

<u>SURNAME:</u>		<u>NAME:</u>		<u>A1</u>
<u>STUDENT ID:</u>				
<u>TEACHER:</u>				

Question 1	Answers
<p>Consider the following pairs of values in two's complement (2C) and sign and magnitude (SM). For each pair and in both representations, determine which one is the higher value:</p> <p>a) 01001 <?> 10001 b) 10110 <?> 11010</p>	<p>a: 2C: a: SM: b: 2C: b: SM:</p>
<p><i>Report the most relevant steps</i></p>	

Question 2
Which are the main characteristics of the memories available in a processing system?

Question 3
Write the algebraic expression or the truth table of the Boolean function that is TRUE when an input value, represented in pure binary on 3 bits, is greater or equal to 4

Question 4 (PROGRAMMING)

Write a C program that computes the motorway tolls. The file `tolls.txt` contains one for each row, the fares for any segment of the motorway. Any segment of the motorway is identified by one entrance tollbooth and one exit tollbooth. Every row has the following format:

```
Entrance_tollbooth1      Exit_tollbooth2      fare
```

The following assumptions are true:

1. The number of rows in the file is unknown a priori, but it cannot be greater than 25
2. The names of each tollbooth (entrance and exit) do not contain spaces and the maximum length is 20 characters
3. The fare is a real value
4. It is not guaranteed any order in the memorization of the motorway segments within the file, for example, if a row reports the fare segment between Torino and Chivasso:

```
Torino      Chivasso      3.50
```

It is not guaranteed that the following row reports the motorway segment between Chivasso and the next tollbooth.

Moreover, the file does not contain any ambiguity (for example, the same entrance tollbooth does not appear more than once with a different exit tollbooth).

As an example, consider the following `tolls.txt` file that describes the different segments of a motorway between Torino and Milano:

```
Torino      Chivasso      3.50
Santhia     Vercelli      2.50
Chivasso    Santhia       3.25
Magenta     Rho           5.50
Novara      Magenta       3.00
Rho         Milano       4.35
Vercelli    Novara        1.20
```

Write a program that, receiving the names of the entrance and exit tollbooths from the command line, determines:

- 1) If it is possible to directly reach the exit tollbooth from the entrance tollbooth. The program must report also the cost for performing the route (rounding to two decimal digits);
- 2) If not, report if it is possible to reach the exit tollbooth from the entrance tollbooth traversing at maximum 3 motorway segments. In this case, the program must report:
 - a. The number of segments traversed
 - b. The total cost (rounding to two decimal digits);
- 3) If it is not possible to complete the route traversing 3 segments at maximum.

In addition, if the entrance tollbooth and/or the exit tollbooth are not contained within the file `tolls.txt`, or if the entrance tollbooth is equal to the exit tollbooth, the program must print an error message.

Examples of execution:

```
C:\>progr.exe Santhia Magenta
```

```
Destination reached in 3 segments. Total cost: 6.70
```

```
C:\>progr.exe Torino Santhia
```

```
Destination reached in 2 segments. Total cost: 6.75
```

```
C:\>progr.exe Santhia Rho
```

```
It is not possible to reach the destination traversing 3 segments at maximum.
```

<u>SURNAME:</u>		<u>NAME:</u>		<u>A2</u>
<u>STUDENT ID:</u>				
<u>TEACHER:</u>				

Question 1	Answers
<p>Consider the following pairs of values in two's complement (2C) and sign and magnitude (SM). For each pair in both representations, determine which one is the higher value:</p> <p>a) 10001 <?> 11101 b) 11111 <?> 10001</p>	<p>a: 2C: a: SM: b: 2C: b: SM:</p>
<p><i>Report the most relevant steps</i></p>	

Question 2
Describe the units composing the CPU and their functionalities

Question 3
Write the algebraic expression or the truth table of the Boolean function that is TRUE when an input value, represented in pure binary on 3 bits, is less than 4

Question 4 (PROGRAMMING)

Write a C program that computes the length of a given motorway. The file `distances.txt` contains one for each row, the distances between consecutive tollbooths for any segment of the motorway. Any segment of the motorway is identified by one entrance tollbooth and one exit tollbooth. Every row has the following format:

```
Entrance_tollbooth1      Exit_tollbooth2      distance
```

The following assumptions are true:

1. The number of rows in the file is unknown a priori, but it cannot be greater than 25
2. The name of the tollbooths (entrance and exit) do not contain spaces and the maximum length is 20 characters
3. The distance is a real value
4. It is not guaranteed any order in the memorization of the motorway segments within the file for example, if a row reports the distance between Torino and Chivasso:

```
Torino      Chivasso      23.7
```

It is not guaranteed that the following row reports the motorway distance between Chivasso and the next tollbooth.

Moreover, the file does not contain any ambiguity (for example, the same entrance tollbooth does not appear more than once with different exit tollbooth).

As an example, consider the following `distances.txt` file that describes the different distances among tollbooths of a motorway between Torino and Milano:

```
Torino      Chivasso      23.7
Santhia     Vercelli      21.9
Chivasso    Santhia       35.0
Magenta     Rho           19.3
Novara      Magenta       23.4
Rho         Milano        18.5
Vercelli    Novara        24.8
```

Write a program that, receiving the names of the entrance and exit tollbooths from the command line, determines:

- 1) If it is possible to directly reach the exit tollbooth from the entrance tollbooth. The program must report also the number of km travelled (rounding to two decimal digits);
- 2) If not, report if it is possible to reach the exit tollbooth from the entrance tollbooth traversing at maximum 3 motorway segments. In this case, the program must report:
 - a. The number of segments traversed
 - b. The total number of km travelled (rounding to two decimal digits);
- 3) If it is not possible to complete the route traversing 3 segments at maximum. In addition, if the entrance tollbooth and/or the exit tollbooth are not contained within the file `distances.txt`, or if the entrance tollbooth is equal to the exit tollbooth, the program must print an error message.

Examples of execution:

```
C:\>progr.exe Torino Santhia
```

```
Destination reached in 2 segments. Km travelled: 58.70
```

```
C:\>progr.exe Magenta Novara
```

```
It is not possible to reach the destination traversing 3 segments at maximum.
```