation Extension, 1342
Single: Desktop, 349
Single: Using Qt3D
 Using Qt3D, 466
Single: Using RingRayLib
 Introduction, 652
Single: Using ZeroLib
 Introduction, 825
sleep()
 Stdlib Functions, 317
Smart Garbage Collector
 Language Design, 1385
Snake Game
 What is new in Ring 1.11?, 1543
Snakes And Ladder Game
 What is new in Ring 1.10?, 1533
Sokoban Game
 What is new in Ring 1.11?, 1541
Sort()
 Lists, 93
Sort() and List of Objects
 Object Oriented Programming, 203
Sound Class
 Game Engine for 2D Games, 603
Sound Loading
 Using RingRayLib, 685
Source Code
 Resources, 1664
 The Gold Magic 800 Game, 780
 Using ZeroLib, 828
Source Code File Sections
 Program Structure, 87
space()
 Low Level Functions, 1290
SpaceVim
 Using Other Code Editors, 1592
Special thanks to contributors
 How to contribute?, 1642
split()
 Stdlib Functions, 307
splitmany()
 Stdlib Functions, 307
Sprite Automatic Movement
 Game Engine for 2D Games, 611
Sprite Class
 Game Engine for 2D Games, 602
Sprite Keypress Event
 Game Engine for 2D Games, 612
Sprite Mouse Event
 Game Engine for 2D Games, 613
Sprite State Event
 Game Engine for 2D Games, 614
SQLite

- Introduction, 173
- `sqlite_close()`, 174
- `sqlite_execute()`, 174
- `sqlite_init()`, 174
- `sqlite_open()`, 174
- SQLite Class**
 - `Stdlib Classes`, 346
 - `sqlite_close()`
 - SQLite, 174
 - `sqlite_execute()`
 - SQLite, 174
 - `sqlite_init()`
 - SQLite, 174
 - `sqlite_open()`
 - SQLite, 174
- Squares Puzzle Game
 - Applications developed in a few hours, 12
- SRandom()**
 - Mathematical Functions, 126
- Stack Class**
 - `Stdlib Classes`, 330
- Stars Fighter Game
 - Game Engine for 2D Games, 623
- startswith()**
 - Stdlib Functions, 311
- Static Methods**
 - Code Generator, 1372
- StdBase Class**
 - `Stdlib Classes`, 325
- StdLib - More Functions**
 - What is new in Ring 1.11?, 1550
- Stdlib Classes**
 - Conversion Class, 342
 - `DataType Class`, 341
 - `DateTime Class`, 337
 - `Debug Class`, 340
 - `File Class`, 338
 - `HashTable Class`, 331
 - `Internet Class`, 349
 - Introduction, 324
 - `List Class`, 328
 - `Math Class`, 334
 - `MySQL Class`, 344
 - `ODBC Class`, 343
 - `PostgreSQL Class`, 347
 - `Queue Class`, 331
 - `Security Class`, 348
 - `SQLite Class`, 346
 - `Stack Class`, 330
 - `StdBase Class`, 325
 - `String Class`, 326
 - `System Class`, 339
 - `Tree Class`, 332
- Stdlib Functions**
 - `apppath()`, 304
 - `ASCIIList2Str()`, 322
 - `binarydigits()`, 314
 - `capitalized()`, 307
 - `changestring()`, 317
 - `dayofweek()`, 315
 - `direxists()`, 318
 - `endswith()`, 311
 - `EpochTime()`, 319
 - `evenorodd()`, 313
 - `factorial()`, 309
 - `factors()`, 313
 - `fibonacci()`, 309
 - `file2list()`, 310
 - `filter()`, 306
 - `FSize()`, 318
 - `gcd()`, 311
 - `getnumber()`, 304
 - `getstring()`, 304
 - Introduction, 302
 - `IsBetween()`, 323
 - `isleapyear()`, 314
 - `IsListContainsItems()`, 323
 - `ismainsourcefile()`, 317
 - `ispalindrome()`, 313
 - `isprime()`, 309
 - `isspecial()`, 308
 - `isvowel()`, 308
 - `JustFileName()`, 305
 - `JustFilePath()`, 305
 - `lcm()`, 312
 - `linecount()`, 308
 - `List2Code() Function`, 321
 - `list2file()`, 310
 - `ListAllFiles() Function`, 320
 - `makedir()`, 318
 - `map()`, 306
 - `matrixmulti()`, 314
 - `matrixtrans()`, 315
 - `OSCopyFile() Function`, 321
 - `OSCopyFolder() Function`, 320
 - `OSCreateOpenFolder() Function`, 320
 - `OSDeleteFile() Function`, 321
 - `OSDeleteFolder() Function`, 321
 - `OSRenameFile() Function`, 321
 - `permutation()`, 315
 - `print()`, 303
 - `Print2Str() Function`, 304
 - `prolist()`, 312
 - `puts()`, 303
 - `readline()`, 316
 - `sign()`, 310
 - `sleep()`, 317
 - `split()`, 307

