COE 301 Introduction to Computer Programming Fall, 2024

Homework 6 – Due: 10/09/2024 11:59 pm

Problem 1. [30 points] The mathematical combination function c(n, k) is usually defined in terms of factorials, as follows:

$$c(n,k) = \frac{n!}{k!\,(n-k)!}$$

(1) Write a factorial function that takes a positive integer *n* and returns n!, that is the product of all positive integers less than or equal to *n*.
(2) Write another function that computes *c(n, k)* by calling the factorial function.
(3) Write a main program that asks the user to enter a positive integer. Assuming the user always enters a valid integer number, the program should verify that **n** is greater than 0 and if not, ask for another, checks again, until a correct input was entered. The program then calls the combination function and displays the value c(n,k) for k = 1, 2,…,n on the screen.

Report your results for n=8 in the write-up.
Please submit your .cpp file as "yourLastName_hw6_prob1.cpp".

Problem 2. [35 points] *Sequential coin flips*. Write a C++ function that takes an integer n. The function simulates a series of coin flips, and the function returns the total number of flips it takes until we get n heads in a row. The coin is fair, and each flip has 50% chance of heads. Write a main program that calls the function 5000 times and calculate the average number of flips required to get 5 heads in a row.

Report your results in the write-up.
Submit your .cpp file as "yourLastName_hw6_prob2.cpp".

Problem 3. [35 points] Write a C++ function

```
void countDoc(const string &filename, int &wordCount, int &charCount);
```

that calculates the number of words and the number of characters (excluding spaces) in a text file called `filename`. In main, write a test that use "dat_hw6_prob3.txt" as the input file, and display the number of words and the number of characters (excluding spaces) on your screen.

Hint: you may calculate the length of a string as:
http://www.cplusplus.com/reference/string/string/length/

Report your result in the write-up.
Please submit your .cpp file as "yourLastName_hw6_prob3.cpp".

What to submit:
There should be 4 files in your submission:

1. A write up (any type- .txt, .docx, .pdf are all fine) that contains your answers to all questions in problem 2-3.
2. The .cpp file for your problem 1. Please name this file as [YourLastName]_prob1.cpp.
3. The .cpp file for your problem 2. Please name this file as [YourLastName]_prob2.cpp.
4. The .cpp file for your problem 3. Please name this file as [YourLastName]_prob3.cpp.

Optional Short answers questions. The following questions will not be graded. You may use them for preparing your next week's quiz.

(1) What is the output of the following code segment?

```
for (int k = 5; k < 20; k += 2) {
      if (k%3 == 1){
            cout << k << endl;
      }
}
```

(2) What is the output of the following code block?

```
for (int i=0; i<3; i++ ) {
      for (int j=0; j<i; j++) {
            cout << i << " " << j << endl;
      }
}
```

(3) What will the following code output?

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

void printNumber(int num) {
  cout << "Integer: " << num << endl;
}

void printNumber(double num) {
  cout << "Double: " << num << endl;
```

```
}

void printNumber(int num1, int num2) {
  cout << num1 <<" and " << num2 << endl;
}

int main() {

  double a = 4.1;
  int b = 3;

  printNumber(a);
  printNumber(b);
  printNumber(a, b);

  return 0;

}
```

(4) Please complete the following C++ function that computes the series (1) + (1+2) + (1+2+3) + (1+2+3+4) + ... + (1+2+3+4+...+n) using **a nested for loops**.

```
int func(int n){

      // you may assume n > 0.
      // No error checking is needed


      return ret;

}
```

(5) Please fix **FIVE** errors in the following code so the function computes abs(a-b), where a and b are both double variables. When you run the program, the correct code should display **0.9** on the screen.

```
#include <iostream>
#include <cmath>
using namespace std;

int main() {

  double a = 1.5;
  double b = 2.4;
```

```
    cout<< difference(double a, double b)<< endl;
    return 0;
}
int difference(int x, int y){
    double diff = abs(x-y);
}
```