Week 11 Lecture Notes: Characters, C-Strings, Objectives

Concepts covered in this lesson:

- Character Testing
- Character Case Conversion
- Review of the Internal Storage of C-Strings
- Library Functions for Working with C-Strings
- String/Numeric Conversion Functions
- Writing Your Own C-String-Handling Functions
- The C++ string Class

Character Testing

- Requires `cctype` header file

FUNCTION	MEANING
`isalpha`	`true` if arg. is a letter, `false` otherwise
`isalnum`	`true` if arg. is a letter or digit, `false` otherwise
`isdigit`	`true` if arg. is a digit 0-9, `false` otherwise
`islower`	`true` if arg. is lowercase letter, `false` otherwise
`isprint`	`true` if arg. is a printable character, `false` otherwise
`ispunct`	`true` if arg. is a punctuation character, `false` otherwise
`isupper`	`true` if arg. is an uppercase letter, `false` otherwise
`isspace`	`true` if arg. is a whitespace character, `false` otherwise

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<global> main() : int

Management

Projects

Workspace

Start here | Pr10-1.cpp

```
1  // This program demonstrates some character testing functions.
2  #include <iostream>
3  #include <cctype>
4  using namespace std;
5
6  int main()
7  {
8     char input;
9
10    cout << "Enter any character: ";
11    cin.get(input);
12    cout << "The character you entered is: " << input << endl;
13    if (isalpha(input))
14       cout << "That's an alphabetic character.\n";
15    if (isdigit(input))
16       cout << "That's a numeric digit.\n";
17    if (islower(input))
18       cout << "The letter you entered is lowercase.\n";
19    if (isupper(input))
20       cout << "The letter you entered is uppercase.\n";
21    if (isspace(input))
22       cout << "That's a whitespace character.\n";
23    return 0;
24 }
```

"F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 1...

```
Enter any character: a
The character you entered is: a
That's an alphabetic character.
The letter you entered is lowercase.

Process returned 0 (0x0)   execution time : 9.667 s
Press any key to continue.
```

Logs & others

Code::Blocks | Search results | Cccc | Build log | CppCheck/Vera++ | CppCheck/Vera++ messages | Cscope | Debugger | DoxyBlocks | Fortran info | Closed files list | Thread search

```
Executing: '"C:\Program Files\CodeBlocks/cb_console_runner.exe" "F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 10\Pr10-1.exe"' (in 'F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 10')
Set variable: PATH=C:\Program Files\CodeBlocks\MinGW\bin;C:\Program Files\CodeBlocks\MinGW;C:\Program Files (x86)\Common Files\Oracle\Java\javapath;C:\ProgramData\Oracle\Java\javapath;c:\Program Files (x86)\Intel\iCLS Client;c:\Program Files\Intel\iCLS Client;C:\WINDOWS\System32;C:\WINDOWS;C:\WINDOWS\System32\wbem;C:\WINDOWS\System32\WindowsPowerShell\v1.0;C:\Program Files\Intel\Intel(R) Management Engine Components\DAL;C:\Program Files\Intel\Intel(R) Management Engine Components\IPT;C:\Program Files (x86)\Intel\Intel(R) Management Engine Components\DAL;C:\Program Files (x86)\Intel\Intel(R) Management Engine Components\IPT;C:\Program Files (x86)\Common Files\Acronis\SnapAPI;C:\Program Files (x86)\Acronis\TrueImageHome;C:\Program Files\Microsoft SQL Server\110\Tools\Binn;C:\Program Files\Common Files\NeatReceipts\Drivers\M12;C:\Program Files (x86)\nodejs;C:\usr\bin;C:\Program Files\dotnet;C:\Program Files\Microsoft SQL Server\130\Tools\Binn;C:\Program Files\Common Files\Autodesk Shared\;C:\Program Files\PuTTY;C:\Program Files\Microsoft SQL Server\120\Tools\Binn;C:\Program Files\Java\jdk1.8.0_171\bin;C:\Users\garry\AppData\Roaming\npm
```

F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 10\Pr10-1.cpp | C/C++ | Windows (CR+LF) | WINDOWS-1252 | Line 21, Col 23, Pos 609 | Insert | Read/Write

