

University of Waterloo - MTE 121 Digital Computation

Assignment 3

Questions 1 and 2 of the assignment are to be completed in pairs. You are free to choose your tutorial partners. Please talk to Katherine Idzik (Kat) or Ryan Consell if you would like their help finding a partner.

Before you start to program, it is good programming practice to think about the logic and organization of the problem and write a pseudo code. This then makes it much easier to write an accurate and efficient program.

Experience with programming before starting MTE 121 varies. If you have one partner who is noticeably more experienced than the other, try having the inexperienced person at the keyboard typing the code with the more experienced person offering suggestions that help teach the person with less experience. Teaching another person is a great way to get better at something! If both partners have similar experience, try alternating who is typing the code, the driver, and who is offering suggestions, the navigator.

Deliverables

1. In this course, break, goto, and continue are not allowed. There is no good reason to use them in the problems given.
2. In this assignment, the use of arrays is not appropriate.
3. In this assignment, you will be graded based primarily on accuracy but efficiency will also be considered. Avoid unnecessary, repeated, looping.
4. This assignment focuses on file I/O, for loops, while loops and nested loops.

Question 1

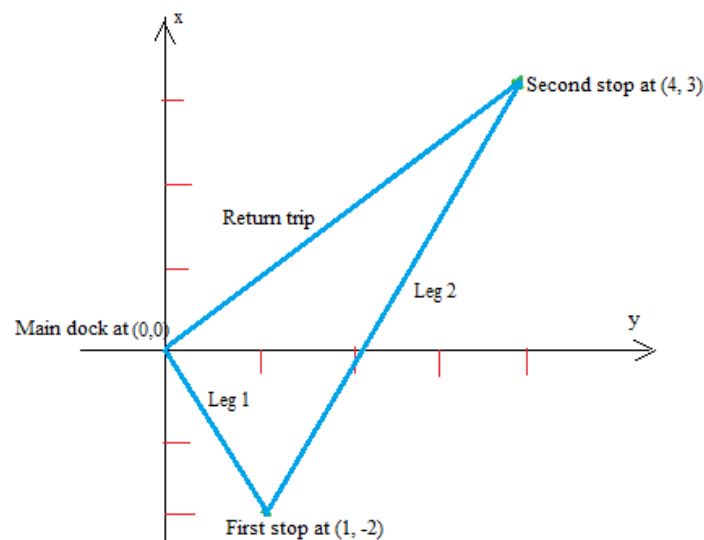
Problem Description

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
Total 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.

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

Problem Description

The investment firm Get Rich Fast, Inc. is providing information to clients about how long they have to wait until their investments reach a desired target value. Let P_i be the value of an investment at the beginning of a year, in millions of dollars, let r be an interest rate for the investment in %, and let P_{i+1} be the value of the investment at the end of that year. Each year, the investments are expected to grow according to the formula

$$P_{i+1} = \left(1 + \frac{r}{100}\right) P_i$$

for each client. However, each client has a different amount invested, at different interest rates, and with different target values they are aiming to reach. A file “clients.txt” contains this data for each client of the firm. In particular, each line contains the data for a different client, and is formatted as follows:

- client first name
- client last name
- current value of investments, in millions of dollars
- interest rate in %
- target value, in millions of dollars

Write a program to determine the minimum number of years each client is expected to have to wait until their investment reaches or exceeds its target value. Please use an integer number of years (i.e., do not include fractions of a year) in your answer.

What you need to do

Your program is to generate a report file for Get Rich Fast, Inc. that includes each client’s expected minimum number of years to reach or exceed their target investment. The report must contain the following information on each line:

- client first name
- client last name
- minimum number of years to reach or exceed their target investment

Format your output using the `setw()` function in a table similar to the example shown below. Remember to include the `iomanip` library.

Count	Dracula	11
Muffin	Man	8
...		

What to submit in Crowdmark

Submit your code and the contents of the output file obtained from processing the input file “clients.txt” in `/*Block comments*/` at the end.