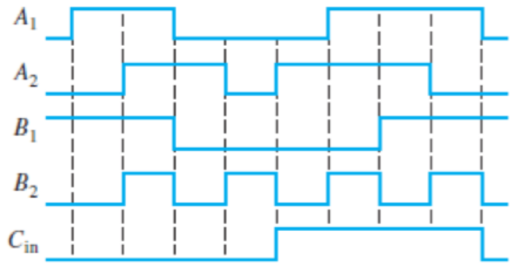
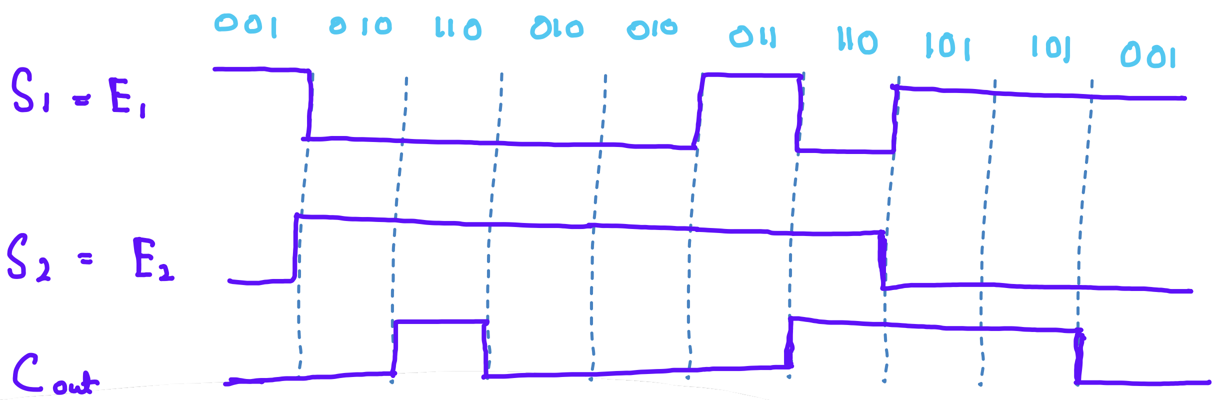
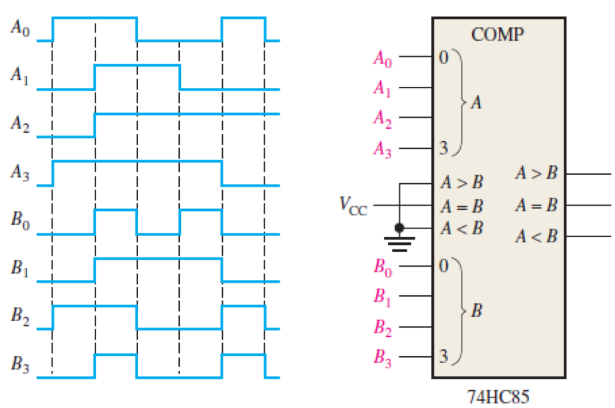
1. The input waveforms in Figure are applied to a 2-bit adder. Determine the waveforms for the sum and the output carry in relation to the inputs by constructing a timing diagram.



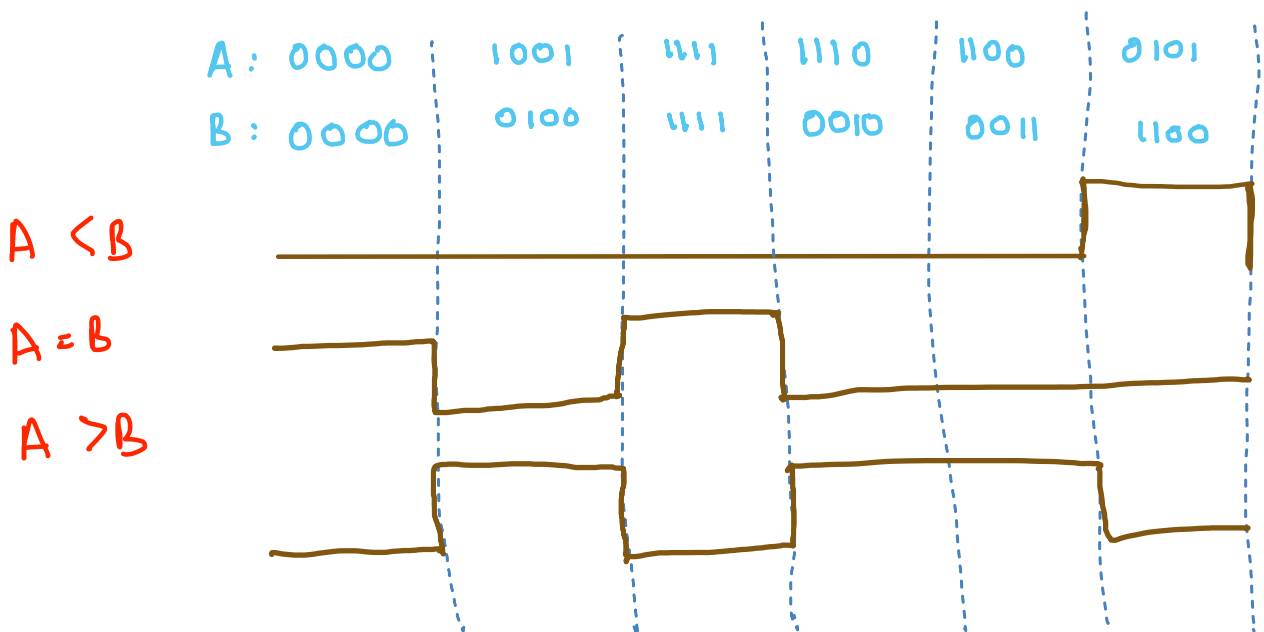
Sol:



