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Assignment 3

Programing Problems [10 points]

Part 1

1) Write an algorithm that checks if **a** is a substring of **b**. In other words, does string **a** occur in string **b**?

Solution:

```
#include <iostream>
#include <string>
using namespace std;
int main(){
    int i = 0, j = 0;
    int count = 0;
    string str1, str2, str3;
    cout << "Enter first word: " << endl;
    getline (cin,str1);
    cout << "Enter second word: " << endl;
    getline (cin,str2);
    if (str2.size() > str1.length()) {
        str3 = str2;
        str2 = str1;
        str1 = str3;
    }
    for (i=0 ; i < str1.length() ; i++){
        if (str1[i]==str2[j] && count < str2.length()){
            count ++;
            if (count == str2.length()){
                cout << "BRAVO, your word " + str2 +
                    "" was found in " + str1 + "" << endl;

                break;
            }
            j++;
        } else if(count > 0){
            i = i-count+1;
            j = 0;
            count =0;
        }
    }
    if(count <str2.length()){
        cout << "SORRY, your word " + str3 +
            "" was NOT found in " + str1 + "" << endl;
    }
    return 0;
}
```

2) After developing your algorithm, indicate the Big-Theta runtime of your algorithm in terms of n , the length of string a , and m , the length of string b .

Solution:

The Big-Theta runtime in this case is n^2 , and the space usage is n .

if $n = 100$;

of iterations = 1,000,000

Runtime = n^2

Space Usage = n

3) As shown in the examples, this can be used to check for substrings in arrays of letters. Come up with a real-world example of where substring checks are done on non-letter inputs.

Solution:

A real world example will be when a user is filling out an electronic form in a website and in order to validate if the input by the user is correct, the program needs to check for valid input such as integers for the date of birth, zip code, phone number, fields respectively.

Part 2

Implement the Vigenere cipher, and answer questions 18 and 19 on page 304.

18. Use the Vigenère cipher with key BLUE to encrypt the message SNOWFALL.

19. The ciphertext OIKYWVHBX was produced by encrypting a plaintext message using the Vigenère cipher with key HOT. What is the plaintext message?

Solution:

18.

19.