



Attempt All Questions

1]

a) Find the smallest number among the following numbers:

$$(11111110.001)_2 \quad (1001010100.01)_{\text{BCD}} \quad (376.1)_{\text{Oct}}$$

b) Draw an equivalent circuit of the 2 input XOR function using only 4 NAND gates with two inputs.

2] Given the following function

$$F(A,B,C) = A'B + AB'C \quad ; \quad A \text{ is the most significant bit}$$

- a) Implement the function using a 2/4 lines decoder with added gates
- b) Implement the complement of the above function using 8/1 multiplexer
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3] a) Write the ROM truth table to implement a digital multiplier that multiply 2 bit input X code by 2 bit input Y code and outputs the multiplication result as a digital code XY. Compute the ROM size

b) Write the PLA program table to implement the following functions; where the PLA has 4 inputs, 3 product terms and 2 outputs

$$F_1 = \Sigma(0,2,6,7)$$

$$F_2 = \Pi(1,3,9,11,12,13,14,15)$$

4] Use a 4 bit parallel full adder chip to perform the given operations in the following table

| S ₁ | S ₀ | Operation |
|----------------|----------------|-----------------|
| 0 | 0 | A+B (add) |
| 0 | 1 | A-B (subtract) |
| 1 | 0 | A+1 (increment) |
| 1 | 1 | A-1 (decrement) |

Where: S₀, S₁ are two selectors bits and A, B are 4 binary bits input codes.
 Draw the complete circuit diagram.

- 5] a) Show how to design a JK flip flop using T-type flip flop
 b) Design a synchronous binary counter that repeats the following sequence {0, 2, 4}, use T-type flip flops
 (*hint*: the unused sequences are don't care terms)
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6] A sequential circuit is described by the following state equations

$$\begin{aligned}
 A^+ &= A(t+1) = A' B + X \\
 B^+ &= B(t+1) = C B' + A \\
 C^+ &= C(t+1) = X' + C
 \end{aligned}$$

Where: X is an external input to the circuit

- a) Write the state table
 b) Draw the circuit diagram using JK flip flops
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