2. For the 4-bit comparator in Figure, plot each output waveform for the inputs shown. The outputs are active-HIGH.



Sol:

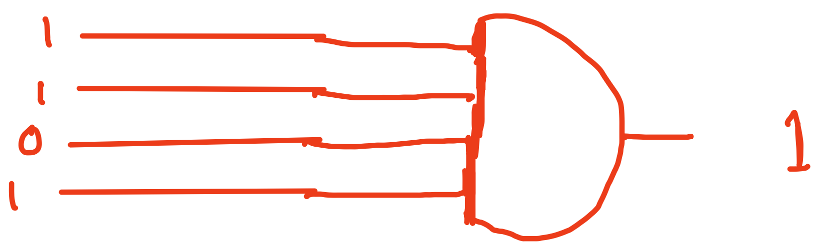


3. Show the decoding logic for each of the following codes if an active-HIGH (1) output is required: (a) 1101 (b) 1000 (c) 11011 (d) 11100

Sol:

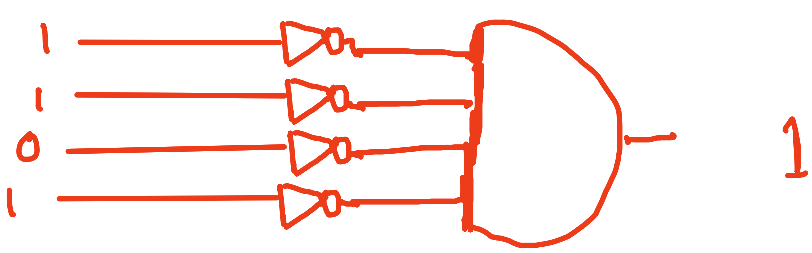
(i) 1101

$AB\bar{C}D$



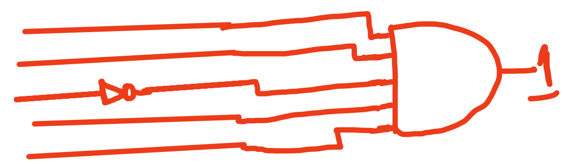
(ii) 1000

$A\bar{B}\bar{C}\bar{D}$



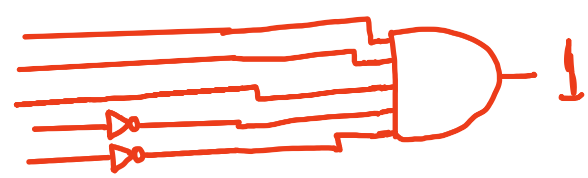
(iii) 11011

$AB\bar{C}DF$



(iv) 11100

$ABC\bar{D}\bar{E}$



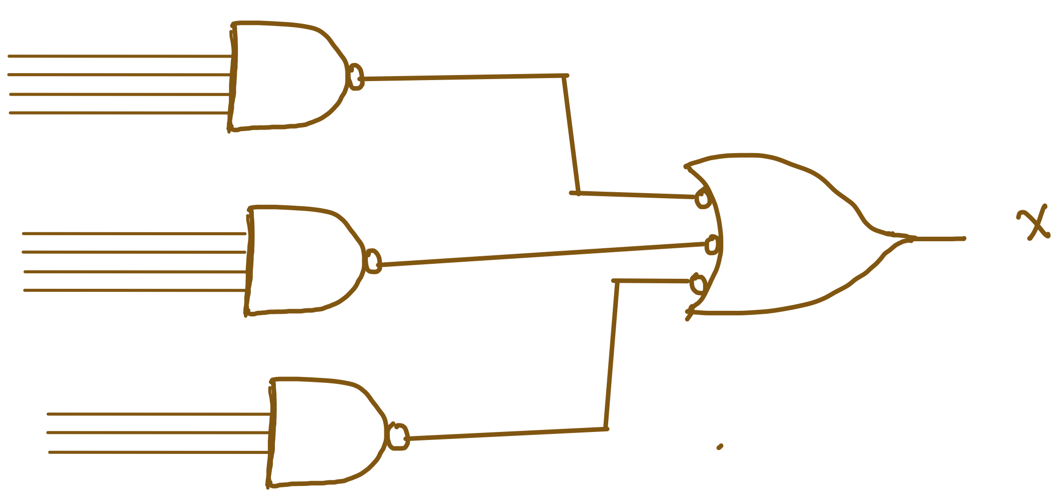
4. You wish to detect only the presence of the codes 1010, 1100, 0001, and 1011. An active-HIGH output is required to indicate their presence. Develop the minimum decoding logic with a single output that will indicate when any one of these codes is on the inputs. For any other code, the output must be LOW.

