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<u>STUDENT ID:</u>				
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Question 1

Given the integer number 4096, determine the minimum number of bits required to represent it as an unsigned pure binary number.

Question 2

A computer system bus consists of an 8-bit Address Bus and a 32-bit Data Bus. Determine the maximum size of the memory in megabytes (MB) that can be controlled using the mentioned bus.

Question 3

Explain, what is the role of the RAM memory in a microprocessor?

Question 4 (PROGRAMMING)

A “magic square” is defined as an arrangement of positive integer numbers placed in a 3x3 square matrix. In such a matrix, the numbers in the same row, in the same column, and in the first and second diagonals, all add up to the same number; this number (the result of the rows/columns/diagonals additions) is called the “magic constant” or “magic sum”.

Examples of magic square:

1	8	3	12
6	4	2	12
5	0	7	12
12	12	12	12

Whichever row/column/diagonal sum gives the same result, magic constant = 12

31	73	7	111
13	37	61	111
67	1	43	111
111	111	111	111

Whichever row/column/diagonal sum gives the same result, magic constant = 111

Write a C program able to analyze an incomplete magic square contained in a file, which name is passed using the command line as the first parameter. Every line in the file contains 3 integer values separated by only one space, the provided file contains an incomplete magic square, i.e., one element is missing, and this value is replaced by -1.

Assume that the file content is correct, and in addition:

1. There is only one missing value (i.e., only one value in the file is replaced by -1)
2. The missing value is placed in one of the three positions in the first diagonal (0,0)-(1,1)-(2,2).

The program shall:

1. Determine, by analyzing the content of the square (i.e., the entire rows/columns/diagonals additions but the ones including the missing value), if it seems possible to attempt to transform the given square into a magic square, by replacing the -1 value. In details, the program must check for all the rows/columns/diagonals additions containing all the three values, if the addition results produce the same value.
2. If so, the program prints to the screen the magic constant computed using the file content.
3. Calculate the value that replaces the missing one (-1) converting the square into a magic square:
 - a. If this value exists, display the square completed with the calculated value.
 - b. Otherwise, indicate that it is impossible to complete the magic square.

Examples of execution:

EX. 1

8	1	6
3	5	7
4	9	-1

It seems POSSIBLE to try to complete the magic square.

Magic constant = 15.

```
8  1  6
3  5  7
4  9  2
```

EX. 2

-1	73	4
13	37	61
67	1	42

It is NOT POSSIBLE to complete the magic square.

EX. 3

31	73	6
13	-1	61
66	1	43

It seems POSSIBLE to try to complete the magic square.

Magic constant = 110.

IMPOSIBLE to complete the magic square.

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Question 1

Given the integer number 2047, determine the minimum number of bits required to represent it as an unsigned pure binary number.

Question 2

A computer system bus consists of a 32-bit Address Bus and an 8-bit Data Bus. Determine the maximum size of the memory in megabytes (MB) that can be controlled using the mentioned bus.

Question 3

Explain, what is the role of the clock signal in a microprocessor?

Domanda 4 (PROGRAMMAZIONE)

It says "magic square" a 3x3 square matrix of positive integers arranged such that, when added together horizontally, vertically and diagonally, they always give the same result, said magic constant.

Examples of magic square:

1	8	3
6	4	2
5	0	7

Whichever horizontal/vertical/diagonal sum gives the same result, magic constant = 12

31	73	7
13	37	61
67	1	43

Whichever horizontal/vertical/diagonal sum gives the same result, magic constant = 111

Write a C program that can analyze and possibly manipulate an incomplete magic square contained in a file, which name is passed from the command line.

The following assumptions are made:

- Only one value is missing and is indicated with the value -1
- The missing value can be located ONLY on the diagonal composed of the positions (0,2)(1,1)(2,0).

The program shall:

4. Determine, by analyzing the current content of the square (i.e., the entire rows/columns/diagonals), if it is possible to attempt to transform it into a magic square, by replacing the -3 value.
5. If so, print to the screen the magic constant derived from the current content.
6. Calculate the value suitable to make the square magic:
 - c. If exists, display the square completed with the calculated value
 - d. Otherwise, indicate that it is impossible to complete the square.

Examples of execution:

8	1	-3
3	5	7
4	9	2

It is POSSIBLE to attempt to complete the magic square.
The derived magic constant is 15.

8	1	6
3	5	7
4	9	2

31	73	7
13	-3	61
67	1	42

With the current content it is NOT POSSIBLE to attempt to complete the magic square

30	73	7
13	37	60
-3	0	43

It is POSSIBLE to attempt to complete the magic square.
The derived magic constant is 110.
It is NOT POSSIBLE to complete the magic square.