

DIGITAL LOGIC & DESIGN (EE-1005)

ASSIGNMENT #3

ID: \_\_\_\_\_

NAME: \_\_\_\_\_

SECTION: \_\_\_\_\_

Read the Instructions Carefully

- ❖ **NOTE: Use Assigned number & Your Name**
- ❖ **(Same as Assignment 1)**
  - ❖ Your assigned number is given to you in excel sheet provided with assignment
  - ❖ **FOR EXAMPLE:** Assigned Number if your assigned number is **0821**

	Assign Digit 0	Assign Digit 1	Assign Digit 2	Assign Digit 3
Short for Assigned Digit	A0	A1	A2	A3
Write Assigned Number Digit By Digit	7	8	2	1

FOR EXAMPLE: Name is **HAMAZADAUD**

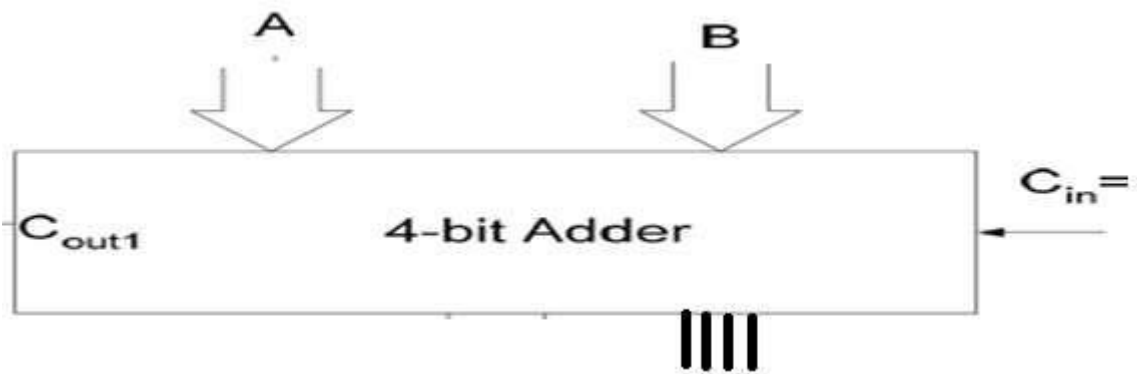
- ❖ Use your name instead of HAMZA
- ❖ If your name starts with **MUHAMMAD** kindly use your second name
- ❖ Convert repeated character to small letter or to other symbols to make them unique (see example for **A, a & @**)

	SIXTH CHARACTER OF YOUR NAME	FIFTH CHARACTER OF YOUR NAME	FOURTH CHARACTER OF YOUR NAME	THIRD CHARACTER OF YOUR NAME	SECOND CHARACTER OF YOUR NAME	FIRST CHARACTER OF YOUR NAME	ZERO CHARACTER OF YOUR NAME
Short for CHARACTER	C0	C1	C2	C3	C4	C5	C6
YOUR NAME CHARACTER BY CHARACTER	\$	@	a	Z	M	A	H

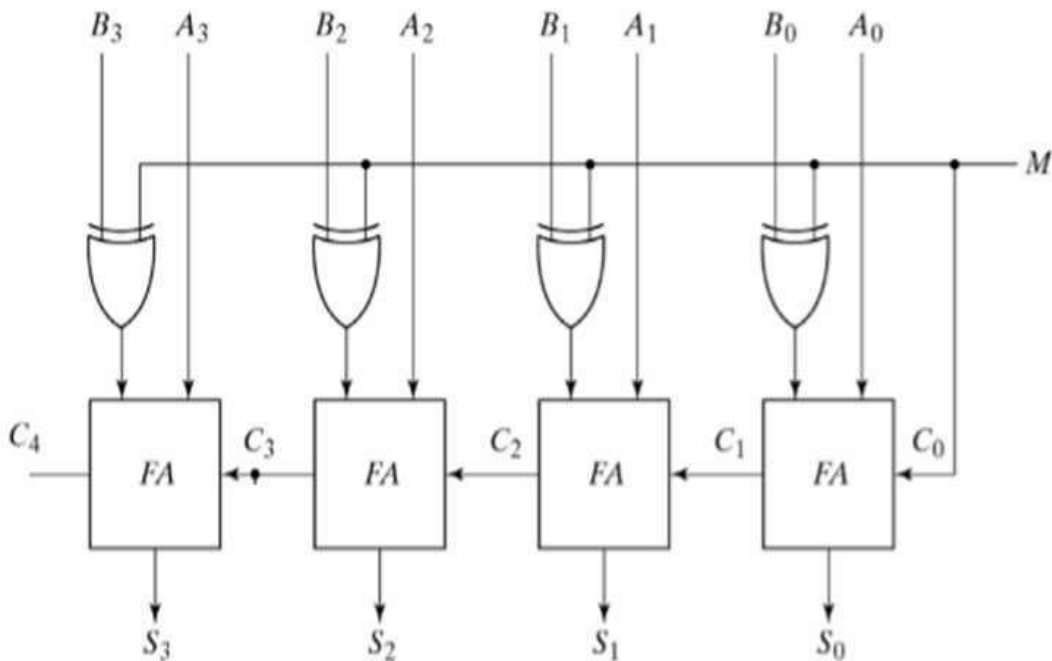
1. Design **4-bit adder** using just **Half adders**? Only circuit is required?

