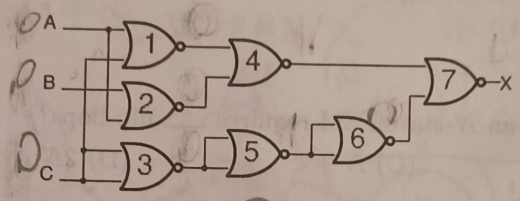
Problem #1 ■ Completely darken/fill in the bubble for [C].

Problem #2 ■ *Select the best phrase to create a TRUE statement:* A priority encoder ___.

(A) determines the MSb asserted in its input
(B) recreates its input at one of its chosen outputs
(C) with B inputs asserts only one of 2^B outputs creating a minterm signal
(D) recreates one of its chosen inputs at its output
(E) none of these

Problem #3 ■ X = ___.



(A) $\bar{A}+B+C$ (B) $\bar{A}+\bar{B}+C$ (C) $\bar{A}\bar{B}C$ (D) $AB\bar{C}$ (E) none of these

Problem #4 ■ Which of the following statements about a flip-flop (FF) is *incorrect*?
(A) FFs are useful when a bit being stored is synchronized to an oscillating clock signal.
(B) FFs are edge-triggered.
(C) FFs are level-sensitive.
(D) FFs can be implemented using two D latches in master-servant arrangement.
(E) None of these

Problem #5 ■ *Select the phrase that makes the statement most correct.* A sequential circuit's output ___.
(A) is dependent on the present and the past sequence of input values
(B) is dependent only on the present combination of input values
(C) counts the number of changes that have been made to the input values
(D) creates a steady and predictable value for all input values
(E) is correct when the states are binary-encoded.

Problem #6 ■ Which of the following statements about a flip-flop is *not* true?
(A) Flip-flops are useful when a bit being stored is synchronized to an oscillating clock signal.
(B) Flip-flops are edge-triggered.
(C) Flip-flops are level-sensitive.
(D) Flip-flops can be implemented using two D latches in master-servant arrangement.
(E) None of these

Problem #7 ■ The minimum number of FFs required for an N state FSM is ___.

(A) $2N$ (B) $\lceil \log_2 N \rceil$ (C) N (D) $N+1$ (E) none of these

Problem #8 ■ Which of the following does *not* describe an FSM?
(A) An FSM describes combinational behavior.
(B) An FSM describes sequential behavior.
(C) FSM is short for Finite State Machine.
(D) An FSM starts in an initial state, and changes state based on input values over time.
(E) None of these.

Problem #9 ■ Which of the following statements is *incorrect*?
(A) The FSM's next state is based on the present state and FSM inputs.
(B) More FSM transitions likely means more state register bits.
(C) A state memory (register) stores the value of the FSM's current state.
(D) More FSM outputs likely means more logic.
(E) None of these

Problem #10 ■ One-hot encoding of an N-state FSM requires ___ flip-flops?
(A) $\log_2 N$ (B) N (C) $N+1$ (D) $2N$ (E) None of these

Problem #11 ■ Which statement is *incorrect*?
(A) Two states are equivalent if the states have the same output, and the same next state for the same input values.
(B) When removing an equivalent state, the incoming and outgoing transitions can be removed.
(C) Removing a state may reduce the size of a controller's state register and/or logic.
(D) Given two equivalent states, either state can be removed.
(E) None of these

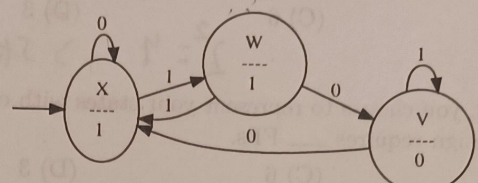
Problem #12 ■ A synchronous sequential system is driven with a 40 MHz clock. What is the time duration (in ns) between rising edges?
(A) 0.025 (B) 25 (C) 1 (D) 40 (E) none of these

Problem #13 ■ Assume an FSM with state S has inputs A and B. Which transitions are correctly formed?
(A) State S has two outgoing transitions, one with condition AB, another with $\bar{A}B$.
(B) State S has two outgoing transitions, one with condition A, another with B.
(C) State S has two outgoing transitions, one with condition AB, another with $\overline{AB}$.
(D) State S has three outgoing transitions, one with condition AB, another with $\bar{A}\bar{B}$, and a third with $\bar{A}B$.
(E) None of these

