COE 301 Introduction to Computer Programming Fall, 2024

Homework 8 – Due: 10/23/2024 11:59 pm

Problem 1. [30 points] Write a function `isSorted` that takes an input vector of integers called vec and return true if vec is sorted in increasing order. Write a simple test program to demonstrate that the function returns the correct values for the following vector<int> vec inputs.
Report your result in the write-up.
Please submit your .cpp file as "yourLastName_hw8_prob1.cpp".

vec	Returns
{1, 2, 5, 6}	true
{5, 6, 0, 1}	false
{}	true
{10}	true
{10, 5, 10}	false
{10, 10, 20}	true
{10, 10, 20, 5}	false

Problem 2. [35 points] *Moving average*. Please write a C++ function

```
vector<double> movingAverage(vector<double> &v, int n)
```

The function takes an input vector of doubles called v and returns a vector called vout of the same size. The m[th] element in the output vector equals:

$$\frac{v_m + v_{m-1} + \cdots + v_{m-n+1}}{n}$$

If any term in the above equation has a negative index, assume its value is zero. For example, for a vector {1.0, 2.0, 3.0, 4.0} and n equals 2, the output vector should be {(1.0+0.0)/2, (2.0+1.0)/2, (3.0+2.0)/2, (4.0+3.0)/2}. For the same vector and n equals 3, the output vector should be {(1.0+0.0+0.0)/3, (2.0+1.0+0.0)/3, (3.0+2.0+1.0)/3, (4.0+3.0+2.0)/3}. Write a simple test program to test for the case:

```
vector<double> v = {1.0, 2.0, 3.0, 4.0, 3.0, 3.5};
and n = 2, 3, 4.
```

Report your result in the write-up.
Submit your .cpp file as "yourLastName_hw8_prob2.cpp".

Problem 3. [35 points] *Cash 5 Lottery.* Cash 5 lottery asks the player to select 5 numbers from 1 and 35, and the player win the big prize by matching all five

numbers. Write a function that takes a vector that contains 5 unique winning integers, and another vector of 5 unique integers a player chose. The numbers are **NOT** sorted. The function returns the number of matches between the winning numbers and your ticket.

Winning numbers	Player's numbers	Function returns
{1, 12, 3, 20, 15}	{15, 1, 4, 12, 35}	3
{35, 7, 26, 17, 8}	{8, 7, 26, 35, 17}	5
{27, 2, 9, 15, 29}	{3, 1, 8, 14, 20}	0

Write a main program that asks the user to enter a set of 5 winning numbers (you can assume the user always enters valid numbers), then main program then reads 1000 *Cash 5 tickets* from a text file "dat_hw8_prob3.txt" (each line contains 5 numbers that the player chose for a ticket) and count how many tickets matches five numbers, four numbers, three numbers, two numbers using the function you just implemented.

Report your results for the winning number {31, 17, 4, 5, 20} in the write-up. Submit your .cpp file as "yourLastName_hw8_prob3.cpp".

Bonus problem (+50 points). We made a fun lab: LabX-GameOfLife. You may complete it any time before Dec 1. If you come up with a solution, send it to me *by email*, and I will grade your code and provide feedback to you. I will give partial credits for solutions that are not fully working.

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 1 and 2.
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.

(1) What are the **two problems** of the following code?

```
int x[5];
for( int i=0; i<=5; i++ ) {
   cout << " " << x[i];
 }
```

(2) What is the output for the following code segment?

```
int x[7] = {3, 5, -1, 7, -3, 2, 8};
int y[5] = {0, 1, 4, 3, 8};
int *px;
px = y;
px[3] = 5;
cout << "y[3] =" << y[3] << endl;

px = x;
cout << "px[3] =" << px[3] << endl;
```

(3) Explain why the following code segment leads to memory leak?

```
int *ptr;
for(int i = 0; i < 100; i++){
     ptr = new int[5];
}
delete[] ptr;
```

(4) Explain what this function computes.

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

double func(vector<double> &x)
{
   double ret = 0;
```

```
    for( int i=0; i<x.size(); i++ ) {
        ret += x[i]*x[i];
    }

    return sqrt(ret);
}
```

(5) what is the output of the following C++ code?

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

int main() {
  int n = 4;
  vector<int> x(n, 5);

  for(int i = 0; i < n; i++){
     cout << x[i] << endl;
  }
  cout << "The length of x: " << x.size() << endl;

  return 0;

}
```

(6) What is the output of the following code?

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

int someFunc(int *arr, int size) {

   int  ret = 0;

   for (int i = 0; i < size; ++i) {
      ret += arr[i];
   }
```

```
    return ret;
}

int main () {

    int x[4] = {1, 2, 3, 4};

    cout << someFunc(x,4) << endl;

    return 0;
}
```