

<b><u>SURNAME:</u></b>		<b><u>NAME:</u></b>		<b><u>B1</u></b>
<b><u>STUDENT ID:</u></b>				
<b><u>TEACHER:</u></b>				

Question 1	Answers
<p>Convert the following numbers <b>from decimal to two's complement (2C) on 5 bits</b> and sum up (still in 2C) exclusively those numbers for which the conversion is feasible.</p> <p>a. +10    b. -13    c. -21    d. -19</p>	<p>a:</p> <p>b:</p> <p>c:</p> <p>d:</p> <p>sum:</p>
<p><i>Report the most relevant steps</i></p>	

Question 2	
<p>Sort <b>in ascendant order</b> the following hexadecimal values, representing binary values in <b>2C</b> on 16.</p> <p>0xFFFF, 0x0000, 0x1234, 0x8765</p>	

Question 3
<p>For the following Boolean function F, derive the truth table and verify whether it is equivalent to an OR function with 3 variables: <math>F = A(C+AB)+(AC+C'A')</math></p>
<p><i>Include in the table the most relevant intermediate steps</i></p>

**Question 4 (PROGRAMMING)**

An ASCII file named `trajectories.txt` contains the descriptions of the paths followed by a set of smart micro-robots. They are free to move in a discrete plane of size  $N \times N$  slots ( $N$  is constant, known a priori). Each row of such file describes the path followed by just one micro-robot among adjacent points. Specifically, each row indicates

- The name of the robot (*up to 10 characters*)
- The coordinates of the starting point ( $x,y$ )
- The sequence of maximum 100 movements performed by the micro-robot.

Such movements are limited to a unitary increment or decrement, either horizontal or vertical; Each movement is identified in the file by a pair of symbols with the following encoding: the sign '+' identifies an increment, the sign '-' identifies a decrement, the sign 'h' identifies an horizontal movement, the sign 'v' a vertical movement. The sequence of symbols does not contain spaces.

The following example considers 2 rows of `trajectories.txt` in which the micro-robots, identified with "Rj6k" and "Ra9012", are free to move in a  $5 \times 5$  space. They follow the trajectory depicted in figure (the starting points are the coordinates (1,1) and (4,3) respectively).

Rj6k 1 1					Ra9012 4 3				
x(1,1)		X	<u>X</u>	X				<u>X</u>	
X			<u>X</u>			x	x	<u>X</u>	
X			<u>X</u>			x		<u>x(4,3)</u>	
X	X	X	X						

File `trajectories.txt`  
**Ra9012 4 3 -v-v+v-h-h+v**  
**Rj6k 1 1 +v+v+v+h+h+h-v-v-v-h+h+h**  
 Rq12a 2 2 -v-h+v+h-v+h+v-h

The following statements are true:

- The length of a given trajectory is not known a priori but is at most 100 movements
- The same micro-robot can visit the same position more than once (*as in the example above*)
- Different micro-robots can visit the same positions
- The micro-robots can follow paths with different length
- **All the described trajectories are correctly contained in the  $N \times N$  plane. Therefore, is not necessary to verify their correctness**
- The number of micro-robots and thus the number of trajectories stored in the file, is not known

Write a C program that receives from the command line the following parameters:

1. The identifier of two micro-robots
2. The name of the ASCII file that contains the trajectories

The program must print **the total number of slots that have been visited by both robots.**

**Example of execution**

```
c:\> paths.exe Rj6k Ra9012 trajectories.txt
```

**OUTPUT**

```
There exist 3 slots visited by both robots.
```

<b><u>SURNAME:</u></b>		<b><u>NAME:</u></b>		<b><u>B2</u></b>
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Question 1	Answers
<p>Convert the following numbers from <b>decimal to signed magnitude (SM) on 5 bits</b> and sum up (still in SM) those numbers for which the conversion is feasible</p> <p>a. +10   b. -13   c. -21   d. -19</p>	<p>a:</p> <p>b:</p> <p>c:</p> <p>d:</p> <p>sum:</p>
<p><i>Report the most relevant steps</i></p>	

Question 2
<p>Describe the mechanism for passing parameters to a function by value and by reference</p>

Question 3
<p>For the following Boolean function F, derive the truth table and verify whether it is equivalent to an OR function with 3 variables: <math>F = A(C+AB)(AC+C'+A')</math></p>
<p><i>Include in the table the most relevant intermediate steps</i></p>

**Question 4 (PROGRAMMING)**

An ASCII file named <trajectories.txt> contains the descriptions of the paths followed by a set of smart micro-robots. They are free to move in a discrete plane of size  $N \times N$  slots ( $N$  is constant, known a priori). Each row of such file describes the path followed by just one micro-robot among adjacent points. Specifically, each row indicates

- The name of the robot (*up to 10 characters*)
- The coordinates of the starting point ( $x, y$ )
- The sequence of maximum 100 movements performed by the micro-robot.

Such movements are limited to a unitary increment or decrement, either horizontal or vertical; each movement is identified in the file by a pair of symbols with the following encoding: the sign '+' identifies an increment, the sign '-' identifies a decrement, the sign 'h' identifies a horizontal movement, the sign 'v' a vertical movement. The sequence of symbols does not contain spaces.

The following example considers 2 rows of <trajectories.txt> in which the micro-robots, identified with "Rj6k" e "Ra9012", are free to move in a  $5 \times 5$  space. They follow the trajectory depicted in figure (the starting points are the coordinates (1,1) and (4,3) respectively).

Rj6k 1 1					Ra9012 4 3				
x(1,1)		X	X	X				x	
X			X			x	x	x	
X			X			x		x(4,3)	
X	X	X	X						

File trajectories.txt

Ra9012 4 3 -v-v+v-h-h+v

Rj6k 1 1 +v+v+v+h+h+h-v-v-v-h+h+h

Rq12a 2 2 -v-h+v+h-v+h+v-h

The following statements are true:

- The length of a given trajectory is not known a priori but is at most 100 movements
- The same micro-robot can visit the same position more than once (as in the example above)
- Different micro-robots can visit the same positions
- The micro-robots can follow paths with different length
- **All the described trajectories are correctly contained in the  $N \times N$  plane. Therefore, is not necessary to verify their correctness**
- The number of micro-robots and thus the number of trajectories stored in the file, is not known

Write a C program that receives from the command line the following parameters:

1. The identifier of two micro-robots
2. The name of the ASCII file that contains the trajectories

The program must print **which between the two robots visited the higher number of different slots.**

**Example of execution**

```
paths.exe Rj6k Ra9012 trajectories.txt
```

**OUTPUT**

```
robot Rj6k visited the higher number of different slots.
```