Problems 14-21 are worth two points each. Complete the FF excitation table. Use the following answers:
(A) d (don't care) (B) 1 (C) 0 (D) none of these

$Q \to Q^+$	J	K
$0 \to 0$	#14	#15
$0 \to 1$	#16	#17
$1 \to 0$	#18	#19
$1 \to 1$	#20	#21

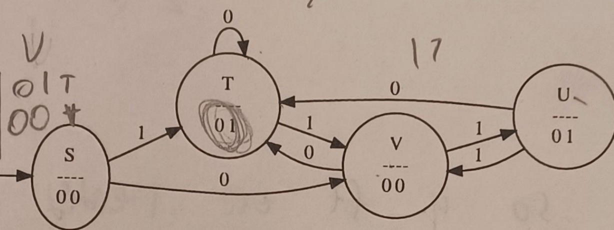
PROBLEM # 22 ■ Assume the FSM was just initialized and in its initial state. What is the FSM output sequence if the FSM is clocked with an input sequence 01010?



(A) 1111001 (B) 111010 (C) 001010 (D) 111111 (E) none of these

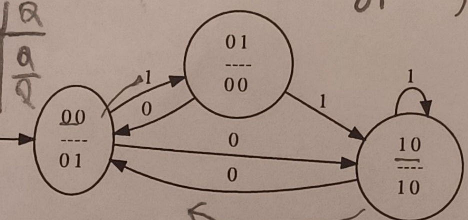
PROBLEM # 23 ■ Which states are equivalent?

(A) T & V (B) T & U (C) S & V (D) U & V (E) none of these



Problems 24-37 are worth two points each. The FSM below has input g and output yz. Your FSM design should use a T-FF and JK-FF. Provide the requested entries in the FSM transition table using

(A) d (don't care) (B) 1 (C) 0 (D) none of these



Q1	Q0	g	Q1⁺	Q0⁺	y	z	T1	J0	K0
0	0	0							
0	0	1	#24	#25	#26	#27	#28	#29	#30
0	1	0							
0	1	1							
1	0	0	#31	#32	#33	#34	#35	#36	#37
1	0	1							

PROBLEM # 38 ■ Select the most correct statement about the FSM diagram below.

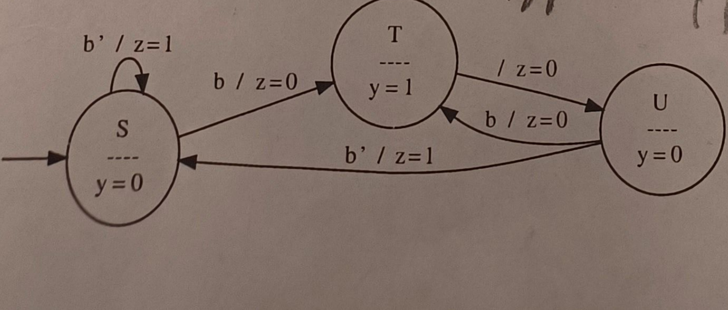
(A) The FSM is a Mealy machine.

(B) The FSM has Moore outputs and Mealy outputs.

(C) The FSM is a Moore machine.

(D) The FSM has state-encoded outputs.

(E) The FSM has one-hot encoded states.



Problem # 39 ■ In Problem #22, you choose to represent your states with binary encoding using SR-FFs. Your design requires ___ FFs.

(A) 2 (B) 4 (C) 6 (D) 3 (E) none of these

$2^2 = 4$ 3 states present so 2 flips

Problem # 40 ■ In Problem #23, you choose to represent your states with one-hot encoding using a mixture of D-FFs and JK-FFs. Your design requires ___ FFs.

(A) 2 (B) 4 (C) 6 (D) 3 (E) none of these

WHEW! You are done. You can use this space for your "scratch work".

4= 0001, 0010, 0100, 1000

$2^1 = 2$ to 1 time

40.) 4 states so 4 ff are needed