

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION
DURATION: 3 HOURS

SUMMER SEMESTER, 2021-2022
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 whereas corresponding CO and PO are written within parentheses.

1. The block diagram in Figure 1 represents how a BCD code (ABCD) is displayed in a 7-Segment Display. The truth table in Figure 2 contains 4-bit input of BCD to 7-bit output of a 7-Segment Display.

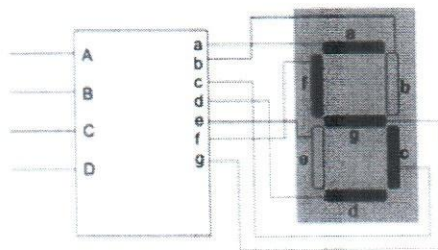


Figure 1: Block Diagram for Question 1.

Decimal Digit	Input lines				Output lines							Display pattern
	A	B	C	D	a	b	c	d	e	f	g	
0	0	0	0	0	1	1	1	1	1	1	0	0
1	0	0	0	1	0	1	1	0	0	0	0	1
2	0	0	1	0	1	1	0	1	1	0	1	2
3	0	0	1	1	1	1	1	1	0	0	1	3
4	0	1	0	0	0	1	1	0	0	1	1	4
5	0	1	0	1	1	0	1	1	0	1	1	5
6	0	1	1	0	1	0	1	1	1	1	1	6
7	0	1	1	1	1	1	1	0	0	0	0	7
8	1	0	0	0	1	1	1	1	1	1	1	8
9	1	0	0	1	1	1	1	1	0	1	1	9

Figure 2: Truth Table for Question 1.

- a) Design the combinational logic circuit (follow the design process) whose input is a 4 bit number (A,B,C,D) and output is a 7-bit display line (a,b,c,d,e,f,g) following the above truth table. 20
(CO3)
(PO1)
- b) Use an appropriate decoder and necessary number of OR gates to implement the combinational logic circuit presented in Question 1. a). 10
(CO2)
(PO1)

2. a) A binary Ripple Adder is a digital circuit used to perform addition of two binary numbers. It is called a Ripple Adder because the carry bit ripples through the circuit from LSB to MSB as each bit is added.
- Is there any design issue regarding efficiency, power consumption, correctness, scalability etc. with this type of circuit for addition purpose? Explain those issues.
 - Design a different type of binary adder circuit which can overcome these issues.
- b) Analyze the following logic diagram in Figure 3.

5 + 3
(CO3)
(PO1)

10
(CO1)
(PO1)

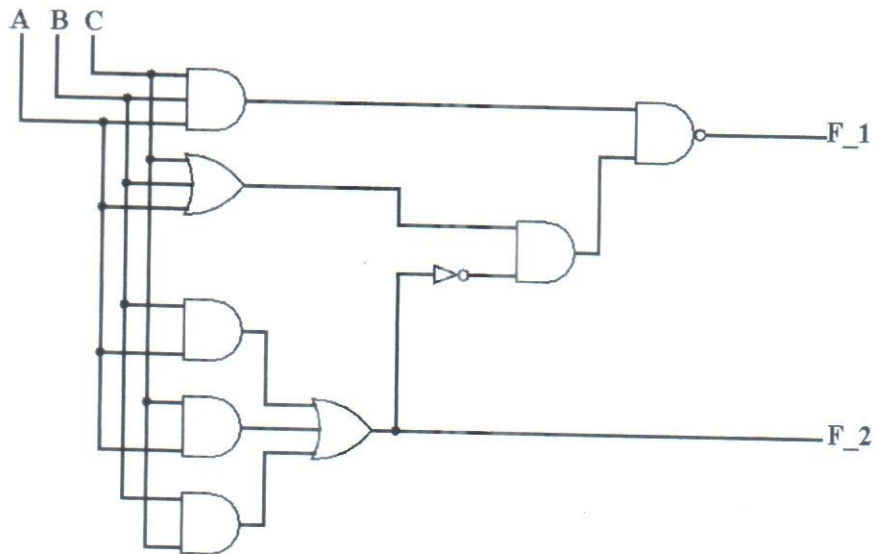


Figure 3: Logic Diagram for Question 4. b).

