

No. of Pages	2
No. of Questions	4

Department of Computer Science and Engineering
MIDTERM EXAMINATION Summer 2015
CSE260: Digital Logic Design
Total Marks: 100 **Time Allowed: 1 hours**

-
- Answer ALL questions
-

Question No. 1

- a) Given the following 4 variable boolean functions ***X***, ***Y***, ***F1*** and ***F2***

$$X(A, B, C, D) = A.C' + B'.D + B.C.D'$$

$$Y(A, B, C, D) = C'.D + B.D$$

$$F1(A, B, C, D) = X(A, B, C, D) . Y(A, B, C, D)$$

$$F2(A, B, C, D) = X(A, B, C, D) + Y(A, B, C, D)$$

Write down the **simplified SOP** expressions for ***F1*** and ***F2***. You may use any method you want.

- b) Write down **the three equations** ($A=B$, $A>B$, $A<B$) for a **6 bit** magnitude comparator.
- c) Construct AND, OR and NOT gates using only NOR gates.

(30 marks)

Question No. 2

In a musical contest, there are 3 judges who mark a contestant out of 21 in total. Each judge can give any mark from 0 to 7. There is no negative marking. Provided the judges will give their marks in binary numbers, you are required to design a circuit that will add up mark the marks obtained by the contestant and also at the end it will show how much mark the contestant has lost.

Clue: You can use as many full adders, 3 bit parallel adders and 5 bit adder cum subtractors you need

(20 marks)

Question No. 3

- a) State the range of a 10 bit 2's complement system.
- b) Represent +67 and -49 using an 8 bit **1's complement number system**, **2's complement number system** and in **sign-magnitude number system**.
- c) Using the binary numbers found above or otherwise, subtract -49 from -67 using the **1's complement method** of subtraction.

- d) Using appropriate justifications, comment on whether your answer in part (c) is an overflow or not.

(15 marks)

Question No. 4

The ongoing EBOLA epidemic in the African continent has scared the authorities at Hajrat Shahjalal International Airport in Dhaka and they have asked the CSE department of BRACU to design a system that would help them to decide what to do with people coming in from African countries that are risk. The Airport authorities has approved the following specifications for the system:

Input (4 variables)

F = 0 indicates the passenger *DOES NOT* have FEVER.

H = 1 indicates the passenger *HAS* a SEVERE HEADACHE.

M = 0 indicates the passenger *DOES NOT* have MUSCLE PAIN.

A = 1 indicates the passenger *HAS* ABDONIMAL (STOMACH) PAIN.

Output (3 variables)

Q = 1 indicates *the passenger should be quarantined* (Kept locked up in a separate area and not let anyone come in contact with him or her so as to prevent EBOLA from spreading).

T = 1 indicates *the passenger is at RISK and needs to be tested*.

G = 1 indicates *the passenger is free to go*.

The Airport authorities has asked us to consider the following points when designing the system:

1. A passenger who has FEVER and MUSCLE PAIN and any one of the other two symptoms (STOMACH PAIN or SEVERE HEADACHE) should be QUARANTINED.
2. A passenger who has TWO OR MORE symptoms out of the four should be sent for testing.
3. A passenger who does not fall in any of the above criteria is free to go.

PLEASE NOTE THAT THIS POINTS ARE GIVEN IN ORDER OF PRIORITY ... so 1 HAS THE HIGHEST PRIORITY AND 3 HAS THE LOWEST.

- a) Using the above specification, prepare a truth table for the system.

(15 marks)

- b) Using 4 variable Karnaugh-Map method, derive SOP expressions for all of the three outputs.

(20 marks)

THE END