

NAME					SURNAME				
STUDENT ID	S							A/1	
<input type="checkbox"/> AAA-LIB/English <input type="checkbox"/> LIC-ZZZ/English <input type="checkbox"/> Other:									

Question 1	<i>Results:</i>
Given the following numbers expressed in base 10 <ul style="list-style-type: none"> ▪ 24 ▪ 30 Transform these numbers in 2's complement (2C) using 6 bits, and then compute the difference between them checking if there is overflow.	2's complement difference: Overflow:
Steps	

QUESTION 2	
Describe the meaning of the logic operator XOR, and write the truth table.	
Response	

QUESTION 3	
Describe the composition of an iterative construct in C language, highlighting the 4 elements that compose it.	
Response	

QUESTION 4 (Programming)

Consider a coding system for black and white images, in which the shades of gray for each pixel is represented by an integer number between 0 (that means black) and 255 (that means white).

Write a C program able to recognize a determinate sequence of pixel (*sub-img*) of dimension $M \times M$ within of a larger image (*IMG*) of dimension $N \times N$ pixel.

Both the sequences of pixels, the one to be recognized (*sub-img*), and the image (*IMG*) are stored in two different text files, whose names is provided as arguments in the command line. Every pixel is represented inside the files as integer numbers and the numbers are separated with a space character.

Make the following assumptions:

- The image *IMG* has a standard resolution of $N \times N$ pixels, where N is a constant declared using `#define` directive.
- The dimension of image *sub-img* is known a priori, with M defined using a `#define` directive.
- The content of the files is always correct.

The program must to verify the presence of *sub-img* in *IMG* and; in the case that *sub-img* is presented in *IMG*, print on the screen the coordinates $\{x, y\}$ of the pixel representing the starting point of the recognized sequence. It is possible that *sub-img* is presented more than one time within *IMG*; in this case, print on the screen the coordinates of all the occurrences.

Example $N=9, M=3$

gradient.txt	Pattern1.txt	Pattern2.txt
86 88 90 120 80 75 70 121 255	93 125 85	10 15 20
87 93 125 85 45 30 35 124 255	130 80 50	15 80 50
91 130 80 50 32 27 22 125 255	85 65 44	85 65 44
135 85 65 44 15 12 10 12 255		
98 70 50 20 5 0 5 10 255		
86 88 90 120 80 75 70 12 255		
87 93 125 85 45 65 35 11 255		
91 130 80 50 32 27 22 13 255		
135 85 65 44 15 0 5 0 255		

Es. 1

```
C:\> recognition gradient.txt Pattern1.txt
```

```
Match starting from the position(2,2)
```

```
Match starting from the position(7,2)
```

Es. 2

```
C:\> recognition gradient.txt Pattern2.txt
```

```
No Match
```

NAME					SURNAME				
STUDENT ID	S							A/2	
<input type="checkbox"/> AAA-LIB/English <input type="checkbox"/> LIC-ZZZ/English <input type="checkbox"/> Altro:.....									

QUESTION 1	<i>Results</i>
Perform the following transformations of base/coding on the following numbers: i. $ABC_H = X_8$ (Hexadecimal \rightarrow Octal) ii. $10101010_{2C} = X_{SM}$ (Two's complement \rightarrow Sign and Magnitude) iii. $156_8 = X_{10}$ (Octal \rightarrow Decimal)	i. ii. iii.
Steps	

QUESTION 2	
Describe the De Morgan theorem, providing an example.	
Response	

QUESTION 3	
Describe the cast operator of the C language, providing an example.	
Response	

QUESTION 4 (Programming)

A text file in ASCII format contains the thermal map of dimension $N \times N$ of a mother board of a computer. The map describes the temperature (in Celsius degree) of each single portion of the board. The possible values are integer values starting from 0 to 145 °C. The sensibility of the thermal sensors used for the measurements is equal to 1 °C. Within of the file, the values of the temperatures are separated by a space.

Write a C program able to verify the presence of a sub-region of dimension $M \times M$ (where $M < N$) inside the map containing the thermal conditions contained in a second text file. These thermal conditions are represented with the same coding used for the Thermal map (temperatures from 0 to 145 °C, sensibility of the measurements equal to 1°C).

Make the following assumptions:

- The name of the file containing the thermal map of dimension $N \times N$ is `ThermalMap.txt`
- N is a fixed constant known a priori, defined using a `#define` directive.
- The name of the file containing the thermal conditions that have to be searched is provided as a unique argument on the command line.
- M (dimension of the sub-region to be found) is known a priori and is defined using the `#define` directive.
- The content of the files is always correct.

The program has to print on the screen the coordinates $\{x,y\}$ of the upper-left corner of the sub-regions containing the searched thermal condition (if present). It is possible that there are more than one occurrence; in this case, the program has to print on the screen all the starting positions.

Example $N=9, M=3$

ThermalMap.txt	Temp1.txt	Temp2.txt
40 41 42 41 39 38 32 40 20	42 41 40	80 65 33
38 70 76 79 46 45 42 40 35	76 43 39	65 64 33
37 75 80 65 33 32 27 22 20	80 34 33	54 59 33
42 73 65 64 33 31 28 23 21		
40 65 54 59 33 31 22 20 18		
41 37 35 32 60 58 43 37 24		
37 75 80 65 33 32 26 24 22		
42 73 65 64 33 31 30 38 27		
40 65 54 59 33 31 31 30 27		

```
C:\> recognition Temp1.txt
```

```
No regions in the searched thermal condition
```

```
C:\> recognition Temp2.txt
```

```
Thermal condition occurred in position (3,3)
```

```
Thermal condition occurred in position (7,3)
```