United International **University (UIU)**

Department of Computer Science and Engineering

CSE 1325: DIGITAL LOGIC DESIGN, Final Summer 2023

Total Marks: **40** Duration: 2 hours

Answer ALL Questions

1. Implement a sequence recognizer using T or J-K flip-flops that can detect the "1010" subsequences, while overlap will be supported between detected subsequences.

For this design:

A. Draw the state diagram by using gray code for assigning state. [1.5]

B. Draw the state table with output and Flip Flop inputs. [2]

C. Minimize the functions of output and Flip Flop inputs. [2]

D. Draw the circuit diagram using the block diagram of Flip Flops and basic gates. [1.5]

E. For an input bit sequence of x= "**1010100011010010 10**", what will be the output bit sequence? [1]

2. A. Design a 3-bit universal shift register with the functions given in the function table below. Here two control bits X and Y determine the mode of operation. Use D Flip Flops for your design. [6]

X	Y	Operation
0	0	Toggle
0	1	Parallel Load
1	0	Shift Right
1	1	Shift Left

B. Design a 4-bit asynchronous Downward Ripple Counter using negative edge J-K Flip Flops. [2]

3. A sequential circuit has two D flip flops, one input X, and one output y is specified by the following input equations:

$$A(t+1) = Ax \oplus B'x'$$
$$B(t+1) = (A' + B)x$$
$$y(t+1) = Ax' + (B' \oplus x)$$

A. Draw the logic diagram of the circuit. [2.5]

B. Derive the state table. [3]

C. Derive the state diagram. [2.5]

4. You are tasked with designing an alarm system for a security application. The system has multiple sensors: Door Sensor, Window Sensor, Motion Sensor, and Fire Sensor. Design a priority encoder circuit that detects the highest priority event among these sensors. Assume that Fire Sensor has the highest priority, followed by Motion Sensor, Door Sensor, and Window Sensor. [4]

5.	Design a 16:1 MUX using 4:1 MUX (as many as you require) only.	[4]
6.	Design an Octal to Binary Encoder. A. Draw the function table B. Write the equations for the output of your encoder. C. Draw the logic diagram of the encoder.	[4]
7.	Implement the following functions using a decoder and OR gates only. $F(X, Y, Z) = \prod M(0,3,5,6)$	[4]

Excitation Tables for different Flip-Flops

Q(t)	Q(t+1)	J	K	Operation
0	0	0	x	No change/reset
0	1	1	x	Set/complement
1	0	x	1	Reset/complement
1	1	x	0	No change/set

Q(t)	Q(t+1)	T	Operation
0	0	0	No change
0	1	1	Complement
1	0	1	Complement
1	1	0	No change