Character Case Conversion

- Require `cctype` header file
- Functions:

  `toupper`: if `char` argument is lowercase letter, return uppercase equivalent; otherwise, return input unchanged

```
char ch1 = 'H';
char ch2 = 'e';
char ch3 = '!';
cout << toupper(ch1);  // displays 'H'
cout << toupper(ch2);  // displays 'E'
cout << toupper(ch3);  // displays '!'
```

Character Case Conversion

- Functions:

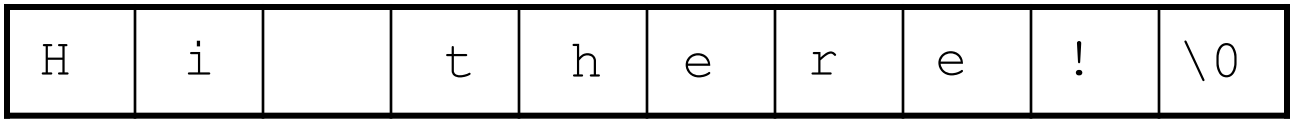
  `tolower`: if `char` argument is uppercase letter, return lowercase equivalent; otherwise, return input unchanged

```
char ch1 = 'H';
char ch2 = 'e';
char ch3 = '!';
cout << tolower(ch1);  // displays 'h'
cout << tolower(ch2);  // displays 'e'
cout << tolower(ch3);  // displays '!'
```

C-Strings

- C-string: sequence of characters stored in adjacent memory locations and terminated by `NULL` character
- String literal (string constant): sequence of characters enclosed in double quotes " " :

```
"Hi there!"
```



C-Strings

- Array of `char`s can be used to define storage for string:
```
const int SIZE = 20;
char city[SIZE];
```
- Leave room for `NULL` at end
- Can enter a value using `cin` or `>>`
  - Input is whitespace-terminated
  - No check to see if enough space
- For input containing whitespace, and to control amount of input, use `cin.getline()`

```
1  // This program displays a string stored in a char array.
2  #include <iostream>
3  using namespace std;
4
5  int main()
6  {
7     const int SIZE = 80;  // Array size
8     char line[SIZE];      // To hold a line of input
9     int count = 0;        // Loop counter variable
10
11    // Get a line of input.
12    cout << "Enter a sentence of no more than "
13         << (SIZE - 1) << " characters:\n";
14    cin.getline(line, SIZE);
15
16    // Display the input one character at a time.
17    cout << "The sentence you entered is:\n";
18    while (line[count] != '\0')
19    {
20       cout << line[count];
21       count++;
22    }
23    return 0;
24 }
```

```
"F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 1...
Enter a sentence of no more than 79 characters:
We are in week 11
The sentence you entered is:
We are in week 11
Process returned 0 (0x0)   execution time : 38.478 s
Press any key to continue.
```

```
Executing: '"C:\Program Files\CodeBlocks/cb_console_runner.exe" "F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 10\Pr10-5.exe"' (in 'F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExampl
10')
Set variable: PATH=C:\Program Files\CodeBlocks\MinGW\bin;C:\Program Files\CodeBlocks\MinGW;C:\Program Files (x86)\Common Files\Oracle\Java\javapath;C:\ProgramData\Oracle\Java\javapath;c:\Program Files (x86)\Intel\iCLS Client;c:\Program Files\In
Client;C:\WINDOWS\System32;C:\WINDOWS;C:\WINDOWS\System32\wbem;C:\WINDOWS\System32\WindowsPowerShell\v1.0;C:\Program Files\Intel\Intel(R) Management Engine Components\DAL;C:\Program Files\Intel\Intel(R) Management Engine Components\IPT;C:\Progr
(x86)\Intel\Intel(R) Management Engine Components\DAL;C:\Program Files (x86)\Intel\Intel(R) Management Engine Components\IPT;C:\Program Files (x86)\Common Files\Acronis\SnapAPI;C:\Program Files (x86)\Acronis\TrueImageHome;C:\Program Files\Micro
Server\110\Tools\Binn;C:\Program Files\Common Files\NeatReceipts\Drivers\M12;C:\Program Files (x86)\nodejs;C:\usr\bin;C:\Program Files\dotnet;C:\Program Files\Microsoft SQL Server\130\Tools\Binn;C:\Program Files\Common Files\Autodesk Shared;C:\
Files\PuTTY;C:\Program Files\Microsoft SQL Server\120\Tools\Binn;C:\Program Files\Java\jdk1.8.0_171\bin;C:\Users\garry\AppData\Roaming\npm
```