splitmany(), 307
 startswith(), 311
 Str2ASCIIList(), 322
 substring(), 316
 sumlist(), 312
 SystemCmd() Function, 319
 SystemSilent() Function, 320
 TimeInfo(), 323
 times(), 306
 TrimAll(), 319
 TrimLeft(), 319
 TrimRight(), 319
 value(), 305
 StdLib functions and classes written in Ring
 What is new in Ring 1.1?, 1392
Step Option
 Control Structures - First Style, 59
Steps to create the extension
 Create your first extension, 1375
StopWatch Application
 What is new in Ring 1.8?, 1498
Str2ASCIIList()
 Stdlib Functions, 322
Str2Hex()
 Data Type, 121
str2list() and list2str()
 Strings, 106
strcmp()
 Strings, 106
String Class
 Stdlib Classes, 326
String Literals
 Strings, 102
String()
 Data Type, 120
String2Constant Application
 What is new in Ring 1.8?, 1497
Strings
 Access String Letters, 102
 Convert Letters Case, 102
 Copy(), 104
 Find SubString, 105
 Get Number of Characters from position, 105
 Get String Length, 102
 Get Substring from position to end, 105
 Introduction, 101
 Left(), 103
 Lines(), 104
 Merge binary characters, 107
 Right(), 103
 str2list() and list2str(), 106
 strcmp(), 106
 String Literals, 102
 Substr(), 105
 Transform Substring To Another Substring, 106
 Trim(), 104
StyleFunctions Class
 Web DevelopmentCGI Library, 578
Substr()
 Strings, 105
substring()
 Stdlib Functions, 316
Sudoku Game
 What is new in Ring 1.11?, 1544
Sum List of Numbers
 Tutorial: Ring Extensions in C/C++, 1318
Sum Two Numbers
 Tutorial: Ring Extensions in C/C++, 1316
sumlist()
 Stdlib Functions, 312
Summary of Scope Rules
 Scope Rules, 271
Super Man 2016 Game
 Game Engine for 2D Games, 638
Swap Items
 Lists, 100
Switch Between Two Images
 RingLibSDL, 889
Switch Statement
 Control Structures - First Style, 57
 Control Structures - Second Style, 64
 Control Structures - Third Style, 68
Syntax Flexibility
 Change Language Keywords, 278
 Change Language Operators, 279
 Ignore new lines after keywords, 287
 Introduction, 277
 Load Syntax Files, 280
 Using "(" around the function parameters, 280
 Using \$ and @ in the start of the variable name, 282
 Using 'case' as 'on' in switch statements, 285
 Using 'def' as 'func' in functions/methods definition, 286
 Using 'end' keyword after Packages/Classes/Functions, 287
 Using 'endpackage'/endclass'/endfunc' keywords after Packages/Classes/Functions, 287
 Using 'put' and 'get' as 'see' and 'give', 285
 Using braces {} in Packages/Classes/Functions, 286
 Using braces to start and end different control structures, 284
 Using Semi-colon after and between statements, 281
 Using the 'else' keyword as 'other' in switch statement, 283
 Using the 'elseif' keyword as 'but' in if statement, 282
 Using the 'end' keyword in different control structures, 283
 What is new in Ring 1.1?, 1389

SysGet() Function
 System Functions, 141

System Class
 Stdlib Classes, 339

System Functions
 ChDir() Function, 146
 CurrentDir() Function, 145
 Example, 143
 ExeFileName() Function, 146
 ExeFolder() Function, 146
 Get Active Source File Name, 144
 Get Command Line Arguments, 144
 Introduction, 139
 IsAndroid() Function, 142
 IsFreeBSD() Function, 142
 IsLinux() Function, 142
 IsMacOSX() Function, 142
 IsMSDOS() Function, 141
 IsUnix() Function, 142
 IsWindows() Function, 141
 IsWindows64() Function, 141
 PrevFileName() Function, 145
 Shutdown() Function, 146
 SysGet() Function, 141
 System() Function, 140
 Version() Function, 146
 Windowsnl() Function, 143

System() Function
 System Functions, 140

SystemCmd() Function
 Stdlib Functions, 319

SystemSilent() Function
 Stdlib Functions, 320

Tempfile()
 Files, 133

Templates
 Web DevelopmentCGI Library, 540

Tempname()
 Files, 133

Testing
 How to contribute?, 1642

Testing the extension
 Create your first extension, 1376

Tetris Game
 What is new in Ring 1.13?, 1574

Text 2D
 Using Qt3D, 487

Text Class
 Game Engine for 2D Games, 603

Text To Speech Application
 What is new in Ring 1.11?, 1546

Texture
 Using Qt3D, 478

Texture Source
 Using RingRayLib, 690

The Browser Menu
 Ring Notepad, 40

The Camera
 Using RingOpenGL and RingFreeGLUT for 3D Graphics, 716

The Cards Game
 Demo Programs, 444
 Desktop, WebAssembly and Mobile Development, 444

The Designer Windows
 Form Designer, 460

The Difference between Qt and RingQt
 Desktop, WebAssembly and Mobile Development, 454

The Distribute Menu
 Ring Notepad, 41

The documentation says functional programming is supported, but then this happens?

