COE 301 Introduction to Computer Programming Fall, 2024

Homework 4 – Due: 09/25/2023 11:59 pm

Problem 1. [30 points] *Random walk of a drunk man.* A drunk man is 100 steps away from his home. His probability of taking a step toward his home (position+1) is 5/8, and taking a step away (position-1) is 3/8. Write a C++ program that simulates his random walk starting at position equals 0 until he reaches his home (position equals 100). The program should count and display how many steps he took to reach his home.

Report the output from three separate runs in the write-up.
Submit your .cpp file as "yourLastName_hw4_prob1.cpp".

Problem 2. [35 points] Write a C++ program to estimate PI using the Monte Carlo method. Your program should ask the user to input the total number of random points (xi, yi) used in the simulation, estimate PI, and display the estimation the difference between your estimated PI value and PI = 3.14159265.

Report the C++ program output when you use 10^2, 10^3, 10^4, 10^5, 10^6 and 10^7 samples in the write-up.
Submit your .cpp file as "yourLastName_hw4_prob2.cpp".

Problem 3. [35 points] *Grade calculator I*. Dr. Schneebly asks you to write a C++ program that (1) reads a student's homework scores from an input text file "dat_hw4_prob3.txt" (in canvas under /Files/HomeworkSets) one at a time. (2) Find the lowest score. (3) Computes the average score after excluding the lowest score. (3) Calculate the student's grade based on the following bracket:

Average Score	Grade
Greater or equal to 90.0	A
Less than 90.0 but greater or equal to 80.0	B
Less than 80.0 but greater or equal to 70.0	C
Less than 70.0	D

(4) displays the average score (after excluding the lowest score), and the final grade using cout.

You may assume the file contains at least one number. But you do not know how many scores the file contains.

Please report your results in the write-up.
Please submit your .cpp file as "yourLastName_hw4_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 1-3.
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 quiz.
(1) How many times does the following loop execute?

```
int i = 0;
while (i <= 5) {
     cout << "Hi." << endl;
     i++;
}
```

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

```
int x = 3;
int i = 0;
while (i < 3) {
    x += 1;
    i += 1;
}
cout << x << endl;
cout << i << endl;
```

(3) what is the output for the following code segment?

```
int k = 8;
```

```
int i = -2;
while (i <= k) {
    i = i + 2;
    k--;
    cout << (i + k) << endl;
}
```

(4) what is the output of the following code segment?

```
char letter = 'a';
while (letter < 'd') {
    cout << letter << endl;
    letter++;
}
```

(5) As we discussed in the lecture, you may generate a random number between [0, 1] (including 0 and 1) with equal probability using:

```
double x;
x = double(rand())/double(RAND_MAX);
```

Based on this, how would you generate a random number between [0, 100]?