Library Functions for Working with C-Strings

- Require the `cstring` header file

- Functions take one or more C-strings as arguments. Can use:
  - C-string name
  - pointer to C-string
  - literal string

Library Functions for Working with C-Strings

Functions:

- `strlen(str)`: returns length of C-string `str`

```
char city[SIZE] = "Missoula";
cout << strlen(city); // prints 8
```

- `strcat(str1, str2)`: appends `str2` to the end of `str1`

```
char location[SIZE] = "Missoula, ";
char state[3] = "MT";
strcat(location, state);
// location now has "Missoula, MT"
```

Library Functions for Working with C-Strings

Functions:

- `strcpy(str1, str2)`: copies `str2` to `str1`

```
const int SIZE = 20;
char fname[SIZE] = "Maureen", name[SIZE];
strcpy(name, fname);
```

Note: `strcat` and `strcpy` perform no bounds checking to determine if there is enough space in receiving character array to hold the string it is being assigned.

C-string Inside a C-string

Function:

- `strstr(str1, str2)`: finds the first occurrence of `str2` in `str1`. Returns a pointer to match, or `NULL` if no match.

```
char river[] = "Wabash";
char word[] = "aba";
cout << strstr(state, word);
// displays "abash"
```

C-String/Numeric Conversion Functions

- Requires `<cstdlib>` header file

FUNCTION	PARAMETER	ACTION
`atoi`	C-string	converts C-string to an `int` value, returns the value
`atol`	C-string	converts C-string to a `long` value, returns the value
`atof`	C-string	converts C-string to a `double` value, returns the value
`itoa`	`int`, C-string, `int`	converts 1st `int` parameter to a C-string, stores it in 2nd parameter. 3rd parameter is base of converted value

C-String/Numeric Conversion Functions

```
int iNum;
long lNum;
double dNum;
char intChar[10];
iNum = atoi("1234"); // puts 1234 in iNum
lNum = atol("5678"); // puts 5678 in lNum
dNum = atof("35.7"); // puts 35.7 in dNum
itoa(iNum, intChar, 8); // puts the string
    // "2322" (base 8 for 1234_10) in intChar
```

C-String/Numeric Conversion Functions - Notes

- if C-string contains non-digits, results are undefined
  - function may return result up to non-digit
  - function may return 0

- `itoa` does no bounds checking – make sure there is enough space to store the result

`string` to Number Conversion

Table 10-5 string to Number Functions

Function	Description
stoi(string *str*)	Accepts a string argument and returns that argument's value converted to an int.
stol(string *str*)	Accepts a string argument and returns that argument's value converted to a long.
stoul(string *str*)	Accepts a string argument and returns that argument's value converted to an unsigned long.
stoll(string *str*)	Accepts a string argument and returns that argument's value converted to a long long.
stoull(string *str*)	Accepts a string argument and returns that argument's value converted to an unsigned long long.
stof(string *str*)	Accepts a string argument and returns that argument's value converted to a float.
stod(string *str*)	Accepts a string argument and returns that argument's value converted to a double.
stold(string *str*)	Accepts a string argument and returns that argument's value converted to a long double.

The to_string Function

Table 10-6 Overloaded Versions of the to_string Function

Function	Description
to_string(int *value*);	Accepts an int argument and returns that argument converted to a string object.
to_string(long *value*);	Accepts a long argument and returns that argument converted to a string object.
to_string(long long *value*);	Accepts a long long argument and returns that argument converted to a string object.
to_string(unsigned *value*);	Accepts an unsigned argument and returns that argument converted to a string object.
to_string(unsigned long *value*);	Accepts an unsigned long argument and returns that argument converted to a string object.
to_string(unsigned long long *value*);	Accepts an unsigned long long argument and returns that argument converted to a string object.
to_string(float *value*);	Accepts a float argument and returns that argument converted to a string object.
to_string(double *value*);	Accepts a double argument and returns that argument converted to a string object.
to_string(long double *value*);	Accepts a long double argument and returns that argument converted to a string object.