2. Convert following **4-bit adder** to 4-bit subtractor circuit? So it could perform operation **A-B**? Use the circuit you have designed to subtract binary (**A0-A3**)

**HINT:** could use 2's complement



3. Perform unsigned Addition **A+B** where A= 1 and B= (A0)<sub>2</sub> using Following is **4-adder/subtractor** circuit? Also write short explanation when A<B



Explanation

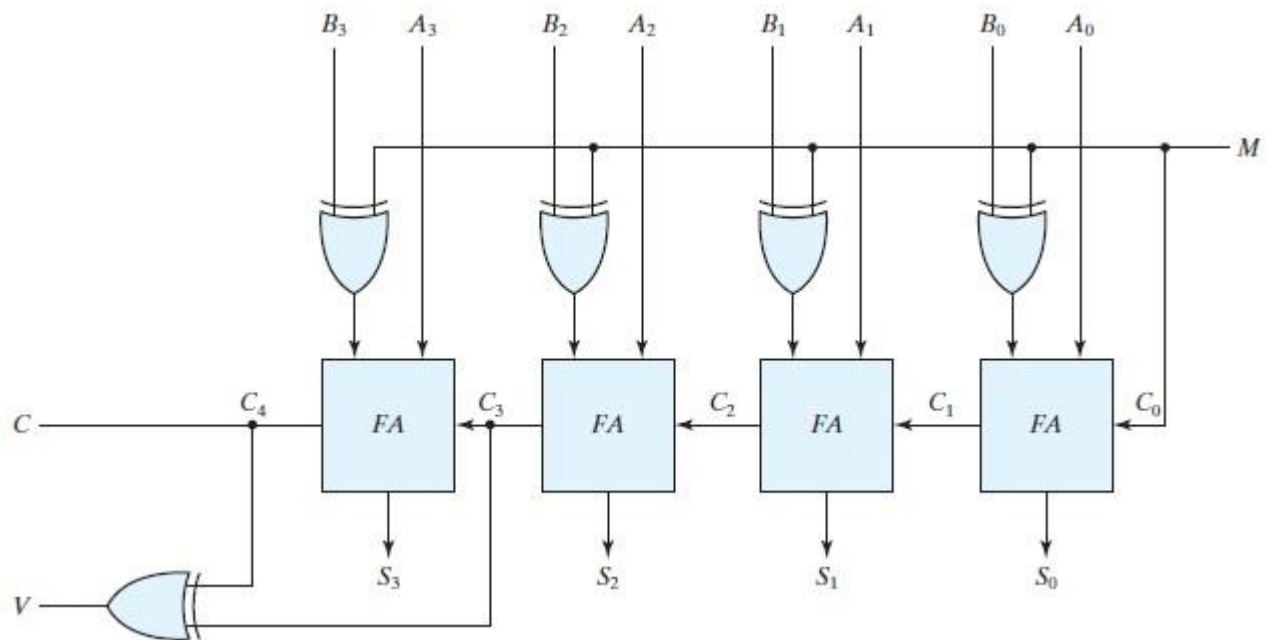
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4. Perform signed Addition **A+B** where A = 2’s complement of (A0)<sub>2</sub> and B= 2’s complement of (A3)<sub>2</sub> using Following is **4-adder/subtractor** circuit? Also write short explanation on working of **overflow flag(v)**