Frequently Asked Questions, 1600

The Edit Menu
 Ring Notepad, 38

The Events Loop
 Desktop, WebAssembly and Mobile Development, 351
 RingLibuv, 921

The File Menu
 Ring Notepad, 37

The files ring.ring and ring.ringo
 Distributing Ring Application, 805

The First GUI Application
 Desktop, WebAssembly and Mobile Development, 350

The First Triangle
 Using RingOpenGL and RingFreeGLUT for 3D Graphics, 709

The First Window using RingFreeGLUT
 Using RingOpenGL and RingFreeGLUT for 3D Graphics, 707

The For Loops uses the local scope
 Scope Rules, 270
 What is new in Ring 1.8?, 1503

The Game Story
 The Gold Magic 800 Game, 778

The Gold Magic 800 Game
 How to play?, 778
 Introduction, 777
 Screen Shots, 778
 Source Code, 780
 The Game Story, 778
 What will you learn?, 778

The Help Menu
 Ring Notepad, 41

- The Main File in the Project
 - Ring Notepad, 36
- The Natural Library
 - What is new in Ring 1.4?, 1419
- The Package Description File
 - Ring Package ManagerRingPM, 821
- The Program Menu
 - Ring Notepad, 40
- The Properties
 - Form Designer, 460
- The Qt project for your Ring application
 - Building RingQt Applications for Mobile, 518
 - Building RingQt Applications for WebAssembly, 522
- The Ring Package ManagerRingPM
 - What is new in Ring 1.10?, 1536
- The RingPM Registry File
 - Ring Package ManagerRingPM, 824
- The Self Object
 - Scope Rules, 258
- The Tools Menu
 - Ring Notepad, 41
- The Trace Library and the Interactive Debugger
 - BreakPoint, 294
 - Disable BreakPoints, 294
 - Execute Program Line by Line, 293
 - Interactive Debugger, 293
 - Introduction, 291
 - Loading the Trace library, 292
 - Pass Error, 293
 - Trace All Events, 292
 - Trace control flow between functions, 292
 - Using the Interactive Debugger, 294
- The Type Hints Library
 - Example, 289
 - Introduction to the Type Hints Library, 288
 - Rules, 290
 - User Types, 289
 - Using Types inside Code, 290
 - Why Type Hints?, 289
- The View Menu
 - Ring Notepad, 38
- Threads
 - Graphics and Game Programming, 596
- Threads Example
 - RingLibuv, 927
- Threads Example - Using Classes
 - RingLibuv, 927
- Threads Support
 - Code Generator, 1360
- Three Scopes
 - Scope Rules, 257
- TicTacToe 3D Game
- Using RingOpenGL and RingAllegro for 3D Graphics, 765
- Time()
 - Date and Time, 109
- TimeInfo()
 - Stdlib Functions, 323
- TimeList()
 - Date and Time, 110
- times()
 - Stdlib Functions, 306
- Trace All Events
 - The Trace Library and the Interactive Debugger, 292
- Trace control flow between functions
 - The Trace Library and the Interactive Debugger, 292
- Trace Library and Interactive Debugger
 - What is new in Ring 1.5?, 1461
- Transaction Example
 - MySQL Functions, 172
- Transactions and Using Commit and Rollback
 - ODBC Functions, 162
- Transform Substring To Another Substring
 - Strings, 106
- Transparent Image
 - Graphics and Game Programming, 595
- Transparent Implementation
 - Language Design, 1383
- Tree Class
 - Stdlib Classes, 332
- Triangle Rotation
 - Using RingOpenGL and RingFreeGLUT for 3D Graphics, 712
- Trim()
 - Strings, 104
- TrimAll()
 - Stdlib Functions, 319
- TrimLeft()
 - Stdlib Functions, 319
- TrimRight()
 - Stdlib Functions, 319
- TrueType Fonts
 - Graphics and Game Programming, 592
- Try/Catch/Done
 - Eval() and Debugging, 148
- Trying to be natural
 - Language Design, 1378
- Tutorial: Number to Words
 - What is new in Ring 1.12?, 1559
- Tutorial: Ring Extensions in C/C++
 - Build the extension on different platforms, 1315
 - Create Table, 1333
 - Display List, 1327
 - Filter List Items, 1321
 - Generate List, 1325
 - Hello World, 1314

