

ASSIGNMENT 3

GENE-121-2017-3F-ASSN-03-Description

Fall 2017

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INTRODUCTION

This assignment is to be completed in pairs.

In this assignment, you will demonstrate your ability to write iterative programs. These programs that require repetition at their core in order to accomplish their task. This assignment is about creating well-designed loops.

QUESTION 1 – FINDING ROOTS

In this question, you will demonstrate that you can utilize loops to find minimum values.

Write a program that finds the root (solves for x) for the following equation:

$$3x^5 + 11x^4 + 12x^3 - 7x + 5 = 0$$

You are guaranteed that the root is between the value of -5 and 5. Your program must find the root to a minimum precision of 0.0001.

QUESTION 2 – 24-HOUR CLOCK

In this question, you will be using loops for input verification and applying modulus operations.

Write a program that accepts two 24-hour times as four-digit numbers. Your program must use loops to verify that the times entered are valid 24-hour times. The two times are guaranteed to be on the same day.

Your program must calculate the number of minutes between the two times entered.

Sample output

```
Enter first time: 804
Enter second time: 2372
Enter second time: 2303
There are 899 minutes between the two times.
```

Submit your output for three separate (well-designed) test cases.

QUESTION 3 – WATER TAXI

The Davos Water Taxi Company uses a boat on Georgian Bay to transport people and goods from the main dock to various islands and ports around the bay. The service charge for a trip is \$11.00 for each stop and \$2.70 per kilometer of travel. Some people take a full round trip back to the main dock and are therefore charged for the distance to travel back. Other people get off at the last given coordinates and are not charged for the taxi travelling back to the main dock.

A GPS records the (x , y) position for each stop. The position of the main dock is (0,0). Each leg of the trip is made in a straight line.

A file called "taxi.txt" contains the records for all the trips made in August. Each line in the file contains the information for one customer. The data on each line is formatted as follows:

- A binary (0 or 1) value that indicates whether the customer returned to the main dock or not. 1 = return trip and 0 = no return trip.
- The number of stops, not including returning to the main dock.
- Pairs of (x,y) coordinates for each of the stops.

Here are the first three lines of the "taxi.txt" file:

```
0 1 0 10.2
1 2 0 -3 4 -3
0 4 0 -3 4 -3 -7.5 2.6 5.1 6
...
...
```

To help verify your understanding of the data file format, here is an explanation of the second line of the data file:

- The customer returned to the main dock, and therefore must be charged for that leg of the trip.
- There were three legs to the trip:
 1. From the main dock due south to (0, -3), a distance of 3km.
 2. From (0, -3) due east to (4, -3), a distance of 4km.
 3. From (4, -3) northwest back to the main dock, a distance of 5km.

Your program is to generate a report file summarizing the taxi's earnings for the month of August. The report must contain the following information on each line:

- Trip number
- Return to main dock (0 = no, 1 = yes)
- Number of stops (not including return to main dock)
- Total distance travelled for the trip
- Total cost charged to the customer
- Cumulative distance travelled during the month
- Cumulative cost charged to all customers during the month

The report is to display only the lines for the first five trips and then every tenth thereafter (i.e. the 15th, 25th, etc.). Format your output using the setw() and setprecision() functions in a table similar to the one shown below. This data matches the given "taxi.txt" file, and therefore can be used for initial verification of your program. You should perform further manual calculations to verify the correctness of your program.

Trip	Return	Stops	Distance	Cost	Cumulative Distance	Cumulative Cost
1	0	1	10.20	38.54	10.20	38.54
2	1	2	12.00	54.40	22.20	92.94
3	0	4	32.84	132.67	55.04	225.61
...						
...						

The report must also include the following data at the bottom:

- cumulative distance travelled for all of August
- cumulative amount collected from all customers for all of August
- the length of the longest trip
- the cost of the least expensive trip

HINT

It is recommended that your program first simply be able to read the input file and display it to the screen, before proceeding to attempt any calculations of distance or cost. Trying to debug incorrect calculations while unsure if the data is being read correctly from the file can be very frustrating.