

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

QUESTION 1	<i>Results</i>
The following numbers n1 and n2 are 8-bits in 2's complement form, calculate their values in decimal. n1= 01010101 n2= 10010001	n1 ₁₀ : n2 ₁₀ :
Steps:	

QUESTION 2
Compute the true table of the following boolean function: $f(A,B,C)=((A \cdot B') \cdot (A+C')) + (C + C')$ Answer:

QUESTION 3
Explain the functions of the internal clock inside a microprocessor. What impact the clock period has on the execution of the instructions? Answer:

QUESTION 4 (Programming)

Write a C program to count how many times two words appear consecutively (the first word followed by the second word immediately or the second word is immediately followed by the first word) in a text file.

To implement this program, we make following assumptions:

- The two words you need to count are specified through command line arguments
- The file name is "MyTextFile.txt"
- The file contains multiple lines
- The words inside the file are separated by one or more spaces
- The punctuations (e.g. comma ',', period '.') should be ignored during comparisons
- There may be duplicated punctuation such as "!!" and "??"
- The program should execute in a case-insensitive way, e.g. "How" and "hoW" are the same word
- The two words should be considered consecutive even if they are in different lines (providing there is no other words between them)
- The size of the file is NOT known
- Each word has a maximum length of 20 characters

An example of "MyTextFile.txt" contains following text:

```
Yes, and how many times must a man look up  
before he can see the sky?
```

Example executions of the program:

```
C:\> count.exe yes and  
The words "yes" and "and" appear consecutively in the text (1 time)
```

```
C:\> count.exe how times  
The words "how" and "times" didn't appear consecutively in the text
```

```
C:\> count.exe before Up  
The words "before" and "Up" appear consecutively in the text (1  
time)
```

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QUESTION 1	<i>Results</i>
The following numbers n1 and n2 are in Sign and Magnitude form, calculate their values in decimal n1= 11010101 n2= 00010001	n1 ₁₀ : n2 ₁₀ :
Steps	

QUESTION 2	
Compute the truth table for the following boolean function: $f(A,B,C)=(A \cdot B') + (B \cdot C') + (A \cdot A')$	
Answer:	

QUESTION 3	
List and explain briefly steps of the instruction execution cycles based on a microprocessor.	
Answer:	

QUESTION 4 (Programming)

Write a C program to determine if a design in black and white contains at least one black square of size NxN. The size of the design is 1024x1024 and stored in a file, where "0" represents white (the background) and "1" represents black (the figures). An area in the design is considered as black square if and only if it is surrounded by a white border.

To implement the program, we make the following assumptions:

- The filename is specified on the command line as the first argument
- The value of N is specified on the command line as the second argument, and less than 1024
- No black square is directly in contact with the edge, that is the first and last row, the first and last column are always white
- The format of the file is always correct (1024 lines of 1024 “1”s or “0”s)

Example 1: in file **fig1.txt** (all the rest of 1024x1024 is 0 and not shown here for space limitation):

[illegible]

```
C:\> checksquare.exe fig1.txt 6
```

The design contains one black square of 6x6.

Example 2: in file **fig2.txt** (all the rest of 1024x1024 is 0 and not shown here for space limitation):

[illegible]

```
C:\> checksquare.exe fig2.txt 6
```

The design does not contain black square of 6x6.

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QUESTION 1	<i>Results</i>
The following numbers n1 and n2 are 8-bits in 2's complement form, calculate the sum of the two numbers and check if there is an overflow n1= 11010101 n2= 01000001	n1 (CA2) + n2 (CA2) = Overflow:
Steps	

QUESTION 2	
Compute the truth table of the following boolean function: $f(A,B,C)=(B + A') + (B \cdot C') + (B' \cdot B)$	
Answer:	

QUESTION 3	
Explain what is done during the link phase of a program. In particular, what types of files are used as input files and what types of output files are generated by the linker.	
Answer:	

QUESTION 4 (PROGRAMMING)

Given a design in white, black and yellow, write a C program to check if all the squares of “yellow” of size NxN are completely surrounded by a black border.

To implement the program, we make following assumptions:

- The name of file containing the design is specified on command line as the first argument
- The value of N is specified on command line as the second argument
- A pixel is considered adjacent to other 8 pixels: left/right, up/down and 4 diagonals
- The size of the design is 1024x1024 (i.e. the file contains 1024 lines of 1024 characters), where “0” represents white (the background), “1” represents black and “2” yellow
- No square of “yellow” is directly in contact with the edges, that is, the first/last row and the first/last column contain only “0”
- The format of the file is always correct

Example 1: in the file **fig1.txt** (all the rest of 1024x1024 is 0 and not shown here for space limitation):

```

00000000000000000000000000000000
0011111100001111110001100001100
0012222100001122110001100010000
0012222100001111110000011100000
00122221000000011111111000000000
00122221000000000001111111110000
00111111000000000000000000000000
00000000000011111111100000000000
00000000000000000000000000000000

```

```
C:\> checkblackboard.exe fig1.txt 4
```

All the yellow squares of 4×4 in the design have a black border.

Example 2: in the file **fig2.txt** (all the rest of 1024x1024 is 0 and not shown here for space limitation):

```

00000000000000000000000000000000
001111110000111111000111111100
0012222100001111110001122221000
0012222100001111110000122221000
00122221000000011111110122221000
00122221000000000001111022220000
00111111000000000000000000000000
00000000000011111111000000000000
00000000000000000000000000000000

```

```
C:\> checkblackboard.exe fig2.txt 4
```

NOT all the yellow squares of 4x4 in the design have a black border.