Introduction to Programming

CSC1102 &1103

Lecture-6

American International University Bangladesh

Dept. of Computer Science

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Lecture 6: Outline

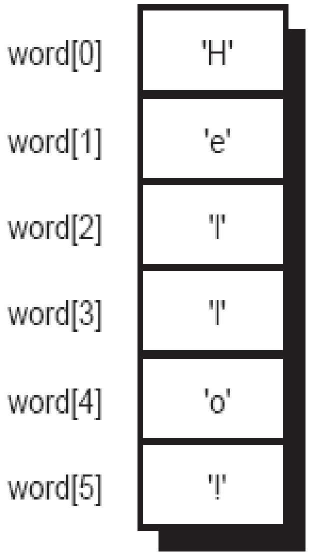
- Strings

Character Arrays/ Character Strings

  - Initializing Character Strings. The null string.
  - Escape Characters
  - Displaying Character Strings
  - Inputting Character Strings
  - String processing:
    - Testing Strings for Equality
    - Comparing   Strings
    - Copying Strings
  - Functions in <string.h>
  - String to number conversion functions
  - Character Strings, Structures, and Arrays
  - Example: Simple dictionary program
    - Sorting the dictionary
    - A better search in sorted arrays

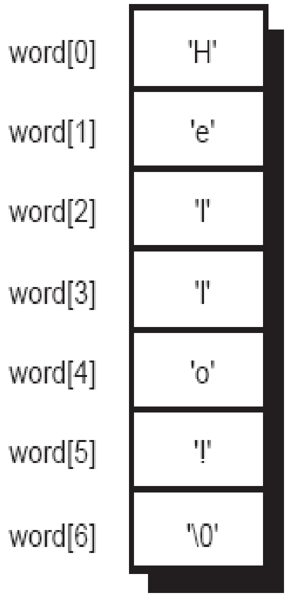
Arrays of characters

- `char word [] = { 'H', 'e', 'l', 'l', 'o', '!' };`
- To print out the contents of the array word, you run through each element in the array and display it.
- To do processings of the word (copy, concatenate two words, etc) you need to have the actual length of the character array in a separate variable !



Character strings

- A method for dealing with character arrays without having to worry about precisely how many characters you have stored in them:
- **Placing a special character at the end of every character string**. In this manner, the function can then determine for itself when it has reached the end of a character string after it encounters this special character.
- In the C language, the special character that is used to signal the end of a string is known as the *null* character and is written as **'\0'**.
- char word [] = { 'H', 'e', 'l', 'l', 'o', '!', '\0' };



Example: string length

```
// Function to count the number of characters in a string
#include <iostream>
using namespace std;
int stringLength (char string[]){
    int count = 0;
    while ( string[count] != '\0' )
        ++count;
    return count;
}
int main (void) {
    char word1[] = { 'a', 's', 't', 'e', 'r', '\0' };
    char word2[] = { 'a', 't', '\0' };
    char word3[] = { 'a', 'w', 'e', '\0' };
    cout<<stringLength (word1)<<endl;
    cout<<stringLength (word2)<<endl;
    cout<<stringLength (word3)<<endl;
    return 0;
}
```

Example: const strings

```
// Function to count the number of characters in a string
#include <iostream>
using namespace std;
int stringLength (const char string[]){
    int count = 0;
    while ( string[count] != '\0' )
        ++count;
    return count;
}
int main (void) {
    const char word1[] = { 'a', 's', 't', 'e', 'r', '\0' };
    const char word2[] = { 'a', 't', '\0' };
    const char word3[] = { 'a', 'w', 'e', '\0' };
    cout<<stringLength (word1)<<endl;
    cout<<stringLength (word2)<<endl;
    cout<<stringLength (word3)<<endl;
    return 0;
}
```

The function declares its argument as a const array of characters because it is not making any changes to the array

Initializing character strings

- Initializing a string:

```
char word[] = "Hello!";
```

- Is equivalent with:

```
char word[] = { 'H', 'e', 'l', 'l', 'o', '!', '\0' };
```

