

# Cygni Primer

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# Chapter 1

## Introduction

### 1.1 What is Cygni

Cygni is a scripting language, implemented in C#.

It supports both procedure-oriented and object-oriented programming.

Cygni is inspired by some scripting language, such as Python, Lua, etc.

If you have any questions, please feel free to discuss with me. My github:  
<https://github.com/JasonHe0727>



# Chapter 2

## Core Cygni

Ok, if you have some programming experience before, I think maybe you don't have to go through all of the contents. Some small examples may be more helpful. Let's begin.

### 2.1 Your First Cygni Program

Here is a simple script which writes message to the screen.

#### 2.1.1 The Code

```
print("Hello Cygni!")
```

#### 2.1.2 Running the Program

Input the previous code in the interpreter, then you will see the input "Hello Cygni!" in the screen.

### 2.2 Variables

The variables in Cygni are dynamic, which means they can be any type, such as number, boolean, string, etc.

You declare variables in Cygni by simply assigning values to them:

```
a = 12  
b = true
```

You may assign one value to several variables:

```
a = b = 89.32
```

Name	CTS Type	Description	Range(Approximate)
number	System.Double	64-bit, double precision floating point	$\pm 4.9 \times 10^{-324} \sim 1.7 \times 10^{308}$
boolean	System.Boolean	Represents true or false	true or false
string	System.String	Unicode character string	

Table 2.1: Predefined Types

## 2.3 Variable Scope

The scope of a variable is the region of code from which variable can be accessed. In Cygni, the scope is determined by the following rules:

- A class, which contains fields, has its own scope.
- A function, which contains local variables, has its own scope.
- If a variable is defined in the program, but not defined in a class or a scope, then it is a global variable, which stays in the global scope.
- Built-in variables are in the built-in scope, which is immutable in the runtime.

The rule of finding variables is: local -> field -> global -> built-in

## 2.4 Types

See table 2.4.

### 2.4.1 The number type

The number type is actually the double type in C#.

### 2.4.2 The boolean type

The boolean type can only be true or false.

### 2.4.3 The string type

Literals of the string type should be enclosed by " or """. Backslashes represents escape sequence. If you write symbol @ at the beginning of the sentence, the backslashes will lose its meaning.



```
s1 = "a string"
s2 = 'another string'
s3 = '@'c:\test.txt'
# If literals start with @,
# the backslashes will lose its meaning
s4 = 'c:\\test.txt' # The 's4' equals to 's3';
```

## 2.5 Flow Control

### 2.5.1 Conditional Statement: The if Statement

The syntax of 'if' statement is as followings:

```
if condition {
    # Do something
} else {
    # Do something
}
```

The final 'else' statement is not a must. If you have several branches, it is convenient to use 'elif' statement for represent them.

```
if condition {
    # Branch One
} elif {
    # Branch Two
} elif {
    # Branch Three
}
```

Here is an 'if' statement example:

```
if x > 10 {
    print('x is greater than 10')
} else {
    print('x is not greater than 10')
}
```

```
if y == 5 {
    print(5)
}
elif y == 10 {
    print(10)
```

```
}  
elif y == 20 {  
    print(20)  
}  
else {  
    print('y is not 5, 10 and 20.')}
```

### 2.5.2 Loops

#### The for loop

Cygni for loop provides a mechanism for iterating from a given start to a given end. The syntax is

```
for iterator = start , end {  
    # Do something  
}
```

The iterator will increase one in performing one iteration. If you want to define the step rather than one, you may use the following syntax:

```
for iterator = start , end , step {  
    # Do something  
}
```

If the step is negative, the negative step will be added to the iterator in every iteration. Note that the step can't be zero. Namely, the step is a non-zero integer. If the step is not an integer, it will be forced into an integer. Another important point is that you should not change the value of the iterator inside the loop.

#### The while loop

The syntax of while is

```
while condition {  
    # Do something  
}
```

Unlike the for loop, the while loop are able to repeat a block of statements for a number of times that is not known before the loop begins. The condition only takes a boolean value.

### The foreach loop

The foreach loop enables you to iterate through each item in a collection (If you don't know what is collection, don't worry. We will talk about it later). There are some built-in collections, such as lists, dictionaries, etc. The syntax is

```
foreach item in collection {  
    # Do something  
}
```

Note that you should not change value inside the loop.

### 2.5.3 Loop Examples

The followings are three examples using different statements to print 1 to 9 in the console.

```
for i = 0, 10 {  
    print(i)  
}
```

```
i = 0  
while i < 10 {  
    print(i)  
    i = i + 1  
}
```

```
foreach i in range(0,10) {  
    print(i)  
}
```

### 2.5.4 Jump Statements

There are three jump statement in Cygni: break, continue, and return. 'break' can jump out from the current loop, 'continue' can start a new round in the loop. 'return' is used to return value from a function.