**NOTE:** If A0 = 9 which cannot be represented using 4-bit signed representation than considered it equal to 8, By taking 2’s complement of A0 and A1 you are considering it as negative number



### Explanation

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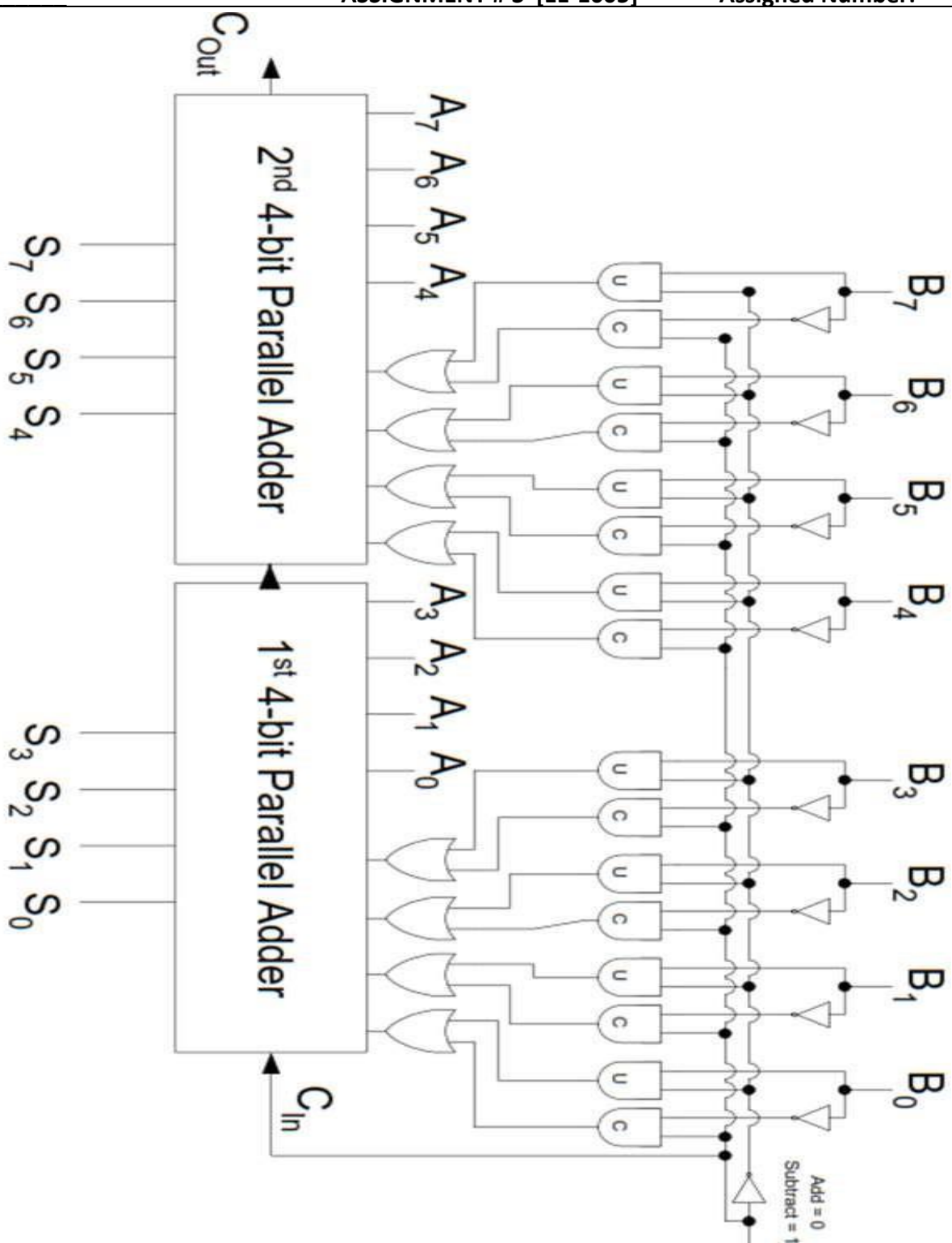