- Increment List Items, [1319](#)
- Replicate List Items, [1323](#)
- Say Hello, [1317](#)
- Sum List of Numbers, [1318](#)
- Sum Two Numbers, [1316](#)
- Tutorial: Ring Extensions in C/C++, [1313](#)
- Update Table, [1330](#)
- Two Cubes
 - Using RingRayLib, [667](#)
- Type Hints Library
 - What is new in Ring 1.5?, [1464](#)
- Type()
 - Data Type, [115](#)
- Ungetc()
 - Files, [136](#)
- Unsigned()
 - Mathematical Functions, [126](#)
- Update Package
 - Ring Package ManagerRingPM, [819](#)
- Update Table
 - Tutorial: Ring Extensions in C/C++, [1330](#)
- Update the Android SDK
 - Building RingQt Applications for Mobile, [517](#)
- Updating the RingPM Registry
 - Ring Package ManagerRingPM, [817](#)
- Upload Files
 - Web DevelopmentCGI Library, [534](#)
- URL Encode
 - Web DevelopmentCGI Library, [539](#)
- Usage
 - Deploying Web Applications in the Cloud, [581](#)
- Use TTF Fonts
 - RingLibSDL, [890](#)
- User Types
 - The Type Hints Library, [289](#)
- Users registration and Login
 - Web DevelopmentCGI Library, [562](#)
- Using "(" around the function parameters
 - Syntax Flexibility, [280](#)
- Using ? to print expression then new line
 - Getting Started - First Style, [44](#)
 - What is new in Ring 1.6?, [1487](#)
- Using \$ and @ in the start of the variable name
 - Syntax Flexibility, [282](#)
- Using && and || operators
 - What is new in Ring 1.6?, [1486](#)
- Using _ in numbers
 - Mathematical Functions, [127](#)
- Using '<' and ':' operators as 'from' keyword
 - What is new in Ring 1.3?, [1414](#)
- Using 'case' as 'on' in switch statements
 - Syntax Flexibility, [285](#)
- Using 'def' as 'func' in functions/methods definition
 - Syntax Flexibility, [286](#)
- Using 'end' keyword after Packages/Classes/Functions
 - Syntax Flexibility, [287](#)
- Using 'endpackage'/endclass'/endfunc' keywords after Packages/Classes/Functions
 - Syntax Flexibility, [287](#)
- Using 'put' and 'get' as 'see' and 'give'
 - Syntax Flexibility, [285](#)
- Using Atom
 - Using Other Code Editors, [1588](#)
- Using Bootstrap Library using Functions
 - Web DevelopmentCGI Library, [556](#)
- Using Bootstrap Library using Objects
 - Web DevelopmentCGI Library, [557](#)
- Using braces {} in Packages/Classes/Functions
 - Syntax Flexibility, [286](#)
- Using Braces to access objects inside Class Methods
 - Scope Rules, [261](#)
- Using braces to escape from the current object scope
 - Scope Rules, [269](#)
- Using braces to start and end different control structures
 - Syntax Flexibility, [284](#)
- Using C/C++ Compiler and Linker
 - Distributing Ring Application, [805](#)
- Using configuration file that wrap C++ library
 - Code Generator, [1362](#)
- Using CR as Carriage return
 - What is new in Ring 1.6?, [1485](#)
- Using Emacs Editor
 - Using Other Code Editors, [1590](#)
- Using Eval() with our Natural Code
 - Natural Language Programming, [242](#)
- Using f after numbers
 - Mathematical Functions, [128](#)
- Using Fonts
 - Using RingOpenGL and RingFreeGLUT for 3D Graphics, [734](#)
- Using Geany
 - Using Other Code Editors, [1587](#)
- Using Layout
 - Desktop, WebAssembly and Mobile Development, [352](#)
- Using Layouts
 - Form Designer, [466](#)
- Using len() and For Loops
 - Performance Tips, [785](#)
- Using Lists during definition
 - Lists, [96](#)
- Using Many Source Code Files
 - Program Structure, [87](#)
- Using Notepad++
 - Using Other Code Editors, [1586](#)
- Using NULL instead of NULLPointer()
 - What is new in Ring 1.2?, [1402](#)

Using Object.Attribute Scope Rules, 258	Using QSpinBox
Using Other Code Editors	Desktop, WebAssembly and Mobile Development, 371
Introduction, 1585	Using Qt3D
SpaceVim, 1592	Camera, 499
Using Atom, 1588	Draw Office, 495
Using Emacs Editor, 1590	Drawing Cone, 474
Using Geany, 1587	Drawing Cube, 467
Using Notepad++, 1586	Drawing Cylinder, 472
Using Sublime Text 2, 1589	Drawing Plane, 476
Using Visual Studio IDE, 1590	Drawing Sphere, 470
Visual Studio Code, 1591	Drawing Torus, 468
Using QCheckBox	Extruded Text, 489
Desktop, WebAssembly and Mobile Development, 378	Frame Action, 485
Using QComboBox Class	Key Press, 480
Desktop, WebAssembly and Mobile Development, 360	Many Objects, 497
Using QDateEdit	Model, 491
Desktop, WebAssembly and Mobile Development, 373	Model Texture, 493
Using QDesktopWidget Class	Object Picker, 482
Desktop, WebAssembly and Mobile Development, 416	Scene, 502
Using QDial	Text 2D, 487
Desktop, WebAssembly and Mobile Development, 374	Texture, 478
Using QDockWidget	Using QTableWidget
Desktop, WebAssembly and Mobile Development, 366	Desktop, WebAssembly and Mobile Development, 369
Using QFrame	Using QTabWidget
Desktop, WebAssembly and Mobile Development, 384	Desktop, WebAssembly and Mobile Development, 368
Using QInputDialog Class	Using QTreeView and QFileSystemModel
Desktop, WebAssembly and Mobile Development, 408	Desktop, WebAssembly and Mobile Development, 357
Using qLCDNumber	Using QTreeWidget and QTreeWidgetItem
Desktop, WebAssembly and Mobile Development, 404	Desktop, WebAssembly and Mobile Development, 358
Using QPrintPreviewDialog	Using QWebView
Desktop, WebAssembly and Mobile Development, 399	Desktop, WebAssembly and Mobile Development, 377
Using QProgressBar	Using Ring2EXE
Desktop, WebAssembly and Mobile Development, 370	Building RingQt Applications for Mobile, 518
Using QProgressBar and Timer	Building RingQt Applications for WebAssembly, 521
Desktop, WebAssembly and Mobile Development, 393	Distributing Ring Application using Ring2EXE, 807
Using QRadioButton and QButtonGroup	Using RING_API_RETMANAGEDCPOINTER()
Desktop, WebAssembly and Mobile Development, 379	Extension, 1348
Using QSlider	Using RingOpenGL and RingAllegro for 3D Graphics
Desktop, WebAssembly and Mobile Development, 372	3D Cube and Texture, 755
	Introduction, 754
	Many Cubes, 759
	More 3D Samples, 775
	TicTacToe 3D Game, 765
	Using RingOpenGL and RingFreeGLUT for 3D Graphics
	Drawing using RingOpenGL, 708
	Frames Per Second, 741
	Introduction, 705