Sol

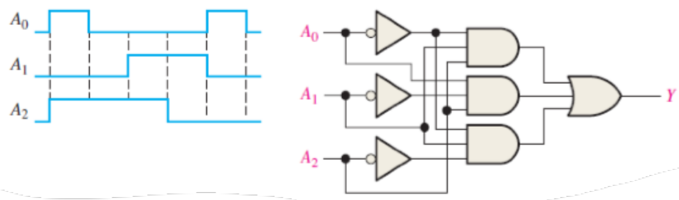
$$X = A\bar{B}C\bar{D} + AB\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + A\bar{B}CD$$

AB \ CD	00	01	11	10
00	$_{0}$	1_{1}	$_{3}$	$_{2}$
01	1_{4}	$_{5}$	$_{7}$	$_{6}$
11	$_{12}$	$_{13}$	$_{15}$	$_{14}$
10	$_{8}$	$_{9}$	1_{11}	1_{10}

$$X = \bar{A}B\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + A\bar{B}C$$

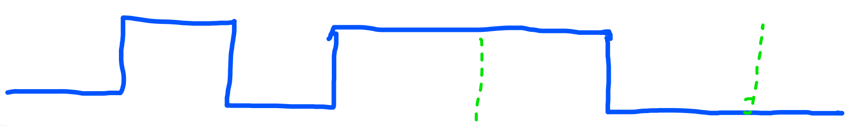


5. If the input waveforms are applied to the decoding logic as indicated in Figure 6–76, sketch the output waveform in proper relation to the inputs.

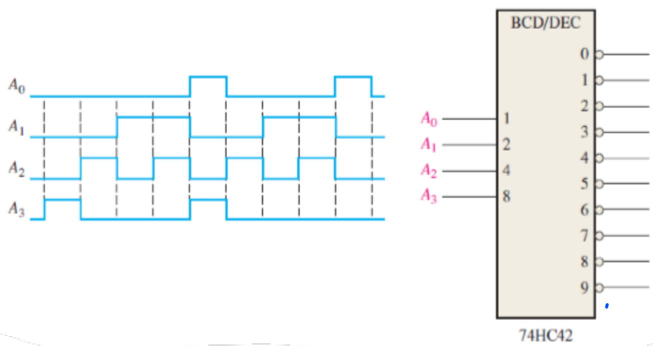


sol:

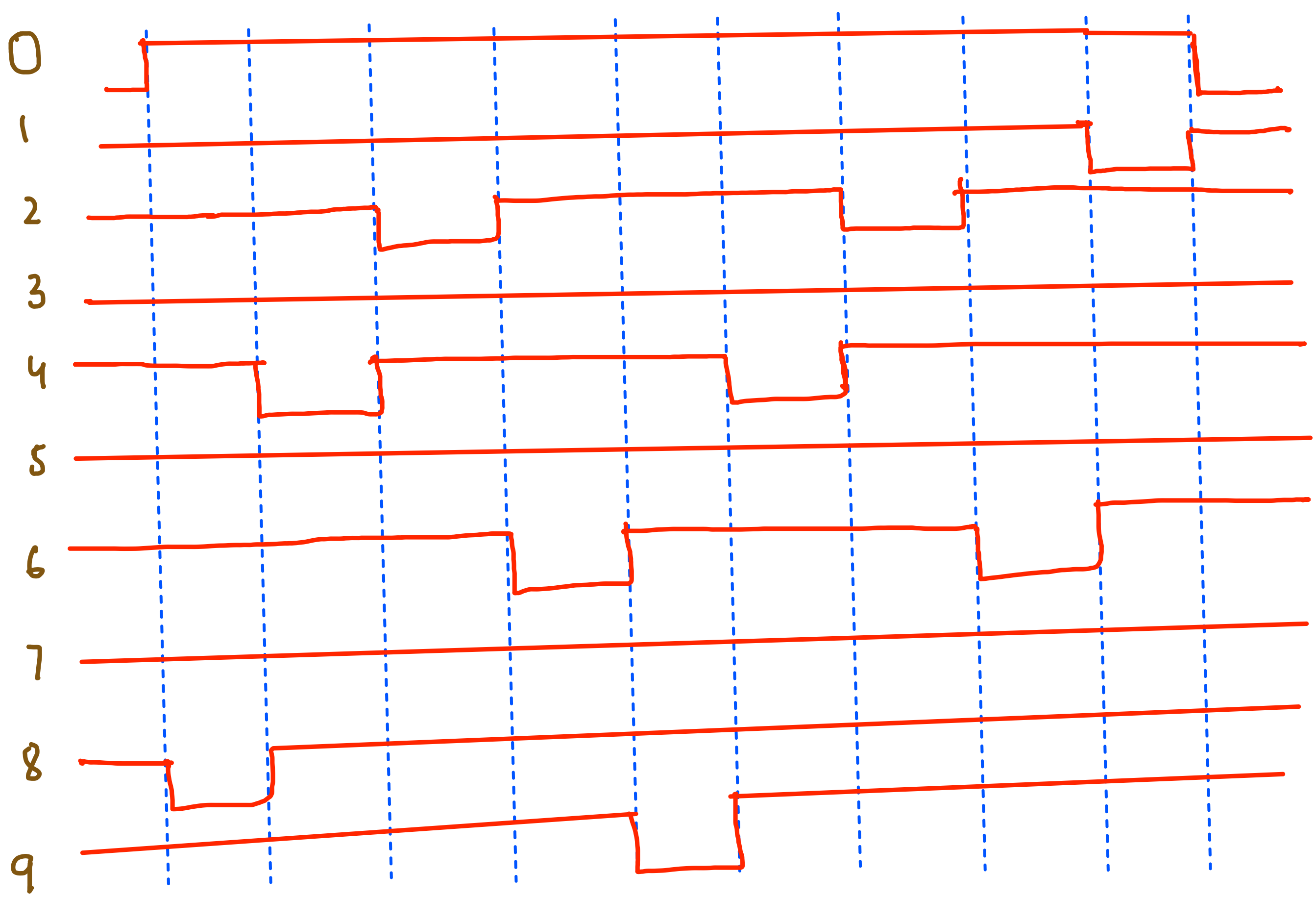
$Y =$



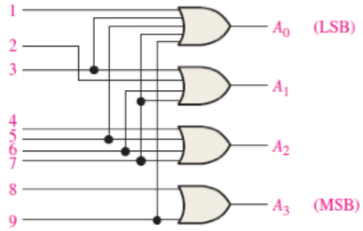
6. BCD numbers are applied sequentially to the BCD-to-decimal decoder in Figure 6–77. Draw a timing diagram, showing each output in the proper relationship with the others and with the inputs.



sol



7. For the decimal-to-BCD encoder logic of Figure, assume that the 9 input and the 3 input are both HIGH. What is the output code? Is it a valid BCD (8421) code?



