



Question No. 1 [5 Points]

- A. A 8-bit register contains the following: **11111111**
- (i) Interpret this content as an unsigned decimal number
 - (ii) Interpret this content as a signed decimal number
- B. Decode the ASCII coded " in HEX format" word **49 20 41 4D 20 46 41 53 48 45 4C**
- C. What is the highest signed decimal that can be represented by four bits
- D. How many bits are required to represent **-20**?

Question No. 2 [10 Points]

- A. Simplify the following Boolean equation using Boolean theorems
$$Y = B + \bar{B} + \bar{A}B\bar{C} + (\bar{A} + \bar{C})$$
- B. A logic circuit implements the following Boolean function: $F = \bar{A}C + A\bar{C}\bar{D}$
It is found that the circuit input combinations $A = C = 1$ can never occur. Find a simpler expression for F using the proper don't care conditions
- C. Obtain the truth table for the following function and express each function in SOP and POS
$$F = (xy + z)(y + xz)$$

Question No. 3 [10 Points]

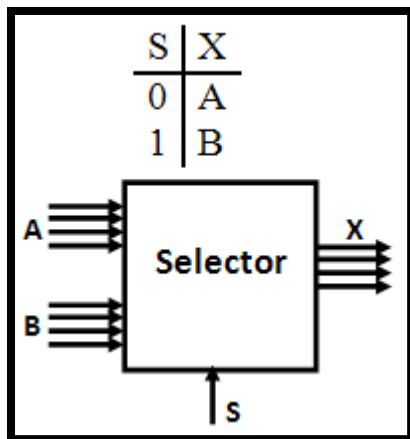
- A. Two tanks store certain liquid chemicals that are required in a manufacturing process. Each tank has a sensor that detects when the chemical level drops to 25% of full. The sensors produce a HIGH level of 5 V when the tanks are more than one-quarter full. When the volume of chemical in a tank drops to one-quarter full, the sensor puts out a LOW level of 0 V. It is required that a single green light-emitting diode (LED) on an indicator panel show when both tanks are more than one-quarter full. **Show how a NAND gate can be used to implement this function.**
- B. A combinational circuit is specified by the following three Boolean functions:
 $F_1 = \sum(0,3,4)$ $F_2 = \sum(1,2,7)$ $F_3 = \prod(0,1,2,4)$
Implement the circuit with a decoder and external OR gate
- C. Design a circuit that can accept a number of 2-bits and outputs the square of that number

Question No. 4 [10 Points]

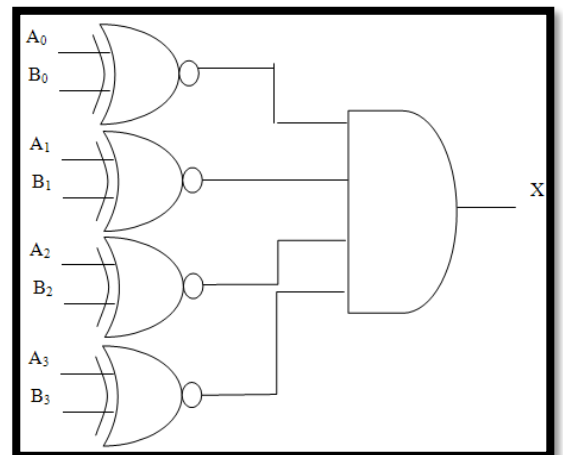
- A. Implement the following Boolean function $F(A,B,C,D) = \sum(0,3,5,6,9,10,11)$ with 4×1 **Multiplexer (Do not use 8×1 MUX)**
- B. Design a **4-input priority encoder** with input **D0** having the lowest priority and input **D3** the highest priority

Question No. 5 [10 Points]

- A. What is the value of X, what do you think about the function of this circuit?
- B. Design a circuit that can select between two 4-bit numbers **A** and **B** to be the output of this circuit

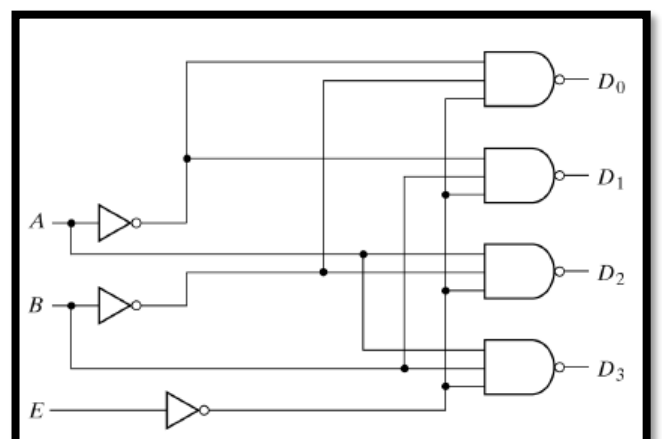


C.



Question No. 6 [5 Points]

- A. Design a combinational circuit with three inputs x, y, z and three outputs A, B, C. when the binary input is 0, 1, 2 or 3, the binary output is one greater than the input. When the binary input is 4, 5, 6, or 7, the binary output is one less than the input— **design using 3 × 8 decoder**
- B. For the logic circuit shown below, Write down the Boolean equations for outputs and then Construct the truth table



Best wishes

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