Part 10: Strings

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Lecture Notes for MAC 101 (Introduction to Computer Science)

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1. How C++ Stores Text?

All information in the computer is stored using 0s and 1s. Therefore all data is stored as a number. When it comes to text, each character is stored using the corresponding ASCII number. Each character gets one byte of memory space.

Question: How many different characters can be represented with one byte of memory space?

Example displaying the ASCII value of a char variable:

```
CharToASCII.cpp
#include <iostream>
#include <bitset>
#include <iomanip>
using namespace std;

int main()
{
        char c;

        cout << "Enter any character: ";
        cin >> c;
        cout << "The character you entered is: " << c << endl;
        cout << "Its ASCII code (decimal) is: " << (int)c << endl;
        bitset<8> x(c);
        cout << "Its ASCII code (binary) is: " << x << endl;
        cout << "Its ASCII code (hexadecimal) is: " << setw(2) << setfill('0') << hex << (int)c << endl;

        return 0;
}
```
```
Output

Enter any character: K
The character you entered is: K
Its ASCII code (decimal) is: 75
Its ASCII code (binary) is: 01001011
Its ASCII code (hexadecimal) is: 4b
```

Example displaying the char value of a ASCII integer variable:

```
ASCIIToChar.cpp
#include <iostream>
#include <bitset>
#include <iomanip>
using namespace std;

int main(){
    int ascii;

    cout << "Enter an integer between 0 and 255: ";
    cin >> ascii;
    cout << "The integer you entered is: " << ascii << endl;
    cout << "The ASCII character is: " << (char) ascii << endl;

    return 0;
}
```
```
Output

Enter an integer between 0 and 255:
75
The integer you entered is: 75
The corresponding ASCII character is:
K
```

Try now: Write a program that uses a for loop to print all the ASCII characters and their corresponding decimal values in tabular format. See the sample output for one of the characters below:

```
35      #
36      $
37      %
```

2. String Manipulation Functions?

C++ has a number of pre-defined functions that help the programmer manipulate arrays of characters or strings. The example below illustrates some of these functions.

StringFunctions.cpp	Output
| ```cpp
#include <iostream>
using namespace std;

int main()
{
    char s[80];
    strcpy(s, "One");
    strcat(s, "Two");
    strcat(s, "Three ");
    cout << "The string created is: " << s << endl;
    cout << "The length of the string is: " << strlen(s);

    return 0;
}
``` | The string created is: OneTwoThree
The length of the string is: 12 |

3. Reading String Input?

Here we explore how a user can input a string value to a C++ program.

StringInput1.cpp	Output
| ```cpp
#include <iostream>
using namespace std;

int main()
{
    char s[80];
    cout << "Enter string: ";
    cin >> s;
    cout << "The string entered is: " << s << endl;
    cout << "The length of the string is: " << strlen(s);

    return 0;
}
``` | Enter string: Hello Andi
The string entered is: Hello
The length of the string is: 5 |

Try now: Follow these steps:

a) Substitute the line `cin >> s;` with line `cin.getline(s,79);`

b) Run the program and input the string "Hello World". What is different from the original program?

c) Now input a long string of more than 80 characters. What do you notice? What is happening?

Another example: Converting all characters of a string to upper case.

UpperCase.cpp	Output
(see code below)	(see output below)

```cpp
#include <iostream>
#include <cstring>
#include <cctype>
using namespace std;

void convert_to_upper(char *s);

int main() {

    char s[100];
    cout << "Enter string to convert & press ENTER: ";
    cin.getline(s, 100);
    convert_to_upper(s);
    cout << "The converted string is:" << endl;
    cout << s << endl;

    return 0;
}

void convert_to_upper(char *s) {
    int length = strlen(s);
    for (int i = 0; i < length; i++)
        s[i] = toupper(s[i]);
}
```

```
Output

Enter string to convert & press
ENTER: Hello all
The converted string is:
HELLO ALL
```

Try now: Modify the program to convert all characters to lower case.

4. The string Class

The new <string> class makes it easier for the programmer to manipulate strings.

StringClassExample1.cpp	Output

```cpp
#include <iostream>
#include <string>
using namespace std;

int main() {

    string str, name, addr, work;

    // Get three strings from the user.
    cout << "Enter name and press ENTER: ";
    getline(cin, name);
    cout << "Enter address and press ENTER: ";
    getline(cin, addr);
    cout << "Enter workplace and press ENTER: ";
    getline(cin, work);

    // Build the output string, and then print it.
    str = "\nMy name is " + name + ", " + "I live at " + addr +
",\nand I work at " + work + ".\n";
    cout << str << endl;

    return 0;
}
```

```
Enter name and press ENTER: Andi Toce
Enter address and press ENTER: New
Rochelle
Enter workplace and press ENTER:
LaGuardia College

My name is Andi Toce, I live at New
Rochelle,
and I work at LaGuardia College.
```

ComparingStrings.cpp	Output

```cpp
#include <iostream>
#include <string>
using namespace std;

int main(){

    string string1 = "one";
    string string2("one");
    string string3("five");
    string string4("ten");

    if(string1 == string2)
        cout << "The two strings are the same" << endl;
    else
        cout << "the strings are different" << endl;

    if(!string1.compare(string2))
        cout << "The two strings are the same" << endl;
    else
        cout << "the strings are different" << endl;

    cout << string1.compare(string2);

    return 0;
}
```

```
The two strings are the same
The two strings are the same
0
```

FunWithStrings.cpp	Output
| ```cpp
#include <iostream>
#include <string>
using namespace std;

int main(){

    string college = "Laguardia";
    cout << "Initial string: " << college << endl;

    college.append(" college");
    cout << "The string after appending: " << college << endl;

    college[2]='G';
    college[10]='C';
    cout << "The string after char change: " << college << endl;

    string s2 = "Community ";
    college.insert(10, s2);
    cout << "The string after insert: " << college << endl;

    for (int i = 0; i < college.size(); i++){
        for(int j=0;j<i;j++)
                cout << " ";
        cout << college[i] << endl;
    }

    return 0;
}
``` | ```
Initial string: Laguardia
The string after appending: Laguardia
college
The string after char change:
LaGuardia College
The string after insert: LaGuardia
Community College
L
 a
  G
   u
    a
     r
      d
       i
        a

          C
           o
            m
             m
              u
               i
                t
                 y

                   C
                    o
                     l
                      l
                       e
                        g
                         e
``` |

Try now: Write a program *ReverseString.cpp* that takes a string as an input and prints the string in reverse order.

Try now: Write a C++ program *FindSubstring.cpp* that takes as an input two strings from the user and determines whether the first string is a substring of the second. If yes, also print at what position the substring starts.