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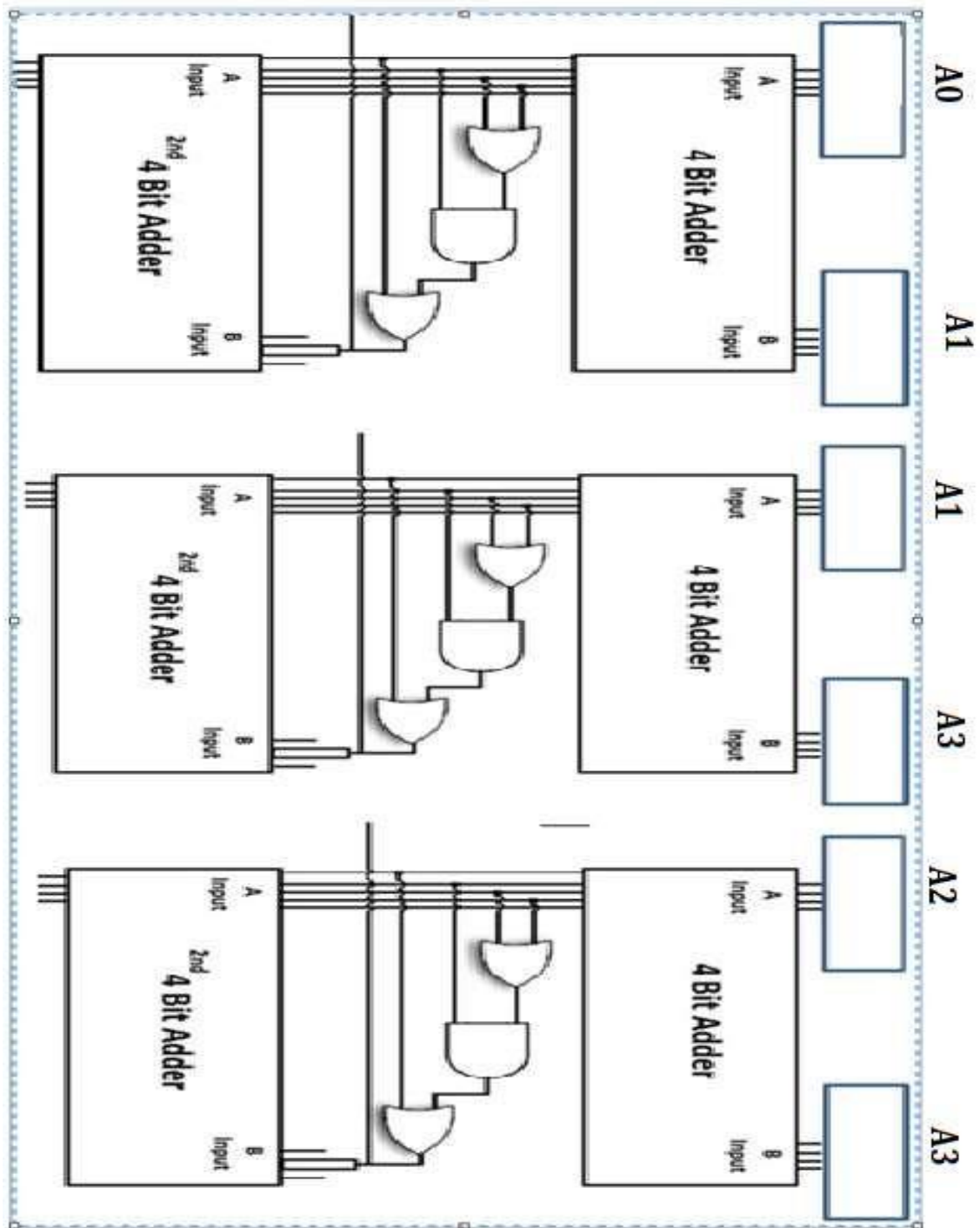
5. Following is an **8-bit unsigned adder/subtractor** circuit. Apply following numbers to the circuit and perform A-B **NOTE:** where **A** = Binary of the first two digits of the assigned number

