United International **University (UIU)**

Department of Computer Science and Engineering

CSE 1325: DIGITAL LOGIC DESIGN, Midterm Fall 2023

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. A) Convert the Hexadecimal number E4D6.B to octal, decimal and binary numbers. [2]

B) Perform the following conversion by using base 2 instead of base 10 as the intermediate base for the conversion: $(103)_4$ to octal. [3]

2. A) Using Boolean identities, reduce the given Boolean expression: [2]

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

B) Convert the following expression into both canonical SoP and canonical PoS forms using Boolean algebra : [3]

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

3. For the following function: (i) Find all the Prime implicants, (ii) Find all the essential prime implicants and (iii) Find a simplified expression in Sum of Product (SOP). [5]

$$F\ (A, B, C, D) = \prod_M(3,5,7,12,14) + \sum_d(0,1,6,10,11)$$

4. Consider the following non-canonical function. Find the simplified expression in Sum of Product (SOP) and Product of Sum (POS) using k-map. [5]

$$F(P, Q, R, S) = PQ'R + P'QRS' + PQR'S + PQR$$

5. Optimize the following Boolean functions using K-map in (i) Sum of Product (SOP) form, (ii) Product of Sum (POS) form (iii) Between minimized SOP and POS, which one do you think will be easy to implement and why? [5]

$$G(X, Z, Y, W) = \sum_m(0,2,6,7,8,10,12,13,14)$$

6. Your best friend's birthday is coming up in two weeks and you want to gift him something special! You want to design a box that would open its lid and dispense chocolates to your friend for the next two weeks. Knowing DLD, you figured you could make a circuit that would control the box's lid. However, you want to give him chocolates on weekdays only, on weekends the box should not open.

Now, design a combinational circuit that opens the box on weekdays for two weeks. Consider that the week starts on Saturday, and Thursday and Friday (your friend is also in UIU!) are the weekend. **Start your cases by mapping binary 0 to Saturday and continue for 14 days**. For all unmapped cases, consider "don't care" as the output. A table with sample input-output cases is given below for your reference.

Input	Case	Output	Reason
0000	1st Saturday	1	Weekday, so the box should open.
0001	1st Sunday	1	
0101	1st Thursday	0	Weekend, so the box shouldn't open.
0111	2nd Saturday	1	Weekday, so the box should open.
1111	-	X	It is not needed for the mapping.

In your design process, show the following steps:

(i) Show the entire truth table. [2]

(ii) Find the simplified expression for the output bits in the Product-of-Sum (POS) form using k-map. [2]

(iii) Draw the circuit diagram using basic gates. [1]