3. Your teacher has asked you to develop a boolean function on the training board with 5 input switches named A,B,C,D, and E. There will be only 1 output. The output LED will turn on for the following conditions:
- if all switches are turned off.
 - if only switch A or only switch C or only switch E is turned on.
 - if only switches A and E, or only switches C and E are turned on.
 - if only switches A, B, and E, or only switches A, C, and E are turned on.
 - if only switches A, B, C, and E are turned on.

15 +
8 + 7
(CO3)
(PO1)

Answer the following questions based on this scenario.

- Find the simplified boolean expression by using Quine-McCluskey Tabular Method.
- Find the simplified boolean expression by using K-Map Method.
- Use a 8:1 MUX to implement the boolean function.

4. a) Write down the logic diagram, characteristic table, characteristic equation, and excitation table of RS, D, JK, and T flip flop. 3 × 4
(CO2)
(PO1)
- b) Construct a 5 × 32 decoder with four 3 × 8 decoder and one 2 × 4 decoder. Use labelled block diagram for this construction. 8
(CO2)
(PO1)
5. a) Explain 'Race Around' condition in JK flip flop. Describe the possible solution to avoid this condition. 10
(CO2)
(PO1)
- b) Analyze the sequential circuit in Figure 4 following the analysis procedure. 15
(CO3)
(PO1)

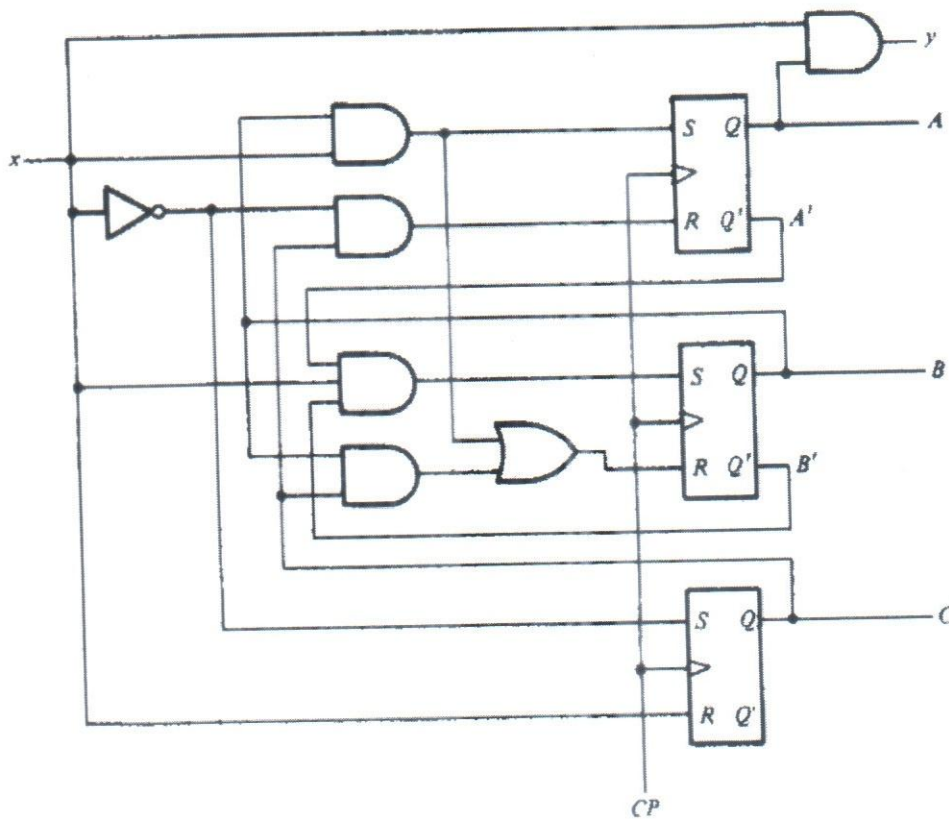


Figure 4: Logic Diagram for Question 5. b).