$$A = (A_0 A_1)_{10} = (?)_2$$

$$B = (63)_{10} = (?)_2$$

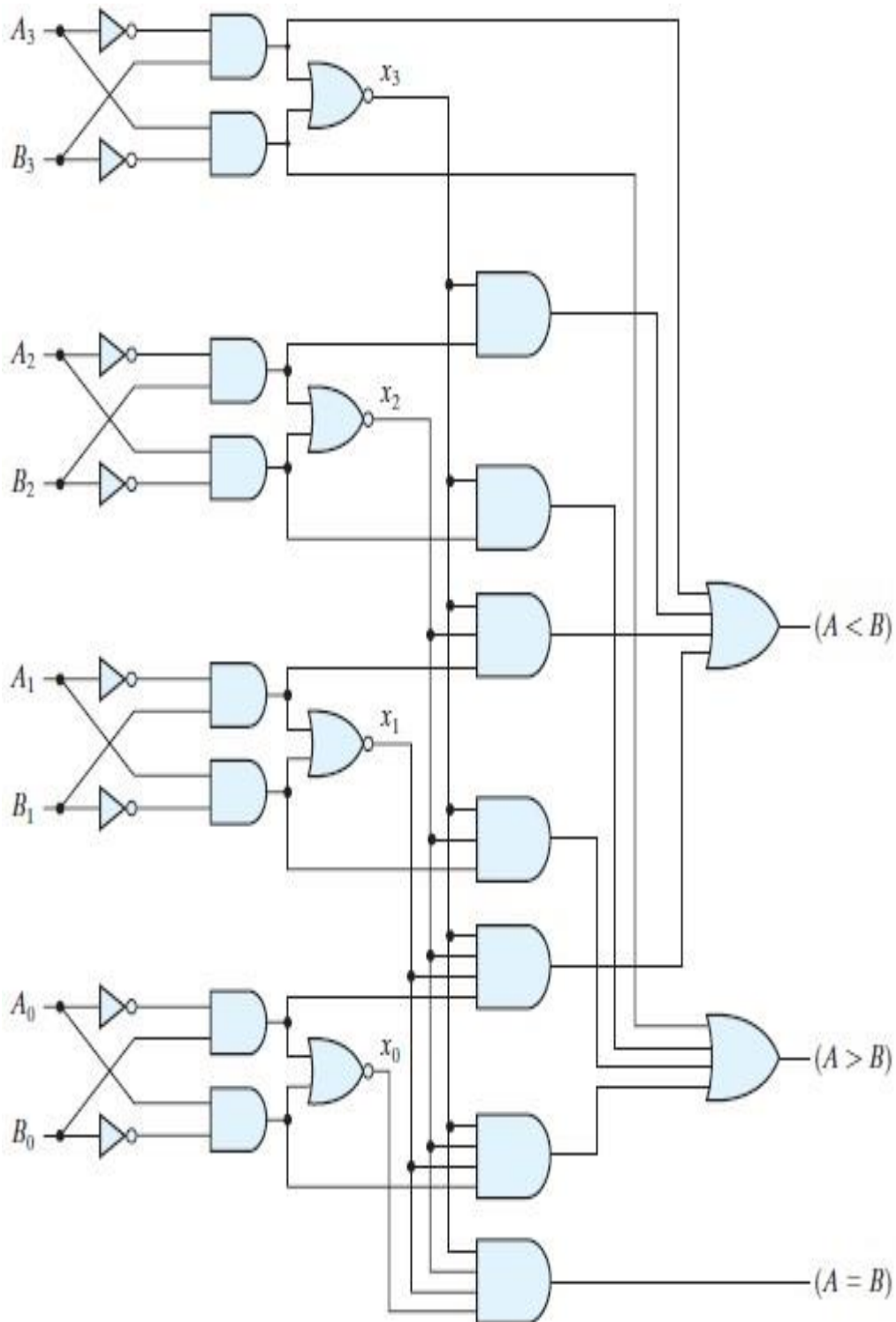


6. Perform three different **BCD Additions** using the following circuits? Convert **A0, A1, A2, A3** from your assigned numbers to **BCD numbers** and apply on the circuits given below