- Keyboard Events and Colors, 713
- Make a Cube using RingOpenGL and RingFreeGLUT, 751
- Menu Events, 726
- Mouse Events, 723
- Samples SourceAuthors, 706
- The Camera, 716
- The First Triangle, 709
- The First Window using RingFreeGLUT, 707
- Triangle Rotation, 712
- Using Fonts, 734
- What is RingFreeGLUT?, 707
- What is RingOpenGL?, 706
- Window Resize Event, 710
- Using RingRayLib
 - 3D Camera, 656
 - 3D Camera Free, 657
 - 3D Picking, 664
 - Basic Shapes, 670
 - Basic Window, 653
 - Bezier Lines, 673
 - Camera First Person, 662
 - Collision Area, 675
 - Colors Palette, 679
 - Cubic Map, 694
 - Draw Ring, 671
 - Following Eyes, 677
 - Full Screen, 666
 - Functions, 696
 - Geometric Shapes, 692
 - Image Drawing, 686
 - Image Generation, 688
 - Input Keys, 654
 - Input Mouse, 655
 - Input Multi-touch, 660
 - Introduction, 653
 - Mouse Wheel, 659
 - Music Playing, 683
 - Rectangle Scaling, 681
 - Sound Loading, 685
 - Texture Source, 690
 - Two Cubes, 667
- Using RingZip Classes
 - RingZip, 860
- Using Self.Attribute
 - Object Oriented Programming, 204
- Using Self.Attribute in the Class Region to define new attributes
 - What is new in Ring 1.1?, 1396
- Using Semi-colon after and between statements
 - Syntax Flexibility, 281
- Using String2Constant
 - Multi-language applications, 513
- Using Sublime Text 2
- Using Other Code Editors, 1589
- Using Tab instead of char(9)
 - What is new in Ring 1.6?, 1485
- Using the ! operator as not
 - What is new in Ring 1.6?, 1485
- Using the 'else' keyword as 'other' in switch statement
 - Syntax Flexibility, 283
- Using the 'elseif' keyword as 'but' in if statement
 - Syntax Flexibility, 282
- Using the 'end' keyword in different control structures
 - Syntax Flexibility, 283
- Using the Interactive Debugger
 - The Trace Library and the Interactive Debugger, 294
- Using the Natural Library
 - Defining Commands, 251
 - Defining commands using classes, 254
 - Introduction, 248
 - Natural Library - Demo Program, 249
 - Operators, 254
- Using the QColorDialog Class
 - Desktop, WebAssembly and Mobile Development, 403
- Using the QFileDialog Class
 - Desktop, WebAssembly and Mobile Development, 395
- Using the QListWidget Class
 - Desktop, WebAssembly and Mobile Development, 354
- Using the QTextEdit Class
 - Desktop, WebAssembly and Mobile Development, 353
- Using the QTimer Class
 - Desktop, WebAssembly and Mobile Development, 392
- Using the tool
 - Code Generator, 1353
- Using This in the class region as Self
 - Object Oriented Programming, 206
 - What is new in Ring 1.8?, 1501
- Using This.Attribute and This.Method()
 - Object Oriented Programming, 205
- Using This.Attribute in nested Braces inside the Class Methods
 - What is new in Ring 1.1?, 1397
- Using Types inside Code
 - The Type Hints Library, 290
- Using Visual Studio IDE
 - Using Other Code Editors, 1590
- Using ZeroLib
 - Introduction, 826
 - Source Code, 828
 - Z() function, 826
 - ZeroBasedList Class, 826
 - ZeroBasedString Class, 827

