



## EE1005 – Digital Logic Design Quiz# 5

**Instructor:** Muhammad Adeel Tahir    **Section:** CS-2F

**Time:** 40 Minutes

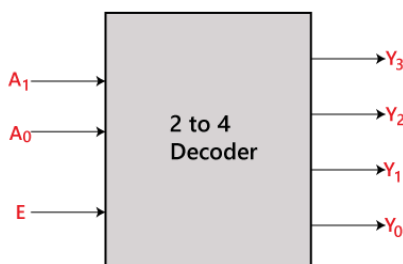
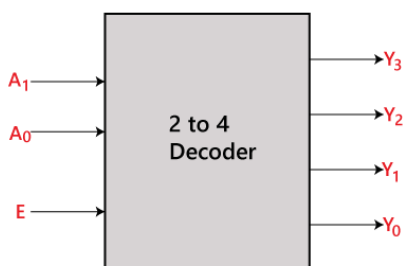
**Name:** \_\_\_\_\_

**Roll No:** \_\_\_\_\_

**Total: 25+20+2= 65 marks**

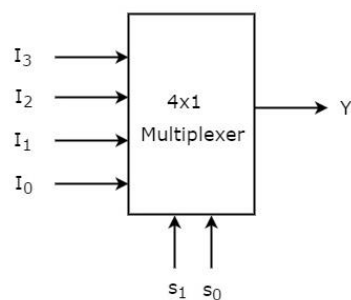
**Instructions:** Make sure the handwriting is neat and clean while drawing the circuit, quiz will be marked as 0 if attempted in a writing that is not readable at all.

**Question 1:** Design a combinational circuit that takes 3-bit input and at the output it multiplies it by 3 and adds 1 to have the final output. Design this circuit using only 2:4 decoders and basic logic gates if necessary. **[10 marks]**

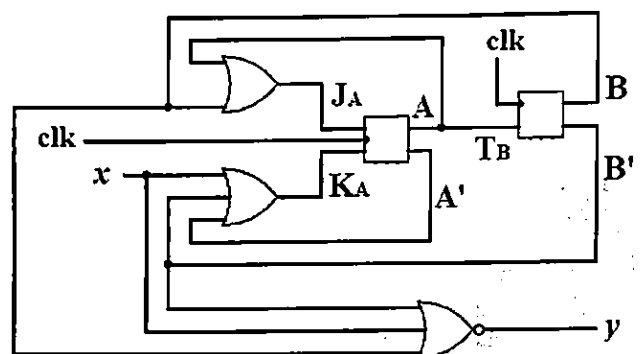
**[3+5+7 = 15 marks]**

- [illegible]



**[2+5+3=10 Marks]**

- State Diagram: (no cutting allowed)**




State Equation(s):

**Question 4:**

[6+1+1+2= 10 marks]

- Reduce the given state table to minimum possible number of states.
- Determine the number of flip flops required to designed a sequential circuit described by the above mentioned state table?
- Determine the number of flip flops required to design a sequential circuit described by the reduced state table?
- Draw the state diagram corresponding to the reduced state table.

State Table (binary checking- no cutting allowed)				
Present State	Next State		Output	
	X=0	X=1	X=0	X=1
A	A	E	1	0
B	C	F	0	1
C	B	H	1	0
D	B	F	1	0
E	D	F	0	1
F	H	G	1	1
G	D	H	0	1
H	H	G	1	1

a)

State Reductions (step by step)

b) \_\_\_\_\_ c) \_\_\_\_\_

d) State Diagram:

**Question 5:** A sequential circuit takes a binary sequence (one bit per cycle) as input and gives Y as output. The output Y is 1 if the input is having even number of 1's and Y=0 otherwise. Design the above mentioned circuit by using D-Flip Flop(s). You can complete your design by: **[2+5+5+3 = 15 marks]**

- Constructing state diagram
- State Table
- Required Equations
- Circuit Diagrams

**State Diagram: (Cutting not allowed)**

**State Table:**



**Equations:**

**Circuit Diagram:**

**Question 6:** Select the correct option(s) and fill the box with LETTERS:

**[5 marks]**

**1) What is the function of a 4-to-1 multiplexer?**

- A) Combines four inputs into one output.
- B) Selects one of four inputs to output.
- C) Divides one input into four outputs.
- D) Encodes four inputs into fewer lines.

**2) What is true about a 2-to-4 line decoder?**

- A) Activates multiple outputs at a time.
- B) Has 4 inputs and 2 outputs.
- C) Has 2 inputs and 4 outputs, one active at a time.
- D) All outputs are always active.

**3) What does a D latch do?**

<b>1</b>	
<b>2</b>	
<b>3</b>	
<b>4</b>	
<b>5</b>	

- A) Divides the clock frequency.
- B) Stores a bit when enabled.
- C) Converts serial to parallel data.
- D) Toggles between states.

**4) What feature do sequential circuits have?**

- A) Only arithmetic operations.
- B) Memory elements.
- C) No clock signals.
- D) Faster than combinational circuits.

**How can decoders and multiplexers be used together?**

- A) Decoder enables multiplexer signals.
- B) Multiplexer selects decoders.
- C) Decoder outputs connect to multiplexer inputs.
- D) Multiplexer generates decoder selection lines.

**Bonus Question:**

**[2 marks]**

A basket contains five apples. You, your friend, and their friend each take one apple. How is it possible that one apple remains in the basket? Think of a logical answer.

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