Tutorial 5
NWEN241
Systems Programming

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Content

- This tutorial will solve two problems:
  - Standard C Problem
    - A function which counts the number of whitespace characters in a string
  - Standard C++ Problem
    - A class with only one static method to count the number of digits in a string

C Problem

- How can we keep track of how many white spaces there are in a sentence?
- For example: count the number of white space characters which occur in the string below

"The quick brown fox jumps over the lazy red dog"

First Step : Header File

- Setup the header file

  editorc.h

  Declare the function prototype for the **count_white_space_characters** function

```
/**
* Prototype for function which counts the number of white space characters
*/


int count_white_space_characters(const char *buffer, int len);
```

Next Step: Implement Function

- Implement the function prototype in a separate C file

  editorc.c:

  - Implement the function in a separate c file, making use of the **isspace()** function from the **<ctype.h>** library

editorc.c File

```
#include <ctype.h>
#include "editorc.h”
int count_white_space_characters(const char *buffer, int len)
{
    int i = 0, count = 0;

   while (i < len){
       if (isspace(*buffer)) { count++; }
      buffer++;
      i++;
 }
  return count;
}
```

isspace(int c) Function

- Takes a single character as a parameter
- Checks to see if that character is a white space character
- Types of white space characters:
  - ' ' (0x20) space (SPC)
  - '\t' (0x09) horizontal tab (TAB)
  - '\n' (0x0a) newline (LF)
  - '\v' (0x0b) vertical tab (VT)
  - '\f' (0x0c) feed (FF)
  - '\r' (0x0d) carriage return (CR)
- Returns true or false

Final Step: Write a **main()** Function to Test

- Setup the test c file

  ctest1.c

- Run the test!

```
#include <stdio.h>
#include "editorc.h"
#define TEST_STRING "The quick brown fox jumps over the lazy red dog."

int main(void)
{
   char buffer[] = TEST_STRING;

   printf("Buffer contents: %s\n", buffer);
   int r = count_white_space_characters(buffer, sizeof(buffer));
   printf("Output of count_white_space_characters()  : %d\n", r);
   printf("Actual number of white spaces in buffer: 9\n");

   return 0;
}
```

Write other tests!

- Write tests with strings that have different kinds of white space characters to test your implementation

  ctest2.c:

  Example with **\t** in place of the ' '

  - **ctest3.c:**
    - Mixture of **\n, \f, \v,** ' ' and **\r**

C++ Problem

- How can we keep track of how many digits are in a string?
- For example: count the number of digits which occur in the string below

"12345"

First Step : Header File

- Setup the header file

  editorcc.hh

  Declare a namespace **editorcc**, a class **DigitUtilities** and a static function prototype **countIndividualDigits**

```
namespace editorcc {
        class DigitUtilities {
        public:
         /**
        * Prototype for function which counts the number of
        * individual digits digits in a string
        *
        */
        static int countIndividualDigits(const char *buffer, int len);
        };
}
```

Next Step: Implement Function

- Implement the function prototype in a separate C++ file

  editorcc.cc:

  - Implement the function in a separate C++ file
  - Be sure to implement the function within the declared namespace
  - Make use of the **isdigit()** function from the **<cctype>** library

editorcc.cc File

```
#include <cctype>
#include <cstring>
#include "editorcc.hh”

namespace editorcc {

int DigitUtilities::countIndividualDigits(const char *buffer, int len){
        int i = 0, count = 0;

        while(i < len) {
          if (isdigit(*buffer)){ count++; }
          buffer++;
          i++;
        }

        return count;
}

}
```

isdigit(int c) Function

- Takes a single character as a parameter
- Checks to see if that character is a digit
- Returns true or false

Final Step: Write a **main()** Function to Test

- Setup the test c file
  cctest1.cc
- Run the test!

```
#include <iostream>
#include "editorcc.hh”

#define TEST_STRING "I have 2 brothers, 3 sisters, 3 dogs and 14 goldfish."

using namespace editorcc;
using namespace std;

int main(void){
  char buffer[] = TEST_STRING;

  cout << "Buffer contents: " << buffer << endl;
  int r = DigitUtilities::countIndividualDigits(buffer, sizeof(buffer));
  cout << "Output of countIndividualDigits: " << r << endl;
  cout << "Actual number of digits in buffer: 5" << endl;

  return 0;

}
```

Write other tests!

- Write tests with strings that have different kinds of digits to test your implementation

cctest2.cc:

Example with a mixture of digits in a string

cctest3.cc:

Another example with a mixture of digits in a string

cctest4.cc:

Example with different digits

cctest5.cc

Example which counts digits, alphabetic and white space characters separately

Use of other functions from the C/C++ library: **isalpha()**