United International **University (UIU)**

Department of Computer Science and Engineering

CSE 1325: DIGITAL LOGIC DESIGN, Midterm Fall 2024

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

[Any examinee found adopting unfair means including copy from another examinee will be expelled from the trimester/program as per UIU disciplinary rules.]

Answer <u>All</u> Questions

1.	X=0010|0011|0100. Y=0100|0011|0010. Apply Following operation on above Numbers A) Calculate the excess three codes of each block of the X and Y. B)Convert the excess three codes into BCD. C)Perform the BCD Addition on converted BCD's.	**[5]**
2.	A) Simplify the following Boolean Expression (using **algebraic manipulation)** to an expression containing minimum number of literals. You have to write the identity/formula you use in every step. $F(A,B,C,D) = \overline{(\bar{A}\,B\ + B\,\bar{C})}\,.\,\overline{A\bar{B}}$ B)Convert the following expression into both canonical SoP (SOM) and canonical PoS (POM) forms using Boolean algebra: $F(A,B,C,D) = D\ (\ \bar{A} + B\ ) + \ \bar{B}\,D$	**[2]** **[3]**
3.	Optimize the following function using K-map. Your answer should be in simplified Product of Sum (POS) form. $G(P,Q,R,S) = \ (\mathrm{P} + \overline{\mathrm{Q}}\ + \overline{\mathrm{S}})(\overline{\mathrm{P}}\ + \overline{Q}\ + \mathrm{S})(\overline{\mathrm{P}} + \mathrm{R} + \bar{S})(\mathrm{Q} + \overline{\mathrm{R}}\ + \overline{\mathrm{S}})(\mathrm{R} + \mathrm{S})$	**[5]**
4.	For the following function considering don't care conditions: A) Find all the Prime implicants, B) Find all the Essential Prime implicants C) Find the simplified expression in Product of Sum (SOP) form. $F(A,B,C,D) = \sum_m(0,2,5,6,8,9,10,12,13) + \sum_d(11)$	**[5]**
5.	Consider the following Boolean function. Optimize the function using K-map in– A) Sum of Product (SOP) form B) Product of Sum (POS) form C) Between minimized SOP and POS, which form would you prefer to implement the Boolean function? Give your justification. $F(A,B,C,D) = \prod_M(1,3,4,6,7,9,11,13)$	**[5]**

6.	You are tasked with designing a security system for a locker. The system takes a 4 bit binary number as input. The locker will be unlocked if the first two bits are greater than the second two bits. Design a combinational circuit that will take the 4 bit binary number as input, and compare the first two bits (Most Significant Bits) with the second two bits (Least Significant Bits). The output of the circuit will be HIGH if the first two bits are greater than the second two bits, and will be low if the first two bits are lower than the second two bits. In any other case, consider "Don't Care" as the output. For Example: • 00 11, First two bits: 00, Second two bits: 11, 00 < 11, Output: 0 • 10 00, First two bits: 10, Second two bits: 00, 10 > 00, Output: 1 • 11 11, First two bits: 10, Second two bits: 10, 10=10, Output: X Find a minimized expression for the output function in Sum-of-Products form and draw the circuit diagram using **PLA**.	**[5]**