#### The break Statement

If the break statement occurs in a loop, the current loop will stop.

### The continue Statement

The continue statement is similar to break. Nevertheless, the execution of the current loop will restart at the beginning of the next iteration of the loop, rather than stop.

### The return Statement

The return statement is used to exit a function, returning control to the caller of the function. If the function don't return value, you may just write 'return null' instead.

## 2.6 Console I/O

There are two functions used to read and write in the console in most of the cases: print and input.

```
print('Always nice to see you, Waston.')
```

## 2.7 Using Comments

The line comments start with symbol #.

```
# This is a line comment
```

## 2.8 Rules for Identifiers

Identifiers are the names you give to variables, functions, structs, classes, and so on. Identifiers are case sensitive. Here are the rules for identifiers you can use in Cygni:

- They can contain letter , underscore or numeric characters. However, they must begin with a letter or underscore.
- The Cygni keywords can't be used as identifiers.

The following list displays the Cygni reserved keywords.

- if
- else

- elif
- for
- while
- foreach
- in
- break
- continue
- return
- def
- class
- true
- false
- null



# Chapter 3

## Functions

### 3.1 Declaring Functions

In Cygni, the definition of a function consists of `def` keyword, followed by the function name, followed by a list of input arguments enclosed in parentheses, followed by the body of the function enclosed in curly braces:

```
def FunctionName([parameters]) {  
    # Function Body  
}
```

The function will return the last value of the function body without the `return` statement. Generally, it is better to write the `return` statement to make the code more readable. If you don't want to return any value, just write `"return null"`.

In Cygni, you can wrap C# methods as Cygni functions, which are called the native functions. The usage of native functions is the same as Cygni functions.

### 3.2 Invoking Functions

```
def square(x) {  
    return x * x  
}  
  
square(15)
```

### 3.3 Recursion

A classical example is the computation of factorial.

```
def fact(n) {
    if n == 0 {
        return 1
    } else {
        return n * fact(n - 1)
    }
}
fact(10)
```

### 3.4 Collection

#### 3.4.1 List

The syntax of initializing a list is the same as Python. You can put objects from various types into a list.

A list can be indexed by a non-negative integer. The index starts from zero.

```
list1 = [1, 2, 3, 4, 5]
list2 = [18, false, "Judy"]
list1[0] = 789
```

#### 3.4.2 HashTable

Using function 'hashtable' to initialize a hash table by key-value pairs. The key can only be integer, boolean and string. A hash table can be indexed by the key.

```
ht1 = hashtable("key1",123,"key2",789)
ht1["key1"]
```

### 3.5 Structure Array

The stucture array type is inspired by the Matlab/Octave. You can get element from a struct by the field or by the integer index.



```
s1 = struct("name", "Judy", "age", 16)
s1.name # The same as s1[0]
s1.age
```

## 3.6 Function

### 3.6.1 Cygni Function

Cygni function should be initialized by the 'def' statement. The function can be passed as a parameter.

```
def mul(x){
    return x * y
}

def mul2(f, x){
    return f(x, 2)
}
```

### 3.6.2 Native Function

Native function is imported from C#.

## 3.7 Class

Cygni class can be initialized by the 'class' statement. It supports inheritance. There are some built-in functions to be overridden as followings.

- `__INIT__`: Constructor for the class. The default constructor is a non-arg constructor.
- `__TOSTRING__`: Output the class instance as a string.
- `__ADD__`: override '+' operator.
- `__SUBTRACT__`: override '-' operator.
- `__MULTIPLY__`: override '\*' operator.
- `__DIVIDE__`: override '/' operator.
- `__MODULO__`: override '%' operator.

- `__POWER__`: override `^` operator.
- `__COMPARETO__`: return a integer to indicate the comparision result. This function will override the `'<'`, `'>'`, `'<='`, `'>='` operators.
- `__INDEXER__`: This function takes a list as indexes, and return an element.

### 3.8 User Data

User data is a wrapper for the C# data type.

# Chapter 4

## Structures

The structure is a container, used to organize simple data. The syntax is

```
struct('field1', value1, 'field2', value2, ...)
```

The struct can be initialized by "struct" function. The arguments must be in pairs, and each pair consists of a field and a value. Note that the field must be string.

Here is an example:

```
Susan = struct('name', 'Susan', 'age', 31)
=> struct: {
            name: "Susan"
            age: 31
        }
Susan.name
Susan.age
```

The function can return a struct, namely, you can use it as a structure constructor.

```
def complex(real, imaginary) {
    return struct('real', real,
                  'imaginary', imaginary)
}
a = complex(10, 20)
```

Here are some suggestions. Generally, structures perform better if the number of fields is fairly small, and they have difficult in containing complicated logical. They are suitable for simple data organization. If the logical of the data is more complicated, there exist some better choices, such as classes.

