Name and Surname	
Student ID	
Course	

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SIGN)☐ 16(SIGO-TRIO)☐ 17(TRIP-ZZZ)☐ 18(Automotive)☐Solo Prog☐

Theory

Question 1

	Results
Given the following binary numbers in 2's complement, determine their decimal representations: 11100001 (8bit) 100001 (6bit) 0011 (4bit)	n1: n2: n3:
The most significant passages to arrive the result	

Question 2

Given the following truth table:

a	*b*	*c*	*f*
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Indicate which of the following Boolean functions corresponds to the above truth table and explain why:
1. $f(a,b,c) = a + (b + c) + a$
2. $f(a,b,c) = ab + bca$
3. $f(a,b,c) = a(b + c)a$

Function:

Explanation:

Question 3

Describe the main functions of the registers within the CPU and cite some examples.

Programming

A text file contains the map of an area in the sea. The dimension of the map is **ROWS×COLUMNS**, where **ROWS** and **COLUMNS** are two numeric constants defined with **#define**; in the map, sharps (**#**) represent the land and dots (**.**) represent the sea.

Write a program to interrogate the map. In details, the program should read the file name of the map by passing it as the first argument of the command line. Afterwards, the program should allow the user to input the coordinates of points in the format of "**ROW COLUMN**" and verify that:
- Whether the point is on an island or in the sea;
- If the point is in the sea, identify the direction (**UP, DOWN, RIGHT, LEFT**) in which we should swim in order to reach the nearest island (the swimming is always in the same direction). If we cannot reach any island in the four directions, the program should report that it is not possible to reach an island in the four directions.

The insertion of the points terminates when the user input the point "**-1 -1**".

The following assumptions are assumed:
- The content of the file is correct
- All the islands are rectangular
- The point in the upper left corner has the coordinate (0, 0)
- The user may enter a pair of invalid coordinate (outside the map). In this case, the program should indicate error and ask the user to input a new coordinate.

Example
With **ROWS=10**, **COLUMNS=40**. The file **map.dat** is:

```
........................................
....#####...............................
....#####...............................
....#####..............#############..
....#####.....###.......#############..
....#####.....###.......................
..............###........######.........
..............###........######.........
.........................######.........
........................................
```

Execution of the program:

```
C:\>EXAM.EXE map.dat
Insert the coordinate (R C): 5 12
The nearest island is in the right direction.
Insert the coordinate (R C): 8 6
The nearest island is in the up direction.
Insert the coordinate (R C): 10 0
The point is outside the map. Input again.
Insert the coordinate (R C): 0 20
It is not possible to reach an island.
Insert the coordinate (R C): -1 -1
Program terminated.
```

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SIGN)☐ 16(SIGO-TRIO)☐ 17(TRIP-ZZZ)☐ 18(Automotive)☐Solo Prog☐

Theory

Question 1

	Results
Given the following binary numbers represented in magnitude and sign, determine their decimal representations: 11100001 (8bit) 110001 (6bit) 0001 (4bit)	n1: n2: n3:
The most significant steps to arrive the result	

Question 2

Given the following truth table:	Function:
	Explanation:

a	*b*	*c*	*f*
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

Indicate which of the following Boolean functions corresponds to the above truth table and explain why:

1. $f(a,b,c) = a\,b + c\,a$
2. $f(a,b,c) = a + bca$
3. $f(a,b,c) = a + (b + c) + a$

Question 3

Describe what is the ASCII encoding.

Programming

A text file contains the map of an area in the sea. The dimension of the map is **ROWS×COLUMNS**, where **ROWS** and **COLUMNS** are two numeric constants defined with **#define**; in the map, stars (*****) represent the land and equals (=) represent the sea.

Write a program to query the map. In details, the program should read the file name of the map by passing it as the first argument of the command line. Afterwards, the program should allow the user to input the coordinates of points in the format of "**ROW COLUMN**" and verify that:
- Whether the point is on an island or in the sea;
- If the point is in an island, the dimensions of the island.

The insertion of the points terminates when the user input the point "**-1 -1**".

The following assumptions are assumed:
- The content of the file is correct
- All the islands are rectangular
- The point in the upper left corner has the coordinate (0, 0)
- The user may enter a pair of invalid coordinate (outside the map). In this case, the program should indicate error and ask the user to input a new coordinate.

Example
With **ROWS=10**, **COLUMNS=40**. The file **map.dat** is:

```
========================================
====*****===============================
====*****===============================
====*****==============*************==
====*****=====***=======*************==
====*****=====***=======================
=============***========*****=========
=============***========*****=========
========================*****=========
========================================
```

Execution of the program:

```
C:\>EXAM.EXE map.dat
Insert the coordinate (R C): 5 12
The point is in the sea.
Insert the coordinate (R C): 2 5
The point is within an island 5x5.
Insert the coordinate (R C): 10 0
The point is outside the map. Input again.
Insert the coordinate (R C): 5 15
The point is within an island 4x3.
Insert the coordinate (R C): -1 -1
Program terminated
```