United International University (UIU)

Department of Computer Science and Engineering

CSE 1325/225: DIGITAL LOGIC DESIGN, Midterm Fall 2021

Total Marks: **30** Duration: 1 hour 45 Min

Answer Any Two Questions from Q1 to Q3

1.	a) Represent the numbers $(911)_{10}$ and $(119)_{10}$ in BCD, and then show the steps necessary to form their sum. b) Determine the radix r in the following case: $(911)_r = (1101)_{10}$	[3] [3]
2.	a) Simplify the following Boolean Expression (using algebraic manipulation) to an expression containing a minimum number of literals: $A + B\,(C + \overline{A + C}\,)$ b) Convert the following expression into both canonical SoP and canonical PoS forms: $G\,(L, M, N) = (L + MN)(M + LN)$	[2] [4]
3.	a) Prove that the following Boolean Function is self-dual. Then find its complement. $H(P, Q, R) = (\bar{P} + \bar{Q})(\bar{Q} + \bar{R})(\bar{R} + \bar{P})$ b) Reduce the following Boolean Expression (using algebraic manipulation) to three literals: $\overline{(\bar{X}\,\bar{Y} + Z)} + Z + XY + WZ$	[3] [3]

Answer Any Two Questions from Q4 to Q6

4.	Optimize the following Boolean functions F together with the don't-care conditions d. Find all prime implicants and essential prime implicants, and apply the selection rule. $F(W, X, Y, Z) = \Sigma_m(4, 6, 7, 8, 12, 15)$ $d(W, X, Y, Z) = \Sigma_m(2, 3, 5, 10, 11, 14)$	[6]
5.	Optimize the following Boolean functions using K-map in (i) product-of-sums form, (ii) sum of products form $H(A, B, C, D) = \Pi_M(0, 2, 6, 7, 8, 9, 10, 12, 14, 15)$	[6]
6.	Optimize the following expressions using K-map in (1) sum of products and (2) product of sums forms. Which one will you choose to implement the circuit diagram considering cost criteria? $G(A, B, C, D) = A\bar{C} + \bar{B}D + \bar{A}CD + ABCD$	[6]

Answer Any One Question from Q7 and Q8

7.	You have to design a combinational circuit that will take a 4-bit binary number as input and give output 1 if the number is **greater than 4 but less than 14**. 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. For example, a. Input: 0000, Output: 0 (Input<4) b. Input: 0100, Output: 0 (Input=4) c. Input: 1001, Output: 1 (Input>4) d. Input: 1110, Output: 0 (Input=14)	[6]

8.	You have to design a combinational circuit that will take a 4-bit binary number as input and give output 1 if the **number of '0's is even or equal to 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. For example, a. Input: 0110, Output: 1 (2 zeroes, even) b. Input: 1111, Output: 1 (0 zeroes, even) c. Input: 0001, Output: 1 (3 zeroes, 3) d. Input: 0111, Output: 0 (1 zeroes, odd)	[6]