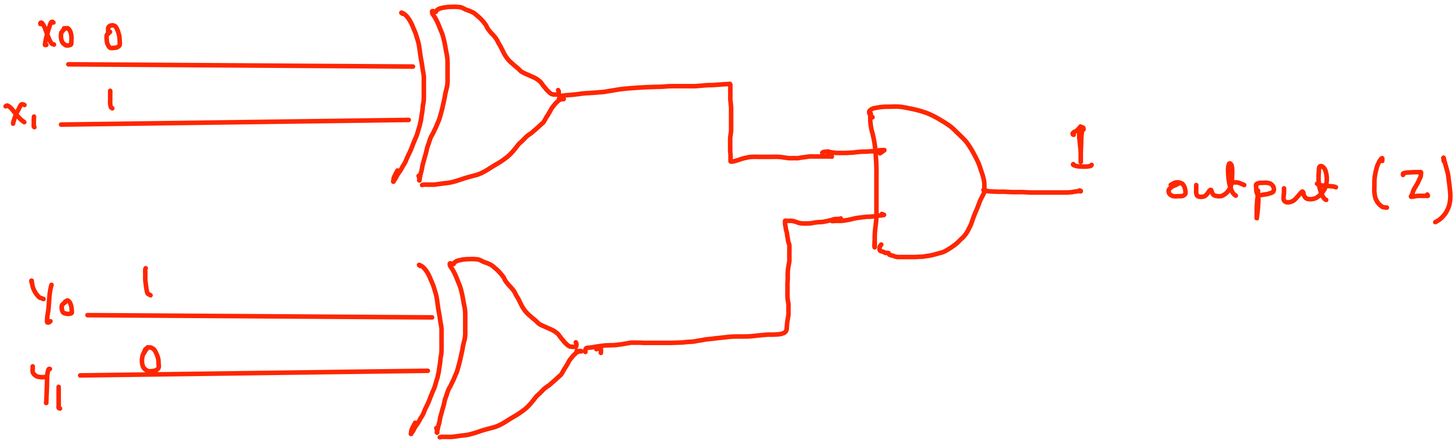
Solution :

BCD (8421) is not valid

Reason being that when 9 (1001) and 3 (0011) are high, anwer will be 13 (1101).

8. The notation x1 x0 represents a two-bit binary number that can have any value (00, 01, 10,11); for example, when x1= 1, x0 = 0, the binary number is 10, and so on. Similarly, y1 and y0 represent another two-bit binary number. Design a logic circuit, using x1,x0,y1, and y0 inputs, whose output will be HIGH only when the two binary numbers x1 x0 and y1 y0 are opposite.

Sol:

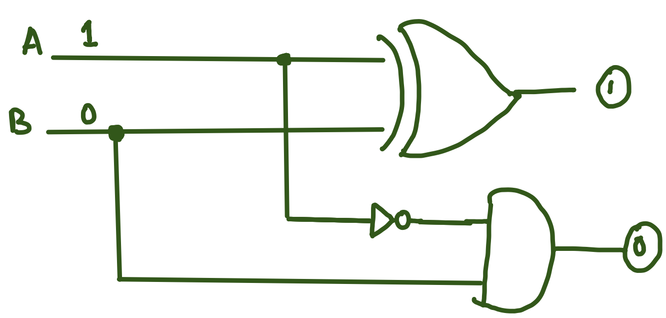


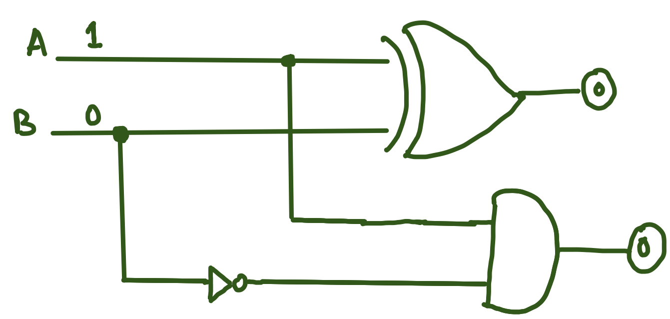
9. Write the function table for a half subtractor (input A and B, output DIFF and CARRY). From the function table, design two logic circuits that will act as half subtractor.