7. Process given values of **A** and **B** on a comparator circuit give below? Where  $A = (A0)_{10} = (?)_2$  and  $B = (A3)_{10} = (?)_2$

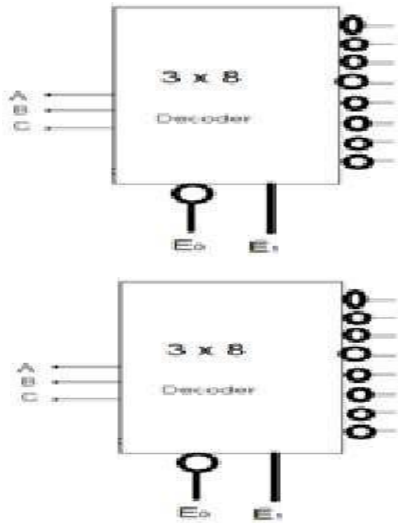
**NOTE:** You are supposed to process each and every gate given below



8. Implement the following function using two **3 X 8 Decoder**. Also write expressions for output  $O_0—O_7$

$$(i, j, k, l) = \sum(2, A_0, A_1, A_2, A_3, (A_0 + A_2), (A_1 + A_3), (A_2 + A_3), 12, 14)$$

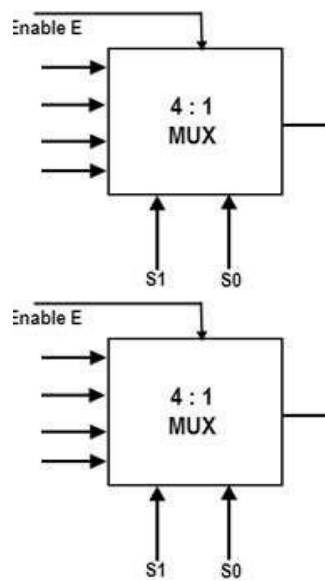
**NOTE:** If any Sum is greater than 15 considered sum equal 10



9. Use following **4 X 1 multiplexer** to create **8 X 1 multiplexer**? Implement the function given below using **8x1** multiplexer?

$$F(x, y, z) = \sum(0, A_2, A_3, (A_2 + A_3), 6)$$

**NOTE:** To get  $(A_2+A_3)$  ADD last two digit of the assigned number if the sum is greater than seven force sum equal result to 7

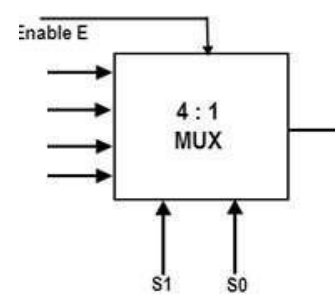




10. Implement the function given below using **4x1** multiplexer?

$$F(x, y, z) = \sum(0, A2, A3, (A2 + A3), 6)$$

**NOTE:** To get (A2+A3) ADD last two digit of the assigned number if the sum is greater than seven force sum equal result to 7



11. Implement the function given below using **8x1** multiplexer?

**NOTE:** If any Sum is greater than 15 considered sum equal 10

$$F(i, j, k, l) = \sum(2, A0, A1, A2,A3, (A0 + A2),(A1 + A3), (A2 + A3), 12,14)$$

12. Implement the function given below using **16x1** multiplexer? **NOTE:** If any Sum is greater than 31 considered sum equal 31

$$F(a, b, c, d, e) = \sum(3, A0, A1, A2, A3, (A0 + A2), (A0 + A1), (A0 + A2 + A3),(A1 + A2 + A3), 17,23,27,30)$$

13. Design **4X2 Low Priority Encoder**?

IN PUT				OUTPUT		
D <sub>0</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	A	B	Valid
0	0	0	0			
1	X	X	X			
0	1	X	X			
0	0	1	X			
0	0	0	1			

SIMPLIFICATION AND EXPRESSIONS

13. Design an **8 X 3 Low Priority Encoder? Priority Encoder** you are designing **A2** and **A3** has the most priority respectively than the other input. Arrange other inputs in ascending order

TABLE

INPUTS								OUTPUTS			
A2=4	A3=6	0	1	2	3	5	7	O <sub>0</sub>	O <sub>1</sub>	O <sub>2</sub>	VALID

SIMPLIFICATION AND EXPRESSION