Writing Your Own C-String Handling Functions

- Designing C-String Handling Functions
  - can pass arrays or pointers to `char` arrays
  - Can perform bounds checking to ensure enough space for results
  - Can anticipate unexpected user input

Pr10-12.cpp - Code::Blocks 20.03

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<global>

Management

Projects

Workspace

Start here | Pr10-1.cpp | Pr10-5.cpp | Pr10-12.cpp

```
1  // This program uses a function to copy a C-string into an array.
2  #include <iostream>
3  using namespace std;
4
5  void stringCopy(char [], char []);  // Function prototype
6
7  int main()
8  {
9     const int LENGTH = 30;  // Size of the arrays
10    char first[LENGTH];     // To hold the user's input
11    char second[LENGTH];    // To hold the copy
12
13    // Get a string from the user and store in first.
14    cout << "Enter a string with no more than "
15         << (LENGTH - 1) << " characters:\n";
16    cin.getline(first, LENGTH);
17
18    // Copy the contents of first to second.
19    stringCopy(first, second);
20
21    // Display the copy.
22    cout << "The string you entered is:\n" << second << endl;
23    return 0;
24 }
25
26 //**********************************************************
27 // Definition of the stringCopy function.                  *
28 // This function copies the C-string in string1 to string2. *
29 //**********************************************************
30
31 void stringCopy(char string1[], char string2[])
32 {
33    int index = 0;  // Loop counter
34
35    // Step through string1, copying each element to
36    // string2. Stop when the null character is encountered.
37    while (string1[index] != '\0')
38    {
39       string2[index] = string1[index];
```

"F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 1...

```
Enter a string with no more than 29 characters:
How are you?
The string you entered is:
How are you?

Process returned 0 (0x0)   execution time : 16.378 s
Press any key to continue.
```

Logs & others

Code::Blocks | Search results | Cccc | Build log | CppCheck/Vera++ | CppCheck/Vera++ messages | Cscope | Debugger | DoxyBlocks | Fortran info | Closed files list | Thread search

```
Executing: '"C:\Program Files\CodeBlocks/cb_console_runner.exe" "F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 10\Pr10-12.exe"' (in 'F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 10')
Set variable: PATH=C:\Program Files\CodeBlocks\MinGW\bin;C:\Program Files\CodeBlocks\MinGW;C:\Program Files (x86)\Common Files\Oracle\Java\javapath;C:\ProgramData\Oracle\Java\javapath;c:\Program Files (x86)\Intel\iCLS Client;c:\Program Files\Intel\iCLS Client;C:\WINDOWS\System32;C:\WINDOWS;C:\WINDOWS\System32\wbem;C:\WINDOWS\System32\WindowsPowerShell\v1.0;C:\Program Files\Intel\Intel(R) Management Engine Components\DAL;C:\Program Files\Intel\Intel(R) Management Engine Components\IPT;C:\Program Files (x86)\Intel\Intel(R) Management Engine Components\DAL;C:\Program Files (x86)\Intel\Intel(R) Management Engine Components\IPT;C:\Program Files (x86)\Common Files\Acronis\SnapAPI;C:\Program Files (x86)\Acronis\TrueImageHome;C:\Program Files\Microsoft SQL Server\110\Tools\Binn;C:\Program Files\Common Files\NeatReceipts\Drivers\M12;C:\Program Files (x86)\nodejs;C:\usr\bin;C:\Program Files\dotnet;C:\Program Files\Microsoft SQL Server\130\Tools\Binn;C:\Program Files\Common Files\Autodesk Shared;C:\Program
```

The C++ `string` Class

- Special data type supports working with strings
- `#include <string>`
- Can define `string` variables in programs:

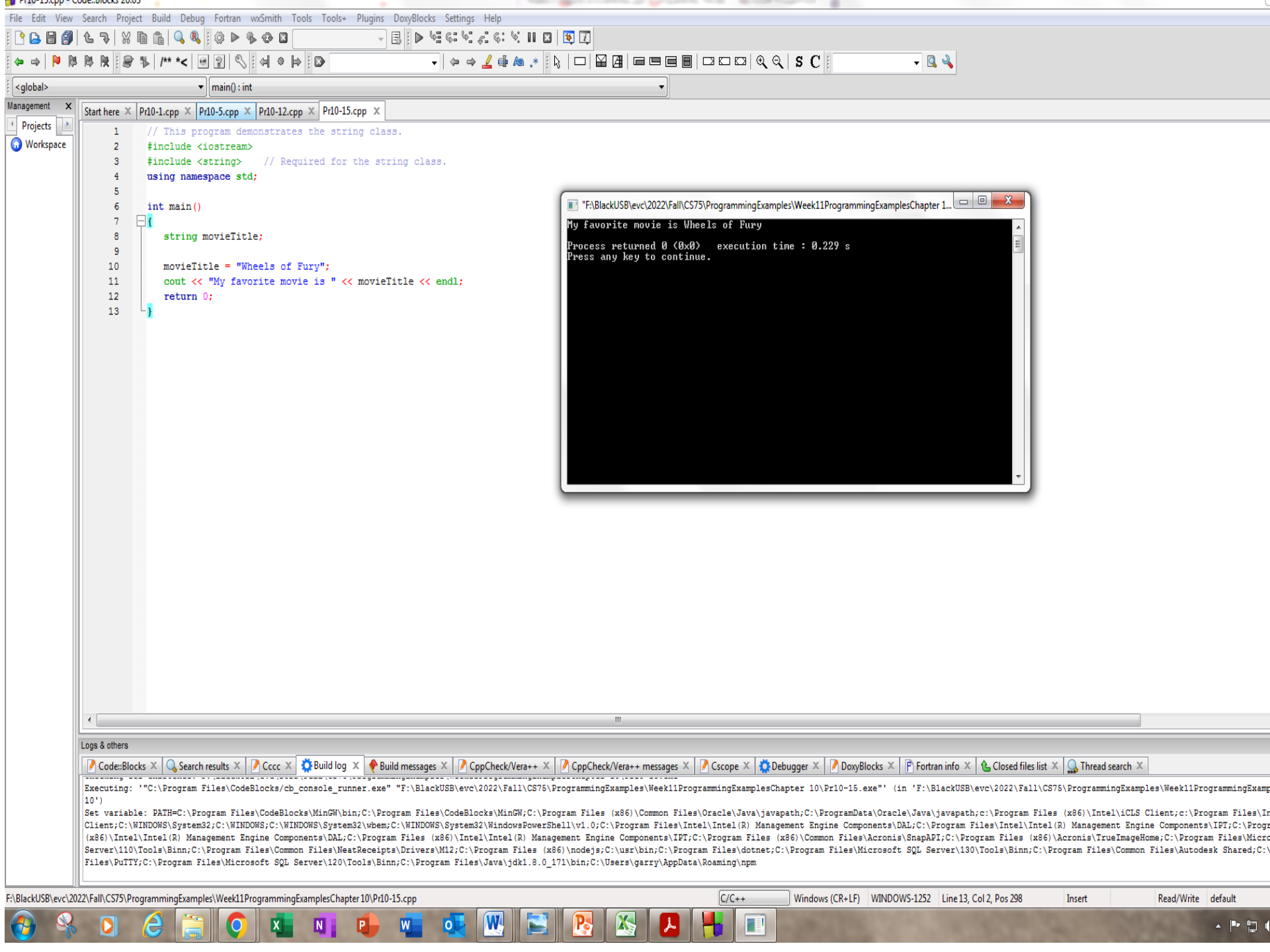
```
string firstName, lastName;
```

- Can receive values with assignment operator:

```
firstName = "George";
lastName = "Washington";
```

