ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION SUMMER SEMESTER, 2022-2023

DURATION: 3 HOURS FULL MARKS: 150

CSE 4205: Digital Logic Design

Programmable calculators are not allowed. Do not write anything on the question paper.

Answer all 6 (six) questions. Figures in the right margin indicate full marks of questions with corresponding COs and POs in parentheses.

1. In your university lab, there are 2 sequential elements - edge triggered JK flip flop and D flip flop. For a new project, you require an SR flip flop but due to budget shortage your request for buying one has been declined.

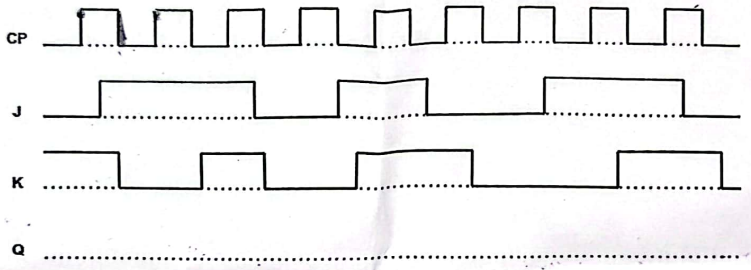

Figure 1: Timeline diagram for Question 1.b

a) What is a sequential circuit? How is it different from a combinational circuit? 5 (CO1) (PO1)

b) Complete the timeline diagram shown in Figure 1 by drawing the output of Q. 8 (CO3) (PO1)

c) As you cannot buy an SR flip flop, build one using a D flip flop. Show all the necessary steps of designing the flip flop from the D flip flop. 12 (CO4) (PO1)

2. a) What are the advantages of tabular method over K-map? 5 (CO1) (PO1)

b) Minimize the following function using tabular method. 20 (CO2) (PO1)
$F(A,B,C,D) = \sum m(0,3,5,6,7,10,12,13) + \sum d(2,9,15)$

3. The National Intelligence Agency has a dedicated project which focuses on identifying signals which may contain secret war information. Recently they have been informed from a trusted source that country X will be using signal 0010 to indicate missile drop and country Y will be using signal 0001 to indicate coastal attack. Given the situation, they formed a team to build a system that recognizes both of the signals.

a) Draw the state diagram to build the system that will recognize both of the mentioned signals and give 1 as output upon recognizing. 13 (CO2) (PO2)

b) Design and draw the final circuit from the state diagram. Show all the necessary steps. 16 (CO1) (PO3)

c) If a long signal 11000010001101001011 is passed through your designed system, what will be the output sequence generated by the system? 6 (CO3) (PO1)

4. In Panem, there are 8 districts. The country has made a rule that each day only one district will get food supply. The Capitol of Panem is in charge to apply this rule. Each day all of the 8 districts sends an electronic request for the supply to the Capitol and only one district will be chosen. They have a combinational circuit to perform this task based on a selecting condition.

a) Which combinational element is suitable to use by the Capitol? Explain how it works and draw the circuit diagram. 12 (CO2) (PO2)

b) Using the mentioned combinational element, implement the following function: $F(A, B, C) = \sum(0, 1, 3, 6, 7)$. 13 (CO2) (PO2)

5. a) Determine the contamination delay and propagation delay of the circuit in Figure 2. Use the information provided in Table 1. 8 (CO3) (PO2)

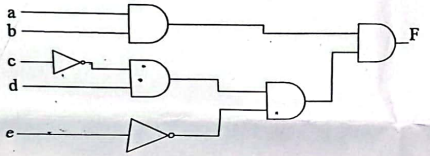

Figure 2: Circuit diagram for Question 5.a

Table 1: Information for Question 5.a

Gate	t_{pd} (ps)	t_{cd} (ps)
NOT	15	10
AND	40	30
OR	35	30
XOR	60	40

b) Reduce the states of the diagram in Figure 3 and draw the final state diagram. 17 (CO2) (PO2)

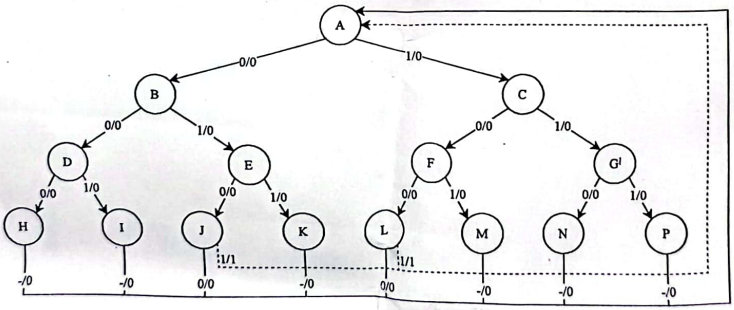

Figure 3: State diagram for Question 5.b

6. a) What is an excitation table? Explain with an example. 5 (CO1) (PO1)

b) What is a race around condition? Design a flip flop that overcomes this condition. Briefly explain how it overcomes the problem. 2 + 8 (CO4) (PO1)