ME 101 Assignment 5 Winter 2022

Deliverables

Questions 1 to 2 of this assignment will be completed in pairs. The questions are quite different, question 1 covering nested loops, and question 2 covering arrays. Question 1 is significantly longer and more challenging than question 2. You want to be familiar with both topics for the upcoming midterm. Work on both questions together, don't divide them up and do one each.

In this assignment you will:

- Use nested loops to read data from a file
- Format output
- Use arrays to store data

There are two deliverables for this assignment:

- Question 1
- Question 2

Crowdmark submission with partnership

Prior to submitting your project work to Crowdmark, you need to form a group according to the instructions (shown below) when you are at the Assignment 5 submission area in Crowdmark.

Click the **Add group members** button at Crowdmark and choose your group for this assignment or wait for someone else to add you to their group. **You will not be able to change your group members after the assignment has been submitted.**

Each group member you add will receive an email notification and shared access to this page. Any group member may submit the assignment or edit group members.

Question 1 – Water Taxi

Understanding the problem

The James Bufét Water Taxi Company uses a boat on the Caribbean Sea to transport people and goods from the main dock to various islands and ports. The service charge for a trip is $15.00 for each stop and $2.60 per kilometer of travel. Some people are regular customers and granted a VIP card to receive a 25% discount of their trip cost.

A GPS records the (x, y) position for each stop.

All trips begin at the main dock (0,0). Each leg of the trip is made in a straight line of the shortest distance between stops (including the main dock).

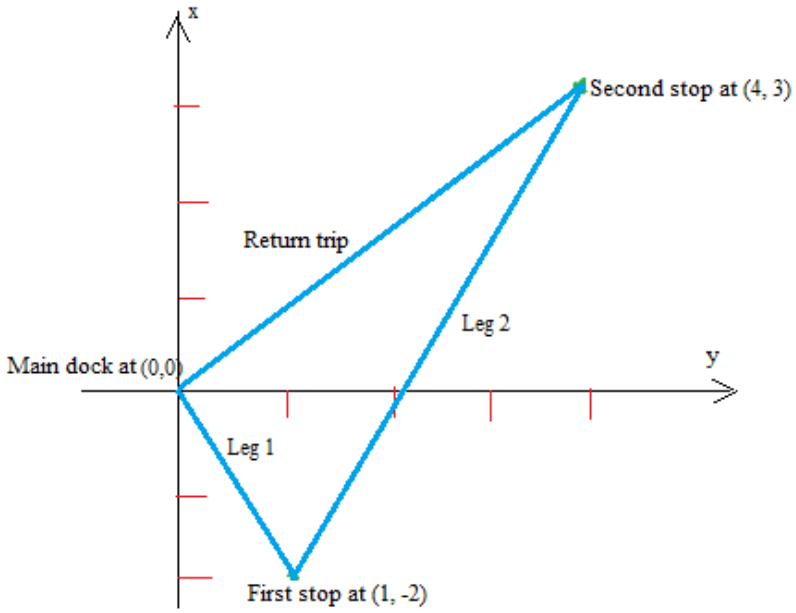
A file called "taxi.txt" contains the records for all the trips made in August. Each line in the file contains the information for one customer. The data on each line is formatted as follows:

- A binary (0 or 1) value that indicates whether the customer has a VIP card or not. 1 = VIP while 0 = not VIP.
- 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    1     -2     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 customer's one line of data in the file: 1 2 1 -2 4 3



- The customer has a VIP card and hence should receive a 25% discount on their trip cost.
- There were two stops:
    - Leg 1 covers distance from the main dock at (0, 0) to the first stop at (1, -2)
    - Leg 2 covers distance from the first stop at (1, -2) to the second stop at (4, 3)

Cost calculation

Leg	Distance (km)	Cost for the leg
Leg 1	2.236	2.236 * $2.60 + $15 = $20.81
Leg 2	5.831	5.831 * $2.60 + $15 = $30.16
Return Trip	5	5 * $2.60 = $13.00
Total Cost		$63.97
Trip Cost after discount		$47.98

What you need to do

Warning: this question is **very** difficult if you don't first design your code and thoroughly understand the problem itself.

Note: Do not use arrays to solve this question.

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
- VIP or not (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 (taxi odometer reading after it was reset to 0 on day 1 of each month)
- Cumulative cost charged to all customers during the month (money the taxi driver collected for the month)

The report is to display only the lines for the first four trips and then every tenth thereafter (i.e. the 14th, 24th, etc.). Format your output using the setw() and setprecision() functions in a table similar to the one shown below. Remember to include the <iomanip> library.

```
trip#  VIP   stops  tripDist  tripCost   totalDist   totalCost
    1    0       1     20.40     68.04       20.40       68.04
    2    1       2     13.07     47.98       33.47      116.02
    3    0       4     40.72    165.86       74.18      281.88
...
...
```

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

What to submit in Crowdmark

Submit your code and the contents of the **output file** obtained from processing the input file "taxi.txt" in /*Block comments*/ at the end.

Question 2 – Grade Statistics

Information about data can be described by the average, or mean μ, which for grades on a quiz is,

$$\mu = \frac{\sum each\ quiz\ grade}{number\ of\ students}$$

The standard deviation is another statistical measure, and indicates the amount by which the grades vary compared to the mean (average). The standard deviation σ is given by,

$$\sigma = \sqrt{\frac{\sum(each\ quiz\ grade - \mu)^2}{number\ of\ students}}$$

The file `quizGrades.txt` contains quiz grades. You can assume that there are fewer than 150 students who completed the quiz.

Write a program that:

- Opens the file `quizGrades.txt` and checks that it has opened correctly; Close the file when done
- Declares an array to store the quiz grades, and reads the grades from the file
- Calculates and outputs the mean and standard deviation of the grades