- Can be displayed via `cout`

```
cout << firstName << " " << lastName;
```


File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help
<global>
main() : int
Management
Projects
Workspace
Start here
Pr10-1.cpp
Pr10-5.cpp
Pr10-12.cpp
Pr10-15.cpp
1 // This program demonstrates the string class.
2 #include <iostream>
3 #include <string> // Required for the string class.
4 using namespace std;
5
6 int main()
7 {
8 string movieTitle;
9
10 movieTitle = "Wheels of Fury";
11 cout << "My favorite movie is " << movieTitle << endl;
12 return 0;
13 }
"F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 1...
My favorite movie is Wheels of Fury
Process returned 0 (0x0) execution time : 0.229 s
Press any key to continue.
Logs & others
Code::Blocks
Search results
Cccc
Build log
Build messages
CppCheck/Vera++
CppCheck/Vera++ messages
Cscope
Debugger
DoxyBlocks
Fortran info
Closed files list
Thread search
Executing: '"C:\Program Files\CodeBlocks/cb_console_runner.exe" "F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 10\Pr10-15.exe"' (in 'F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 10')
Set variable: PATH=C:\Program Files\CodeBlocks\MinGW\bin;C:\Program Files\CodeBlocks\MinGW;C:\Program Files (x86)\Common Files\Oracle\Java\javapath;C:\ProgramData\Oracle\Java\javapath;c:\Program Files (x86)\Intel\iCLS Client;c:\Program Files\Intel\iCLS Client;C:\WINDOWS\System32;C:\WINDOWS;C:\WINDOWS\System32\wbem;C:\WINDOWS\System32\WindowsPowerShell\v1.0;C:\Program Files\Intel\Intel(R) Management Engine Components\DAL;C:\Program Files\Intel\Intel(R) Management Engine Components\IPT;C:\Program Files (x86)\Intel\Intel(R) Management Engine Components\DAL;C:\Program Files (x86)\Intel\Intel(R) Management Engine Components\IPT;C:\Program Files (x86)\Common Files\Acronis\SnapAPI;C:\Program Files (x86)\Acronis\TrueImageHome;C:\Program Files\Microsoft SQL Server\110\Tools\Binn;C:\Program Files\Common Files\NeatReceipts\Drivers\M12;C:\Program Files (x86)\nodejs;C:\usr\bin;C:\Program Files\dotnet;C:\Program Files\Microsoft SQL Server\130\Tools\Binn;C:\Program Files\Common Files\Autodesk Shared;C:\Program Files\PuTTY;C:\Program Files\Microsoft SQL Server\120\Tools\Binn;C:\Program Files\Java\jdk1.8.0_171\bin;C:\Users\garry\AppData\Roaming\npm
F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 10\Pr10-15.cpp
C/C++
Windows (CR+LF)
WINDOWS-1252
Line 13, Col 2, Pos 298
Insert
Read/Write
default

Input into a `string` Object

- Use `cin >>` to read an item into a string:

```
string firstName;
cout << "Enter your first name: ";
cin >> firstName;
```

Using `cin` and `string` objects in program 10-16

Program 10-16

```
1  // This program demonstrates how cin can read a string into
2  // a string class object.
3  #include <iostream>
4  #include <string>
5  using namespace std;
6
7  int main()
8  {
9     string name;
10
11    cout << "What is your name? ";
12    cin >> name;
13    cout << "Good morning " << name << endl;
14    return 0;
15 }
```

Program Output with Example Input Shown in Bold

```
What is your name? Peggy [Enter]
Good morning Peggy
```

Input into a `string` Object

- Use `getline` function to put a line of input, possibly including spaces, into a string:

```
string address;
cout << "Enter your address: ";
getline(cin,address);
```

`string` Comparison

- Can use relational operators directly to compare string objects:

```
string str1 = "George",
       str2 = "Georgia";
if (str1 < str2)
  cout << str1 << " is less than "
       << str2;
```

- Comparison is performed similar to `strcmp` function. Result is `true` or `false`

Other Definitions of C++ `strings`

Definition	**Meaning**
`string name;`	defines an empty string object
`string myname("Chris");`	defines a string and initializes it
`string yourname(myname);`	defines a string and initializes it
`string aname(myname, 3);`	defines a string and initializes it with first 3 characters of `myname`
`string verb(myname,3,2);`	defines a string and initializes it with 2 characters from `myname` starting at position 3
`string noname('A', 5);`	defines string and initializes it to 5 `'A'`s

`string` Operators

OPERATOR	MEANING
`>>`	extracts characters from stream up to whitespace, insert into string
`<<`	inserts string into stream
`=`	assigns string on right to string object on left
`+=`	appends string on right to end of contents on left
`+`	concatenates two strings
`[]`	references character in string using array notation
`>, >=, <, <=, ==, !=`	relational operators for string comparison. Return `true` or `false`

