National University of Computer and Emerging Sciences, Lahore Campus



Course: Digital Logic Design
Program: BS(Computer Science)
60 Minutes

Duration: 60 Minutes
Paper Date: 1st Oct 2018

Section: ALL Exam: Midterm-I

Course Code: EE227
Semester: Fall 2018
Total Marks: 60
Weight 15%
Page(s): 5

Roll No. Section:

Instruction/Notes:

- Attempt all the questions on this answer booklet. You can use extra sheets for your scratch work but they will not be collected and marked.
- Make sure you write your roll # on EVERY sheet of the booklet.
- Use of calculator is not allowed.

Question 1 [2+3+3+3+3=14 Marks] Short Questions

- i. 1's complement of a number N is 0110 1101, 2's Complement of N will be ______
- ii. If F(X, Y, Z) = XY + X'Y'Z then F' =
- iii. $F(A,B,C,D,E) = m_{23}$. Algebraic expression for F will be F =
- iv. $(10100)_2 + (30)_8 = (_____)_{10}$
- v. **Dual** of Boolean expression (X'+0+Z'). (X+Y'+Z) will be

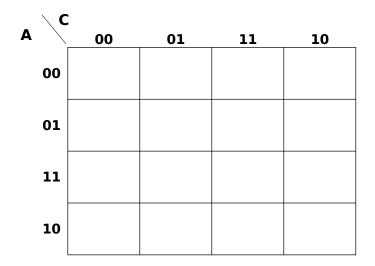
Question 2 [10 x 3 = 30 Marks] A Boolean function is given as follows:

$$F(A,B,C,D) = \sum m(0,2,10,11)$$

d(A,B,C,D) = \sum m(1,3, 4, 6, 8, 9, 12, 14) [don't care]

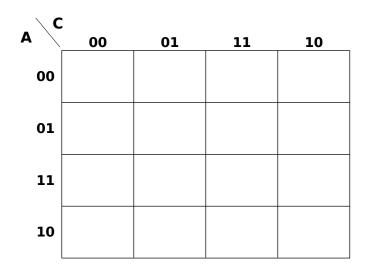
Use only **given KMaps** to optimize the function into:

(i) Sum of Product (SOP) form



 $F(A,B,C,D) = \underline{\hspace{1cm}}$

(ii) Product of Sum (POS) form



 $F(A,B,C,D) = \underline{\hspace{1cm}}$

(iii) Implement the following optimized function with NAND gates ONLY. Complements of inputs are not directly available.

$$F(A,B,C) = AB'+(A'B)C$$

| Question 3 [16 Marks]: We want to design a combinational circuit that computes the function $f(X) = 2X + 2$ for a 2-bit X: | | |
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| (a) How many bits do we need for output? (3 points) | | |
| (b) Draw the truth table for this function. (4 points) | | |
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| (c) Write Simplified Boolean Expression(s) | (3 points) |
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| (d) Draw Circuit Diagram (6) | |
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ROUGH SHEET