- The null string: A character string that contains no characters other than the null character

```
char empty[]= "";
char buf[100]= "";
```

- Initializing a very long string over several lines:

```
char letters[] =
{ "abcdefghijklmnopqrstuvwxyz\
ABCDEFGHIJKLMNOPQRSTUVWXYZ" };
```

- Adjacent strings are concatenated:

```
char letters[] =
{ "abcdefghijklmnopqrstuvwxyz"
"ABCDEFGHIJKLMNOPQRSTUVWXYZ" };

cout<<"Programming" " in C is fun";
```

Strings vs Characters

- The string constant "x“
- The character constant 'x‘
- Differences:

1. 'x' is a basic type (char) but "x" is a derived type, an array of char
2. "x" really consists of two characters, 'x' and '\0', the null character

Escape characters

`\a`	Audible alert
`\b`	Backspace
`\f`	Form feed
`\n`	Newline
`\r`	Carriage return
`\t`	Horizontal tab
`\v`	Vertical tab
`\\`	Backslash
`\"`	Double quotation mark
`\'`	Single quotation mark
`\?`	Question mark
`\nnn`	Octal character value *nnn*
`\unnnn`	Universal character name
`\Unnnnnnnn`	Universal character name
`\xnn`	Hexadecimal character value *nn*

- the backslash character has a special significance
- other characters can be combined with the backslash character to perform special functions. These are referred to as *escape characters*.

String functions

- The C++ library supplies several string-handling functions; You don’t have to re-write them from scratch !
- C++ uses the <string.h> header file to provide the prototypes.
- Most frequently used functions: strlen(), strcat(), strncat(), strcmp(), strncmp(), strcpy(), and strncpy().

- #include <string.h>
- strcat (*s1, s2*)
  - Concatenates the character string *s2* to the end of *s1*, placing a null character at the end of the final string.The function also returns *s1*.
- strcmp (*s1, s2*)
  - Compares strings *s1* and *s2* and returns a value less than zero if *s1* is less than *s2*, equal to zero if *s1* is equal to *s2*, and greater than zero if *s1* is greater than *s2*.
- strcpy (*s1, s2*)
  - Copies the string *s2* to *s1*, also returning *s1*.
- strlen (*s*)
  - Returns the number of characters in *s*, excluding the null character.

String functions (cont.)

- strncat (*s1, s2, n*)
  - Copies *s2* to the *end* of *s1* until either the null character is reached or *n* characters have been copied, whichever occurs first. Returns *s1*.
- strncmp (*s1, s2, n*)
  - Performs the same function as strcmp, except that at most *n* characters from the strings are compared.
- strncpy (*s1, s2, n*)
  - Copies *s2* to *s1* until either the null character is reached or *n* characters have been copied, whichever occurs first. Returns *s1*.
- strchr (*s, c*)
  - Searches the string *s* for the last occurrence of the character *c*. If found, a pointer to the character in *s* is returned; otherwise, the null pointer is returned.
- strstr (*s1, s2*)
  - Searches the string *s1* for the first occurrence of the string *s2*. If found, a pointer to the start of where *s2* is located inside *s1* is returned; otherwise, if *s2* is not located inside *s1*, the null pointer is returned.

Example: String functions

```
#include <iostream>
using namespace std;
#include <string.h> /* provides strlen() prototype */

#define PRAISE " What a super marvelous name!"

int main(void) {
char name[40];
cout<<"What's your First Name? "<<endl;
cin>>name;
cout<<"Hello "<< name<< PRAISE<<endl;
cout<<"Your name of "<<strlen(name)<<" letters occupies
"<<sizeof name<<" memory"<<endl;
return 0;
}
```

Example: String functions

```
#include <iostream>
#include <string.h>
using namespace std;
int main(void) {
char string1[] = "this is";
char string2[] = "a test";
char string3[20] = "Hello, ";
char string4[] = "world!";
cout<< string3<<endl;
strcat(string3, string4);
cout<<string3<<endl;
if(strcmp(string1, string2) == 0)
       cout<<"strings are equal"<<endl;
else cout<<"strings are different"<<endl;
return 0;
}
```