## 4.1 Arithmetic Operators

Cygni supports the following arithmetic operators:

- Add: +
- Subtract: -
- Multiply: \*
- Divide: /
- Modulo: %
- Power: ^
- Unary Plus: +
- Unary Minus: -

```
a = 10  
b = 99.2  
a + b  
=> 109.2
```

## 4.2 Logical Operators

Cygni supports the following logical operators:

- and
- or
- not

```
a and b  
=> False
```

## 4.3 Relation Operators

The following relation operators will return a boolean value:

- `'<'`
- `'>'`
- `'<='`
- `'>='`
- `'=='`
- `'!='`



# Chapter 5

## Classes

The data and functions within a class are known as the class's members. The following example displays

### 5.1 Data Members

Data members are those members that contain data for the class.

### 5.2 Function Members

Functions members are functions defined within the class. The 'function members' includes not only functions, but also constructors, operators, indexers, etc. An example is as followings:

```
class position{
    def __INIT__(nx, ny){
        this.x = nx
        this.y = ny
    }

    def move(nx, ny){
        this.x = nx
        this.y = ny
    }

    def __TOSTRING__(){
        printf("{0}, {1})", this.x, this.y)
    }
}
```

```

}
p1 = position(10,20)
print(p1)
p1.move(35, 47)
print(p1)

```

### 5.2.1 Constructors

The default constructor is a non-arg function, which will only initialize the already-exist fields. You can overload the constructor by writing a function which is named as "`__INIT__`".

```

class MyClass {
    def __INIT__([arguments]) {
        # initialzze the class
    }
}

```

In the example "position", the constructor of class "position" initialize two fields "x" and "y".

### 5.2.2 Implementation Inheritance

If you want to declare that a class derives from another class, use the following syntax:

```

class myDerivedClass: myBaseClass {
    # functions and data members here
}

```

The Cygni class does not support multiple inheritance. Namely, a class can only inherit from one class.

### 5.2.3 Hiding Function Members

If a function with the same name is declared in both base and derived classes, the function in the derived class will hide the one in the base class.

### 5.2.4 Calling Base Versions of Functions

If you want to call functions in the base class, you can use "base"



# Chapter 6

## Built-in Commands

6.1 dofile

6.2 import

6.3 loaddll

6.4 scope

6.5 delete



# Chapter 7

## Lists and Dictionaries

### 7.1 Lists

#### 7.1.1 List Initialization

A List is declared by using the following syntax:

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

Once you append elements to the last of the list, the length of the list will increase. To know how many elements in the specific list, you can use function "len":

```
len(myList)
```

Or use the field "count":

```
myList.count
```

#### 7.1.2 Accessing List Elements

After a list is initialized, you can access the list elements using an indexer. Lists only support integer index. The index starts from zero.

The lists are able to contain values from various types.

```
myList = [123, 'apple', false]
v1 = myList[0] # read first element
v2 = myList[1] # read second element
```

Generally, there are two ways to access every element in a list.

```
for i = 0, myList.count {
    print(i)
```

```
}  
  
foreach i in myList {  
    print(i)  
}
```

## 7.2 Dictionaries

### 7.2.1 Dictionary Initialization

A Dictionary is declared by using the following syntax:

```
myDictionary = { }
```

Once you add key-value pairs to the dictionary, the length of the dictionary will increase. To know how many key-value pairs in the specific dictionary, you can use function "len":

```
len(myDictionary)
```

Or use the field "count":

```
myDictionary.count
```

### 7.2.2 Accessing Dictionary Elements

After a Dictionary is initialized, you can access the Dictionary elements using an indexer. The type of key of Dictionaries only support integer, boolean, string. There is no limit for the types of the values of dictionaries.

```
myDictionary = { 'name', 'Sam', 'age', 37 }  
myDictionary[ 'name' ]  
myDictionary[ 'age' ]
```

You can go through every key-value pair in a dictionary by using "foreach" loop. Every key-value pair is returned as a list. The first in the list is the key, and another is the value.

```
foreach i in myDictionary {  
    print(i)  
}
```

# Chapter 8

## Operators

Cygni supports the operators listed in the following table:  
See table 8.

### 8.1 Operator Overloading

TO DO:

Category	Operator
Arithmetic	<code>+</code> , <code>-</code> , <code>*</code> , <code>/</code> , <code>%</code>
Logical	<code>and</code> , <code>or</code> , <code>not</code>
Comparison	<code>&lt;</code> , <code>&lt;=</code> , <code>&gt;</code> , <code>&gt;=</code> , <code>==</code> , <code>!=</code>
Assignment	<code>=</code>
Member access	<code>.</code>
Indexing	<code>[]</code>

Table 8.1: Operators



# Chapter 9

## Strings