Solution :

Truth table :

A	B	Diff	Carry
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

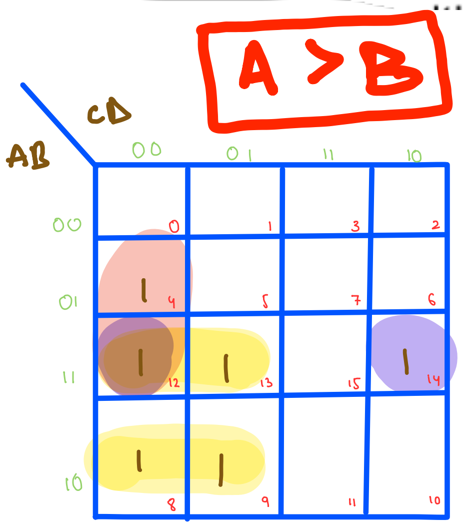




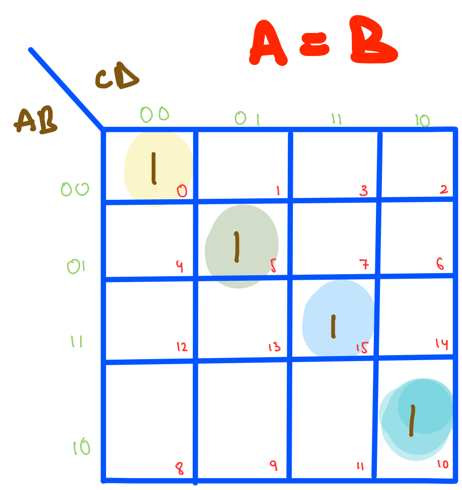
10. Derive an expression for a 2-bit magnitude comparator using Table.

Solution:

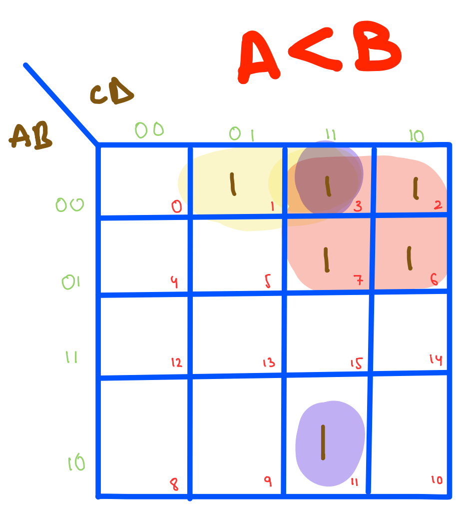
A2	A1	B2	B1	A>B	A=B	A<B
0	0	0	0	0	1	0
0	0	0	1	0	0	1
0	0	1	0	0	0	1
0	0	1	1	0	0	1
0	1	0	0	1	0	0
0	1	0	1	0	1	0
0	1	1	0	0	0	1
0	1	1	1	0	0	1
1	0	0	0	1	0	0
1	0	0	1	1	0	0
1	0	1	0	0	1	0
1	0	1	1	0	0	1
1	1	0	0	1	0	0
1	1	0	1	1	0	0
1	1	1	0	1	0	0
1	1	1	1	0	1	0



$A>B = A_1\bar{B}_1 + A_2\bar{B}_1\bar{B}_2 + A_1A_2\bar{B}_2$



$A=B = A_1A_2B_1B_2 + A_1A\,B_1B_2$
$+ A_1A_2B_1B_2 + A_1A\,B_1B_2$



$A<B = \bar{A}_1\bar{A}_2B_2 + \bar{A}_2B_1B_2 + \bar{A}_1B_1$

11. For the multiplexer in Figure1, determine the output for the following input states: D0 = 1, D1 = 0, D2 = 0, D3 = 1,
(a) S0 = 0, S1 = 1 (b) S1 = 0, S1 = 1 (c) S0 = 1, S1 = 0

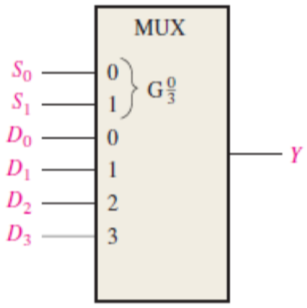


Figure1

12. If the data-select inputs to the multiplexer in the above Figure 1 are sequenced as shown by the waveforms in Figure 2, determine the output waveform with the data inputs specified in Problem 3.

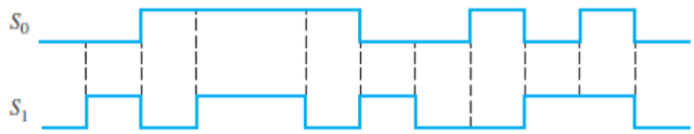


Figure2

13. The waveforms in Figure 3 are observed on the inputs of a 74HC151 8-input multiplexer. Sketch the Y output waveform.

Sol Q 11.

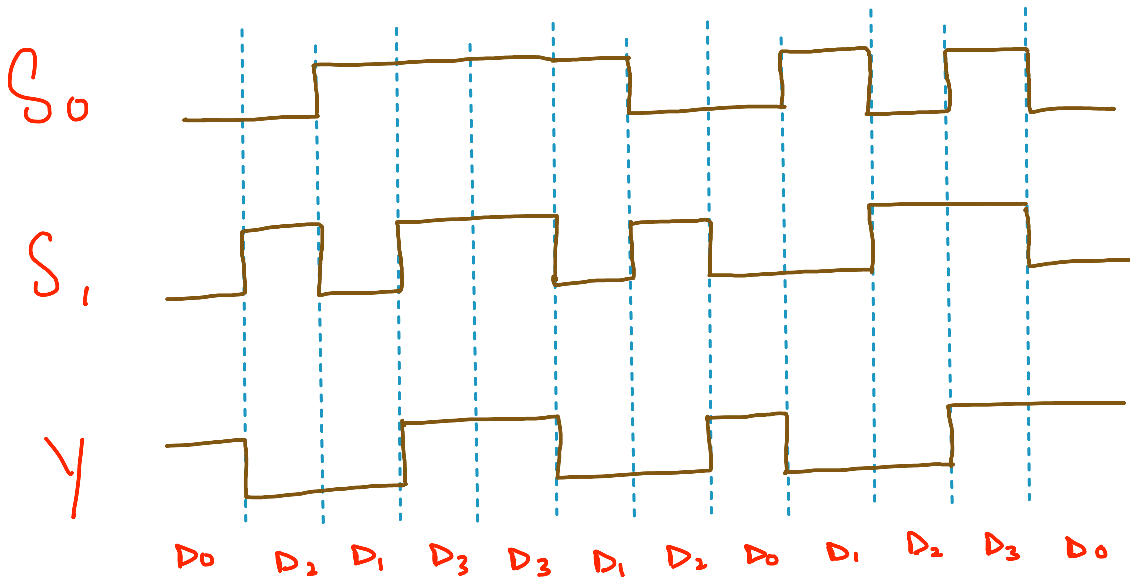
S_1	S_0	Y
0	0	D_0
0	1	D_1
1	0	D_2
1	1	D_3