`string` Operators

```
string word1, phrase;
string word2 = " Dog";
cin >> word1; // user enters "Hot Tamale"
              // word1 has "Hot"
phrase = word1 + word2; // phrase has
                        // "Hot Dog"
phrase += " on a bun";
for (int i = 0; i < 16; i++)
     cout << phrase[i]; // displays
                       // "Hot Dog on a bun"
```

`string` Member Functions

- Are behind many overloaded operators
- Categories:
  - assignment: `assign, copy, data`
  - modification: `append, clear, erase, insert, replace, swap`
  - space management: `capacity, empty, length, resize, size`
  - substrings: `find, front, back, at, substr`
  - comparison: `compare`
- See Table 10-8 for a list of functions.

`string` Member Functions

```
string word1, word2, phrase;
cin >> word1;              // word1 is "Hot"
word2.assign(" Dog");
phrase.append(word1);
phrase.append(word2);  // phrase has "Hot Dog"
phrase.append(" with mustard relish", 13);
          // phrase has "Hot Dog with mustard"
phrase.insert(8, "on a bun ");
cout << phrase << endl; // displays
          // "Hot Dog on a bun with mustard"
```

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<global>

Management

Projects

Workspace

Start here | Pr10-1.cpp | Pr10-5.cpp | Pr10-12.cpp | Pr10-15.cpp | Pr10-21.cpp

```
1  // This program demonstrates a string
2  // object's length member function.
3  #include <iostream>
4  #include <string>
5  using namespace std;
6
7  int main ()
8  {
9     string town;
10
11    cout << "Where do you live? ";
12    cin >> town;
13    cout << "Your town's name has " << town.length() ;
14    cout << " characters\n";
15    return 0;
16 }
```

"F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 1...

```
Where do you live? SanJose
Your town's name has 7 characters

Process returned 0 (0x0)   execution time : 7.617 s
Press any key to continue.
```

Logs & others

Code::Blocks | Search results | Cccc | Build log | Build messages | CppCheck/Vera++ | CppCheck/Vera++ messages | Cscope | Debugger | DoxyBlocks | Fortran info | Closed files list | Thread search

```
Executing: '"C:\Program Files\CodeBlocks/cb_console_runner.exe" "F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 10\Pr10-21.exe"' (in 'F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamples
10')
Set variable: PATH=C:\Program Files\CodeBlocks\MinGW\bin;C:\Program Files\CodeBlocks\MinGW;C:\Program Files (x86)\Common Files\Oracle\Java\javapath;C:\ProgramData\Oracle\Java\javapath;c:\Program Files (x86)\Intel\iCLS Client;c:\Program Files\Intel
Client;C:\WINDOWS\System32;C:\WINDOWS;C:\WINDOWS\System32\wbem;C:\WINDOWS\System32\WindowsPowerShell\v1.0;C:\Program Files\Intel\Intel(R) Management Engine Components\DAL;C:\Program Files\Intel\Intel(R) Management Engine Components\IPT;C:\Program
(x86)\Intel\Intel(R) Management Engine Components\DAL;C:\Program Files (x86)\Intel\Intel(R) Management Engine Components\IPT;C:\Program Files (x86)\Common Files\Acronis\SnapAPI;C:\Program Files (x86)\Acronis\TrueImageHome;C:\Program Files\Microsof
Server\110\Tools\Binn;C:\Program Files\Common Files\NeatReceipts\Drivers\M12;C:\Program Files (x86)\nodejs;C:\usr\bin;C:\Program Files\dotnet;C:\Program Files\Microsoft SQL Server\130\Tools\Binn;C:\Program Files\Common Files\Autodesk Shared;C:\Pro
Files\PuTTY;C:\Program Files\Microsoft SQL Server\120\Tools\Binn;C:\Program Files\Java\jdk1.8.0_171\bin;C:\Users\garry\AppData\Roaming\npm
```

F:\BlackUSB\evc\2022\Fall\CS75\ProgrammingExamples\Week11ProgrammingExamplesChapter 10\Pr10-21.cpp | C/C++ | Windows (CR+LF) | WINDOWS-1252 | Line 1, Col 1, Pos 0 | Insert | Read/Write | default