COE 301 Introduction to Computer Programming Fall, 2019

Homework 6 – Due: 10/18/2019 9:00 am

Problem 1. (25 points) Short answers.

(1) [5 points] Please fix 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);



}
```

(2) [3 points] 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;

}
```

(3) [3 points] Explain what this function computes.

```
int somefunc(int n){
  // you can assume n >= 0
  if(n==0){
    return 0;
  }else{
    return somefunc(n-1)+n;
  }

}
```

(4) [3 points] Please identify and correct the error in the following function.

```
bool isPositive(double num) {
  // the function returns true if num is positive
  // the function returns false otherwise


  if (num > 0){

    bool ret = true;

  }else{

    bool ret = false;

  }

  return ret;

}
```

(5) [3 points] what is the output of the following C++ code? Do you think it works in the correct way?

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

void swap(int &a, int b) {
     int t = a;
     a = b;
     b = t;
}

int main() {
     int q = 3;
     int r = 5;
     swap(q, r);
     cout << "q " << q << endl;
     cout << "r " << r << endl;

     return 0;
}
```

(6) [3 points] what is the output?

```
int a = 5;
int &b = a;
int c = a;

cout << a << "," << b << ","<< c << endl;
c = 3;
cout << a << "," << b << ","<< c << endl;
b = 4;
cout << a << "," << b << ","<< c << endl;
a = 7;
cout << a << "," << b << ","<< c << endl;
```

(7) [3 points] What is the output? Explain the results.

```
int i = 150;
for(int i = 0; i < 3; i++) {
    cout << i << endl;
}
cout << i << endl;
```

(8) [2 points] Variable shadowing and scope. What is the output of this code segment?

```
int main()
{
    int a=5;
    if( a == 5 ) {
        int a=6;
        if( a == 6 ) {
            int a=3;
            cout << "a=" << a << endl;
        }
        if( a == 3 ) {
            a=2;
        }
        cout << "a=" << a << endl;
    }
    cout << "a=" << a << endl;

    return 0;
}
```

Problem 2. (25 points) *Unfair coins*. Write a C++ function

```
int coinFlip()
```

The function `coinFlip` takes no input and simulates the outcome of flipping an unfair coin with 65% chance of getting heads and 35% chance of getting tails. The function should print the outcome of one simulation as "heads" or "tails" on the screen and return 1 if the outcome is heads and 0 otherwise. Using this function, write a main program that simulates flipping a coin repeatedly 1000 times and count how many heads we get in this simulation.

Report your result in the write-up.
Please submit your .cpp file as "yourLastName_hw6_prob2.cpp".

Problem 3. (25 points)) For your 18th birthday, your parents opened a savings account for you and deposits $5000 into the account. The savings account pays a 3.6% interest on the account balance. **The interest is compounded monthly**. At the end of each year, the bank took away **15% of the total interest earned during that yea**r as withhold TAX. You do not plan to withdraw any money from this account. Please write a C++ function

```
double trackMyMoney(double money, double intRate, double taxRate, int years)
```

to compute how much money, you will have in 10 years. You main C++ program should ask the user to input the initial deposit, the interest rate, the tax rate and the number of years.
Report your result in the write-up.
Please submit your .cpp file as "yourLastName_hw6_prob3.cpp".

Problem 4. (25 points) the mathematical combinations function c(n, k) is usually defined in terms of factorials, as follows:

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

The values of c(n, k) can also be arranged geometrically to form a triangle in which n increases as you move down the triangle and k increases as you move from left to right. The resulting structure, which is called Pascal's Triangle, is arranged like this:

$$\begin{array}{ccccccc} & & & c(0,0) & & & \\ & & c(1,0) & & c(1,1) & & \\ & c(2,0) & & c(2,1) & & c(2,2) & \\ c(3,0) & & c(3,1) & & c(3,2) & & c(3,3) \\ c(4,0) & & c(4,1) & & c(4,2) & & c(4,3) \quad c(4,4) \end{array}$$

Pascal's Triangle has the interesting property that every entry is the sum of the two entries above it, except along the left and right edges, where the values are always 1. For example, c(3,2) can be written as c(2,1)+c(2, 2). Using this fact, write a recursive implementation of the c(n, k) function that **uses no loops, no multiplication, and no calls to a function that computes factorial of n**. The function should take two input arguments n and k and return c(n,k).
Write another function that compute c(n, k) using a non-recursive algorithm. The function should take two input arguments n and k and return c(n,k). Write a simple test program to demonstrate that both functions generate the same results for n = 6 and k = 1, 2,…,6.
Report your result in the write-up.
Please submit your .cpp file as "yourLastName_hw6_prob4.cpp".

Submission Instructions:

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 1-4.
2. The .cpp file for problem 2.
3. The .cpp file for problem 3.
4. The .cpp file for problem 4.

Please make sure your last name is included in the filename.