value()	WebLib API, 574
Stdlib Functions, 305	WebPage Class, 579
Variables	Web Library Features
Deep Copy, 52	Web DevelopmentCGI Library, 527
Dynamic Typing, 52	WebAssembly and Mobile Development
Implicit Conversion, 53	Introduction, 349
Introduction, 51	WebLib API
Variables Scope	Web DevelopmentCGI Library, 574
Functions - First Style, 77	WebPage Class
Functions - Second Style, 81	Web DevelopmentCGI Library, 579
Functions - Third Style, 85	Weight History Application
varptr()	Desktop, WebAssembly and Mobile Development, 424
Low Level Functions, 1289	What about Data Representation in Ring?
Version() Function	Frequently Asked Questions, 1595
System Functions, 146	What about Memory Management in Ring?
Video-Music-Player Application	Frequently Asked Questions, 1594
Applications developed in a few hours, 9	What about predefined parameters or optional parameters in functions?
What is new in Ring 1.5?, 1431	Frequently Asked Questions, 1612
Virtual Machine Instructions	What about the Boolean values in Ring?
Language Specification, 1655	Frequently Asked Questions, 1603
Visual Implementation	What are the advantages of using Ring over native C or C++?
Language Design, 1384	Frequently Asked Questions, 1598
Visual Studio Code	What are the advantages to using Ring over C# or Java?
Using Other Code Editors, 1591	Frequently Asked Questions, 1600
Web DevelopmentCGI Library	What are the advantages to using Ring over Lisp or Smalltalk?
Application Class, 575	Frequently Asked Questions, 1598
Configure the Apache web server, 525	What are the advantages to using Ring over Python and Ruby?
Cookies, 537	Frequently Asked Questions, 1600
CRUD Example using MVC, 560	What are the advantages to using Ring over Tcl and Lua?
Database, ModelBase & ControllerBase classes, 569	Frequently Asked Questions, 1600
Generating Pages using Objects, 550	What happens when we create a new object?
Gradient, 549	Frequently Asked Questions, 1607
Hash Functions, 543	What is new in Ring 1.10?
Hello World Program using the Web Library, 526	Better Tests, 1536
HTML Lists, 546	Chess Game, 1528
HTML Special Characters, 542	Game of Life Game, 1531
HTML Tables, 548	Introduction, 1527
HtmlPage Class, 555, 580	Knight Tour Game, 1530
HTTP Get Example, 527	List of changes and new features, 1528
HTTP POST Example, 532	Minesweeper Game, 1529
Introduction, 524	More Games, 1534
Page Class, 576	More Improvements, 1537
Random Image, 545	Pong Game, 1532
Ring CGI Hello World Program, 526	Ring Extension for Visual Studio Code, 1535
ScriptFunctions Class, 578	Snakes And Ladder Game, 1533
StyleFunctions Class, 578	The Ring Package ManagerRingPM, 1536
Templates, 540	What is new in Ring 1.11?
Upload Files, 534	Better Documentation, 1553
URL Encode, 539	Better Performance, 1553
Users registration and Login, 562	
Using Bootstrap Library using Functions, 556	
Using Bootstrap Library using Objects, 557	
Web Library Features, 527	