6. A sequential circuit has 1 input and 1 output. The state diagram of that circuit is shown in Figure 5.

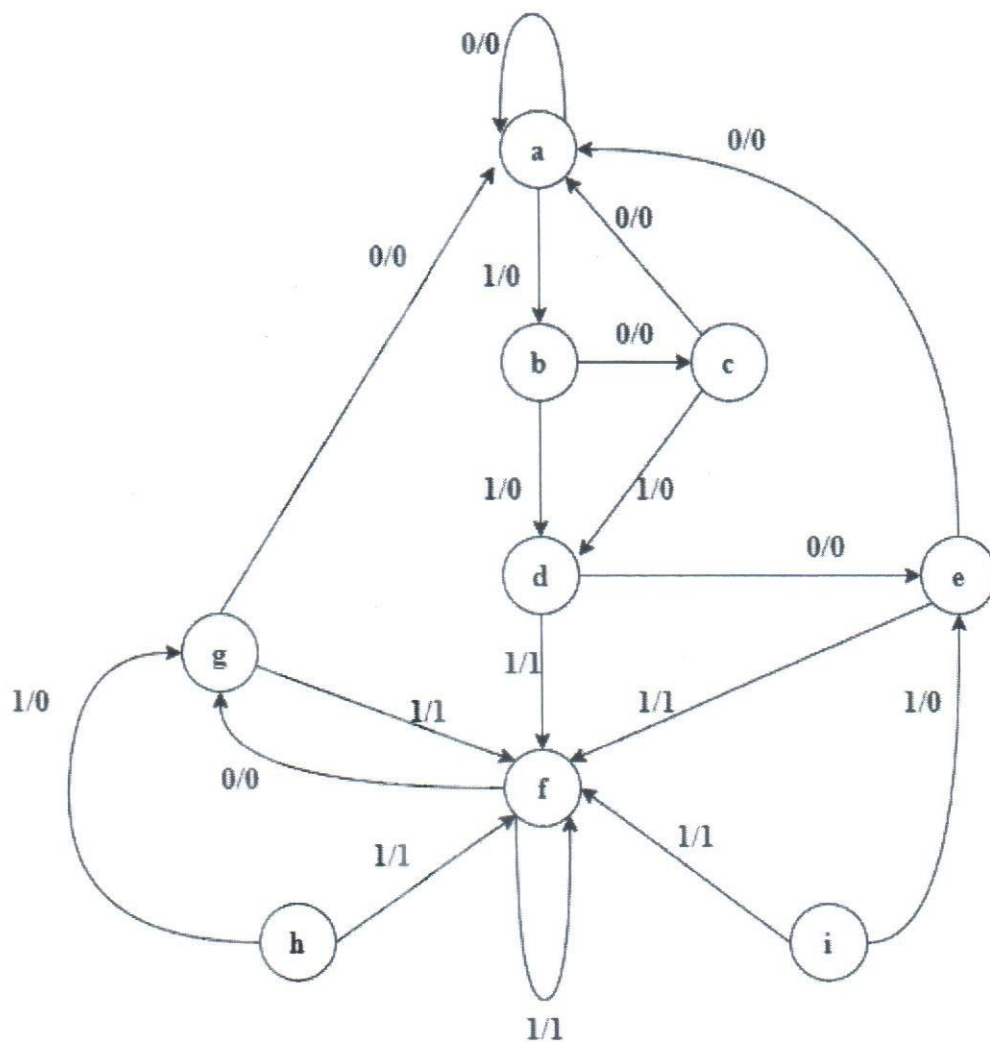


Figure 5: State Diagram for Question 6.

Design the sequential circuit following the design procedure.