United International University
Department of Computer Science and Engineering
CSE 1325/CSE225 Digital Logic Design,
Mid Exam, Fall 2019
Total Marks: 30, Time: 1 hour 45 minutes

Answer Any 2 Questions from Q1 to Q3

1. (a) Find the value of x, for when $(346)_7 = (501)_x$ [3]

   (b) Convert $(2346)_{10}$ and $(8555)_{10}$ into their BCD form and perform BCD addition. [3]

2. (a) Convert the following expression into sum of minterms and product of maxterms. [3]

$$F(A, B, C) = AC + BC' + A'B'$$

   (b) Prove the following Boolean Theorem using Boolean Algebra: [3]

$$(A + B)(A' + C)(B + C) = (A + B)(A' + C)$$

3. Reduce the following Boolean Expression to the indicated numbers of literals using Boolean Algebra Manipulation. [3+3=6]

   (a) $A'B(D' + C'D) + B(A + A'CD)$ to one literal.

   (b) $(A' + C)(A' + C')(A + B + C'D)$ to four literals.

Answer Any 2 Questions from Q4 to Q6

4. Optimize the following function using K-map technique. In your solution, you have to show (i) all prime implicants, (ii) all essential prime implicants and (iii) minimized sum-of-products form. [6]

   $F(A, B, C, D) = \sum m(0, 4, 6, 8, 14)$
   $d(A, B, C, D) = \sum m(2, 5, 7, 9, 10, 11, 13)$

5. Optimize the following Boolean function F in i) simplified sum-of-products (SOP) and ii) simplified product-of-sums (POS) form. Among minimized SOP and POS, which one do you think will be easy to implement and why? [4+2=6]

$$F(A, B, C, D) = \sum m(1, 5, 6, 7, 11, 12, 13, 15)$$

6. Optimize the following function using K-map. You have to show the minimized product-of-sums form. [6]

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

Answer Any 1 Question from Q7 to Q8

7. You have to design a combinational circuit that will take a 4-bit binary number as input, and output 1 if the input is even but not divisible by 3. For example:

   - Input 0100: output 1 (even number)
   - Input 0101: output 0 (odd number)
   - Input 0110: output 0 (even number but also divisible by 3)

   You have to (i) find the simplified expression for the output bit in Sum-of-Products form, and (ii) draw the circuit diagram using basic gates. [6]

8. You have to design a combinational circuit that will take a 4-bit binary number as input, and output 1 if the input contains at least 2 zeros. For example:

   (a) Input 0000: output 1 (4 zeros)

   (b) Input 0001: output 1 (3 zeros)

   (c) Input 0011: output 1 (2 zeros)

   (d) Input 0111: output 0 (1 zero)

   You have to (i) find the simplified expression for the output bit in Sum-of-Products form, and (ii) draw the circuit diagram using basic gates. [6]