- Better RingQt, [1551](#)
- Checkers Game, [1540](#)
- Desktop Screen Shot Application, [1545](#)
- Introduction, [1538](#)
- List of changes and new features, [1539](#)
- Maze Game, [1542](#)
- More 3D Samples, [1539](#)
- More Improvements, [1553](#)
- RingRayLib Extension, [1546](#)
- Snake Game, [1543](#)
- Sokoban Game, [1541](#)
- StdLib - More Functions, [1550](#)
- Sudoku Game, [1544](#)
- Text To Speech Application, [1546](#)
- ZeroLib Library, [1549](#)
- What is new in Ring 1.12?
 - ASCII Table application, [1556](#)
 - Better RingRayLib, [1562](#)
 - BMI Calculator application, [1556](#)
 - Calendar application, [1557](#)
 - Generate Embedded Object File, [1562](#)
 - Go Game, [1555](#)
 - Introduction, [1554](#)
 - Julian Day Calendar application, [1558](#)
 - List of changes and new features, [1555](#)
 - Load Again Command, [1560](#)
 - More Improvements, [1563](#)
 - `ring_state_filetokens()` function, [1561](#)
 - Tutorial: Number to Words, [1559](#)
- What is new in Ring 1.13?
 - Better Organization, [1582](#)
 - Better RingQt, [1577](#)
 - Better RingRayLib, [1580](#)
 - Better Threads Support, [1568](#)
 - Escape Game, [1575](#)
 - Hassouna Course Samples, [1576](#)
 - Introduction, [1565](#)
 - Laser Game, [1568](#)
 - List of changes and new features, [1566](#)
 - Magic Balls Game, [1569](#)
 - Matching Game, [1571](#)
 - MoneyBoxes Game, [1570](#)
 - More Improvements, [1582](#)
 - More Low Level Functions, [1581](#)
 - New Book by Apress, [1566](#)
 - Pairs Game, [1572](#)
 - Ring for WebAssembly, [1567](#)
 - Ring support in SpaceVim, [1577](#)
 - RingStbImage Extension, [1581](#)
 - Tetris Game, [1574](#)
 - Word Game, [1573](#)
- What is new in Ring 1.1?
 - Better Code Generator for Extensions, [1396](#)
 - Better Documentation, [1397](#)
- Better Natural Language Programming Support, [1388](#)
- Game Engine for 2D Games, [1394](#)
- Generate/Execute Ring Object Files*.ringo, [1389](#)
- Introduction, [1387](#)
- List of changes and new features, [1388](#)
- New Functions and Changes, [1391](#)
- RingLibSDL, [1394](#)
- RingSQLite, [1395](#)
- StdLib functions and classes written in Ring, [1392](#)
- Syntax Flexibility, [1389](#)
- Using `Self.Attribute` in the Class Region to define new attributes, [1396](#)
- Using `This.Attribute` in nested Braces inside the Class Methods, [1397](#)
- What is new in Ring 1.2?
 - Better Call Command, [1402](#)
 - Better Functions, [1399](#)
 - Better Quality, [1403](#)
 - Better Ring Notepad, [1399](#)
 - Better RingQt, [1400](#)
 - Display Warnings Option, [1402](#)
 - Introduction, [1397](#)
 - List of changes and new features, [1398](#)
 - New Functions, [1398](#)
 - Objects Library for RingQt, [1400](#)
 - RingLibCurl, [1401](#)
 - Using `NULL` instead of `NULLPointer()`, [1402](#)
- What is new in Ring 1.3?
 - Better Loop|Exit Command, [1412](#)
 - Better Ring Notepad, [1408](#)
 - Better RingQt, [1404](#)
 - Better StdLib, [1412](#)
 - Embedding Ring in Ring without sharing the State, [1414](#)
 - Form Designer, [1416](#)
 - Introduction, [1403](#)
 - List of changes and new features, [1404](#)
 - New Functions, [1413](#)
 - Return Self by Reference, [1413](#)
 - Ring mode for Emacs Editor, [1411](#)
 - RingZip Library, [1415](#)
 - Using '`<`' and '`:`' operators as 'from' keyword, [1414](#)
- What is new in Ring 1.4.1?
 - What is new in Ring 1.4?, [1427](#)
- What is new in Ring 1.4?
 - Better RingQt, [1426](#)
 - Better StdLib, [1424](#)
 - Better WebLib, [1424](#)
 - Change: Basic Extensions are separated from RingVM, [1418](#)
 - Convert between Numbers and Bytes, [1423](#)
 - Introduction, [1417](#)
 - List of changes and new features, [1418](#)

- New Style to Ring Notepad, [1421](#)
- Qt Class Convertor, [1426](#)
- RingREPL, [1422](#)
- The Natural Library, [1419](#)
- What is new in Ring 1.4.1?, [1427](#)
- What is new in Ring 1.5.1?
 - What is new in Ring 1.5?, [1466](#)
- What is new in Ring 1.5.2?
 - What is new in Ring 1.5?, [1470](#)
- What is new in Ring 1.5.3?
 - What is new in Ring 1.5?, [1471](#)
- What is new in Ring 1.5.4?
 - What is new in Ring 1.5?, [1475](#)
- What is new in Ring 1.5?
 - Better Code Generator for Extensions, [1456](#)
 - Better Documentation Generator for Extensions, [1457](#)
 - Better Objects Library, [1443](#)
 - Better Quality, [1466](#)
 - Better Ring Notepad, [1434](#)
 - Better RingQt, [1441](#)
 - Better StdLib, [1437](#)
 - Better WebLib, [1438](#)
 - Calculator Application, [1433](#)
 - Introduction, [1430](#)
 - List of changes and new features, [1431](#)
 - More Syntax Flexibility, [1463](#)
 - Ring VM - Tracing Functions, [1457](#)
 - RingFreeGLUT Extension, [1444](#)
 - RingOpenGL Extension, [1453](#)
 - Trace Library and Interactive Debugger, [1461](#)
 - Type Hints Library, [1464](#)
 - Video-Music-Player Application, [1431](#)
 - What is new in Ring 1.5.1?, [1466](#)
 - What is new in Ring 1.5.2?, [1470](#)
 - What is new in Ring 1.5.3?, [1471](#)
 - What is new in Ring 1.5.4?, [1475](#)
 - Windows StartUp Manager Application, [1432](#)
- What is new in Ring 1.6?
 - Better Ring For Android, [1478](#)
 - Better Ring Notepad, [1481](#)
 - Better RingQt, [1483](#)
 - Better RingREPL, [1484](#)
 - Better RingVM, [1484](#)
 - Better Scripts for building Ring, [1480](#)
 - Better StdLib, [1484](#)
 - Employee Application, [1477](#)
 - Introduction, [1476](#)
 - List of changes and new features, [1477](#)
 - New Tool: Folder2qrc, [1479](#)
 - New Tool: Ring2EXE, [1478](#)
 - RingConsoleColors Extension, [1480](#)
 - RingMurmurHash Extension, [1480](#)
 - Using ? to print expression then new line, [1487](#)
- Using && and || operators, [1486](#)
- Using CR as Carriage return, [1485](#)
- Using Tab instead of char(9), [1485](#)
- Using the ! operator as not, [1485](#)
- What is new in Ring 1.7?
 - Better Documentation, [1492](#)
 - Better Ring Notepad, [1491](#)
 - Better Ring VM, [1492](#)
 - Better Ring2EXE, [1492](#)
 - Better RingQt, [1491](#)
 - Better RingZip, [1492](#)
 - Better Trace Library, [1490](#)
 - Introduction, [1487](#)
 - List of changes and new features, [1488](#)
 - New Command: Load Package, [1488](#)
 - ring_state_new() and ring_state_mainfile() functions, [1490](#)
 - RingLibuv Extension, [1493](#)
 - ringvm_see() and ringvm_give() functions, [1489](#)
- What is new in Ring 1.8?
 - Better Cards Game, [1506](#)
 - Better Code Generator For Extensions, [1507](#)
 - Better Form Designer, [1505](#)
 - Better Performance, [1496](#)
 - Better Ring Compiler and VM, [1507](#)
 - Better RingQt, [1506](#)
 - Compiling on Manjaro Linux, [1501](#)
 - Default value for object attributes is NULL, [1502](#)
 - Find in files Application, [1497](#)
 - FoxRing Library, [1505](#)
 - Introduction, [1495](#)
 - List of changes and new features, [1496](#)
 - Merge binary characters, [1504](#)
 - More 3D Samples, [1499](#)
 - Notes to extensions creators, [1509](#)
 - StopWatch Application, [1498](#)
 - String2Constant Application, [1497](#)
 - The For Loops uses the local scope, [1503](#)
 - Using This in the class region as Self, [1501](#)
- What is new in Ring 1.9?
 - Better Code Generator for Extensions, [1525](#)
 - Better Memory Management, [1524](#)
 - Better Ring Notepad, [1515](#)
 - Better RingQt, [1521](#)
 - Better StdLib, [1516](#)
 - BigNumber Library, [1517](#)
 - Deploying Web applications in the Cloud, [1520](#)
 - Introduction, [1509](#)
 - List of changes and new features, [1510](#)
 - More Games, [1512](#)
 - More Improvements, [1526](#)
 - New Game : Gold Magic 800, [1510](#)
 - RingPostgreSQL Extension, [1518](#)
- What is RingFreeGLUT?

Using RingOpenGL and RingFreeGLUT for 3D Graphics, 707	Why you can specify the number of loops you want to break out of?
What is RingOpenGL?	Frequently Asked Questions, 1601
Using RingOpenGL and RingFreeGLUT for 3D Graphics, 706	Window Flags
What is the difference between Ring and Python? And is Ring Open Source?	Form Designer, 465
Frequently Asked Questions, 1599	Window Resize Event
What is the Ring Architecture?	Using RingOpenGL and RingFreeGLUT for 3D Graphics, 710
Frequently Asked Questions, 1594	Windows StartUp Manager Application
What will you learn?	What is new in Ring 1.5?, 1432
The Gold Magic 800 Game, 778	Windowsnsl() Function
Where can I write a program and execute it?	System Functions, 143
Frequently Asked Questions, 1611	Word Game
Which of 3 coding styles are commonly used or recommended by the community?	What is new in Ring 1.13?, 1573
Frequently Asked Questions, 1629	Wrap structures
While Loop	Code Generator, 1355
Control Structures - First Style, 58	Wrapping C++ Classes
Control Structures - Third Style, 69	Code Generator, 1361
Why do we need Yet Another Programming Language (YAPL)?	Write file using Write()
Frequently Asked Questions, 1593	Files, 130
Why I get a strange result when printing nl with lists?	Writing Comments
Frequently Asked Questions, 1613	Getting Started - First Style, 45
Why I get Calling Function without definition Error?	Getting Started - Second Style, 47
Frequently Asked Questions, 1624	Getting Started - Third Style, 51
Why is Ring largely focussed on UI creation?	Z() function
Frequently Asked Questions, 1598	Using ZeroLib, 826
Why is Ring weakly typed?	ZeroBasedList Class
Frequently Asked Questions, 1597	Using ZeroLib, 826
Why Ring is not case-sensitive	ZeroBasedString Class
Frequently Asked Questions, 1605	Using ZeroLib, 827
Why Ring uses 'See', 'Give', 'But' and 'Ok' Keywords?	ZeroLib Library
Frequently Asked Questions, 1602	What is new in Ring 1.11?, 1549
Why Ring?	Zip Class Reference
Language Design, 1377	RingZip, 862
Why setClickEvent() doesn't see the object methods directly?	ZipEntry Class Reference
Frequently Asked Questions, 1624	RingZip, 862
Why the ability to define your own languages Instead of just handing over the syntax so you can parse it using whatever code you like?	
Frequently Asked Questions, 1601	
Why the Assignment operator uses Deep copy?	
Frequently Asked Questions, 1606	
Why the window title bar is going outside the screen?	
Frequently Asked Questions, 1618	
Why this example use the GetChar() twice?	
Frequently Asked Questions, 1615	
Why Type Hints?	
The Type Hints Library, 289	
Why we don't use () after the QApp class name?	
Frequently Asked Questions, 1618	