a) $S_0 = 0$ $S_1 = 1$: D_2

b) $S_0 = 1$ $S_1 = 1$: D_3

c) $S_0 = 1$ $S_1 = 0$: D_1

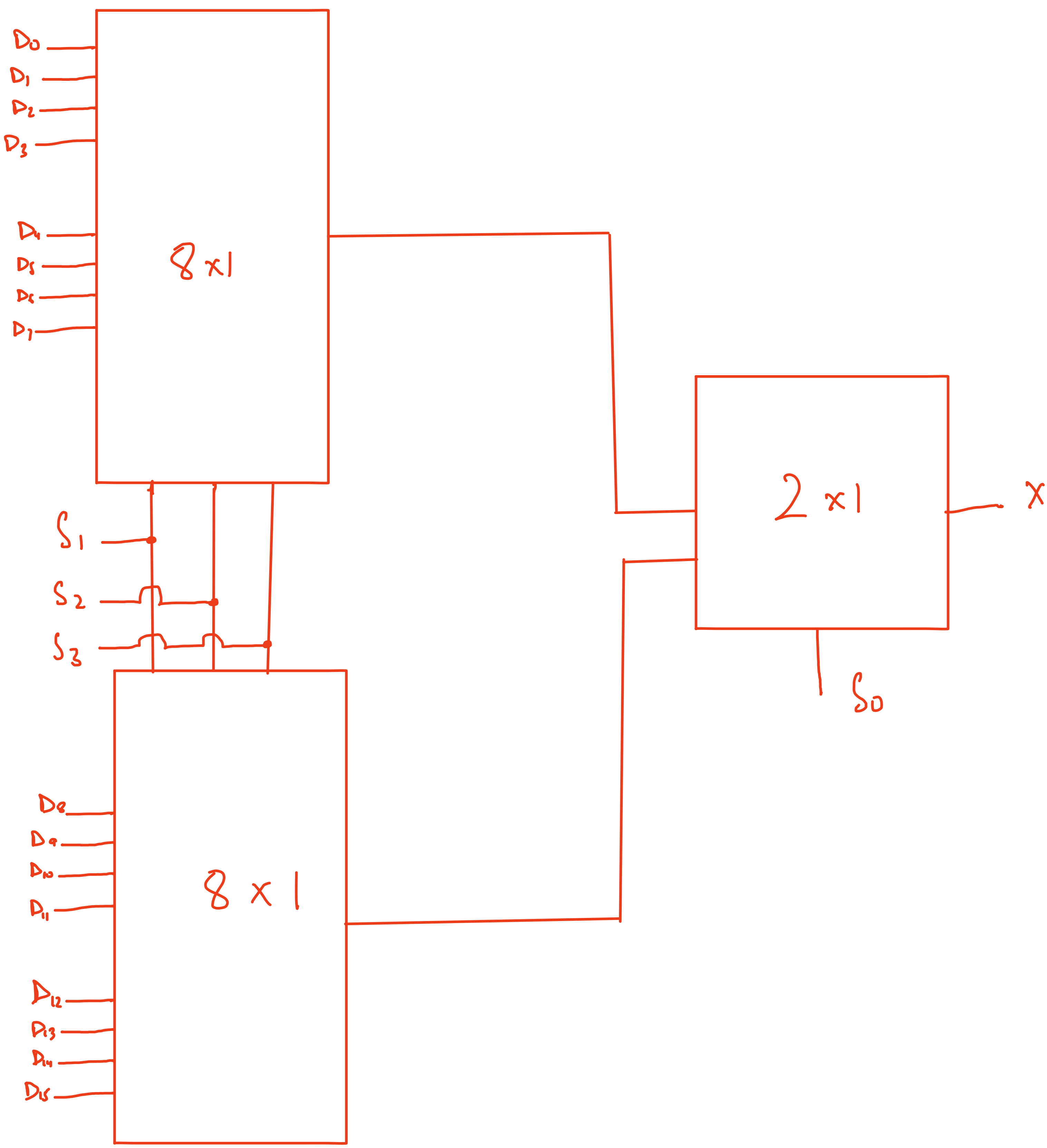
Solution 12:



Solution 13:

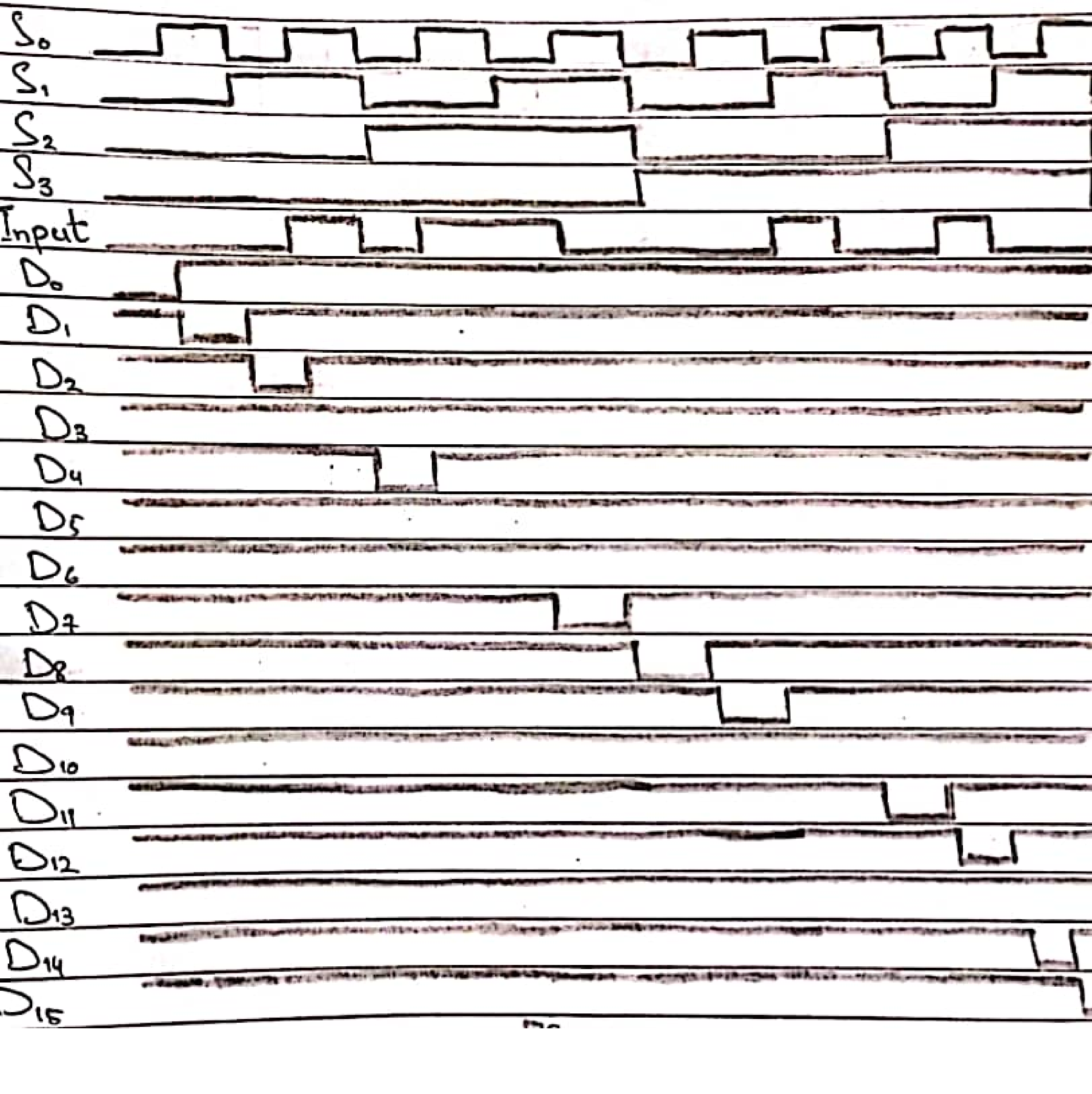
18. Construct a 16 X 1 multiplexer with two 8x1 and one 2x1 multiplexers. Use block diagrams.

Solution:



Q14: Solution:

Data Input: 2468 : 0010010001101000 :
0001011000100100

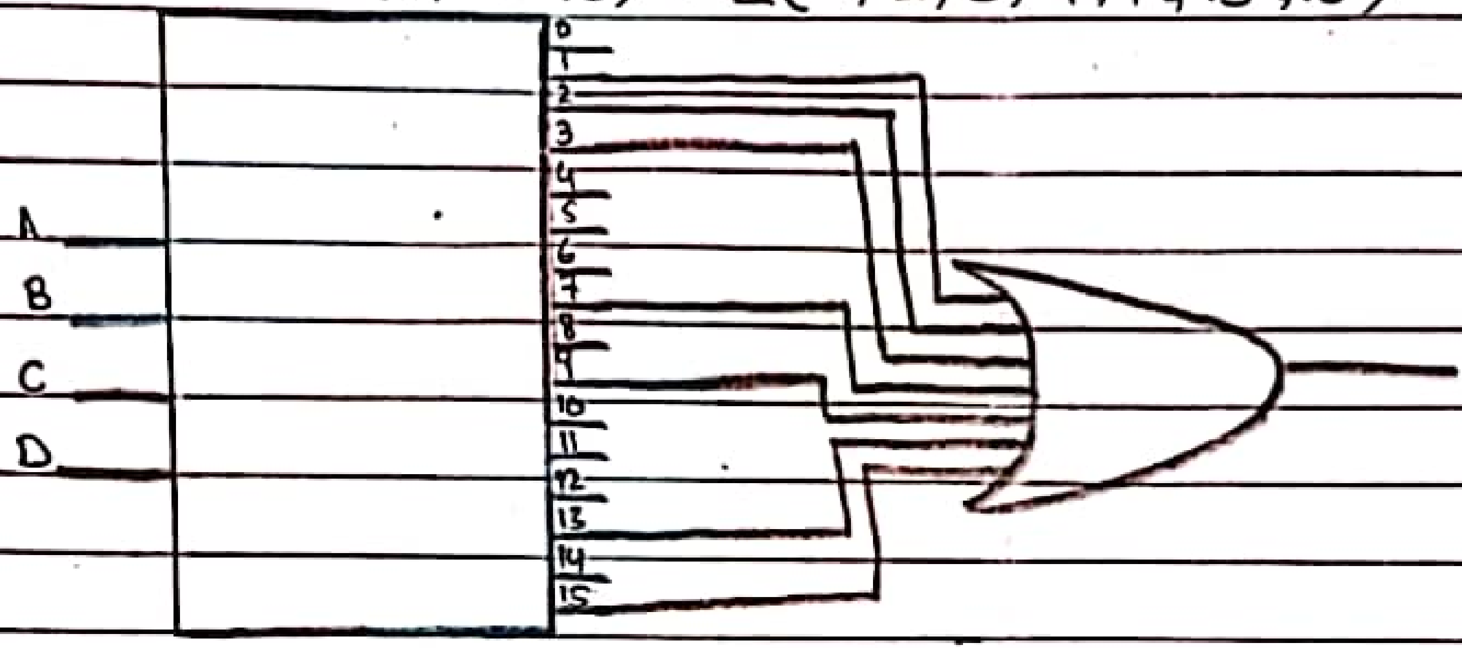


Date

M	T	W	T	F	S	S

Q15: Solution:

$$F(A,B,C,D) = \Sigma(1,2,3,7,9,13,15)$$

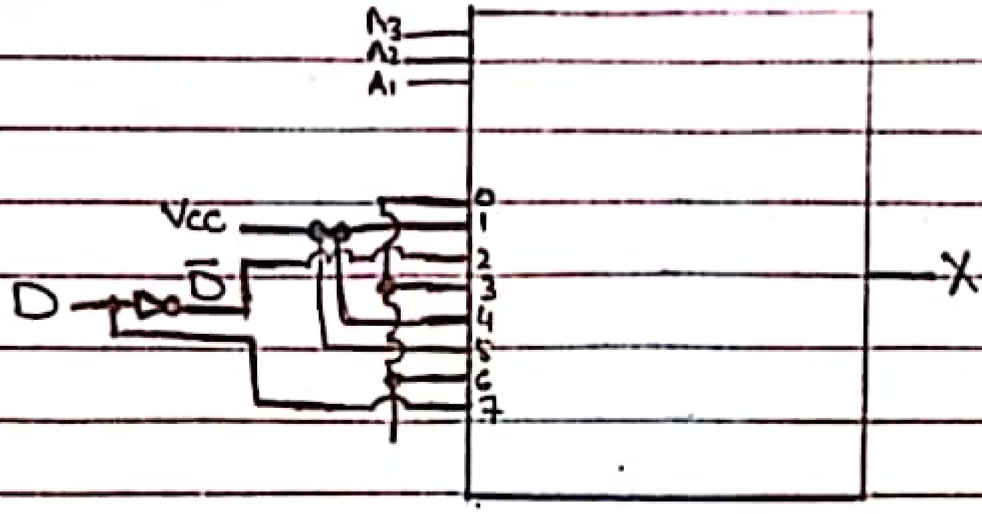


Date
M T W T F S S

Q16: Solution:

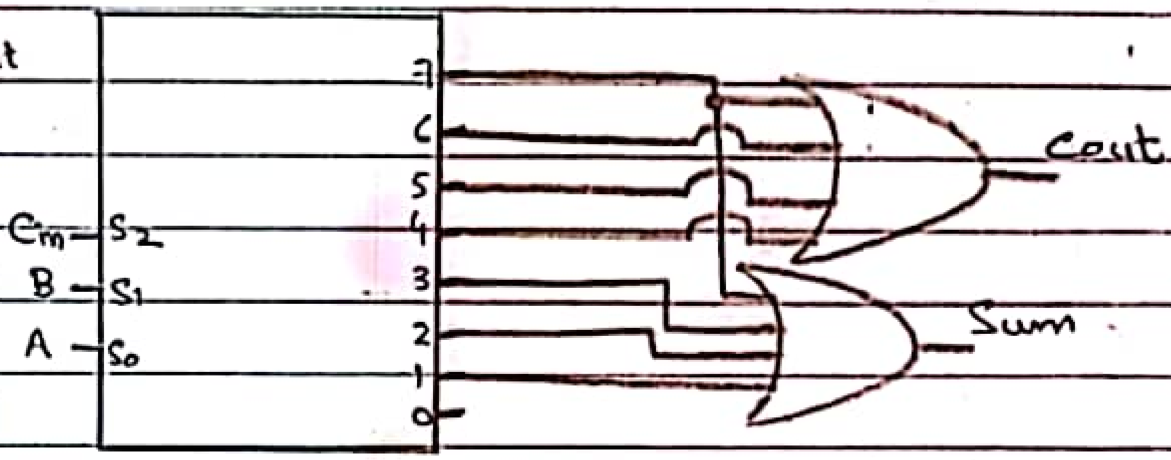
$$X(A_3, A_2, A_1, A_0) = \Sigma(2,3,4,8,9,10,11,15)$$

	A_3	A_2	A_1	A_0	X	
0	0	0	0	0	0	$X=0$
	0	0	0	1	0	
1	0	0	1	0	1	$X=1$
	0	0	1	1	1	
2	0	1	0	0	1	$X=\overline{D}$
	0	1	0	1	0	
3	0	1	1	0	0	$X=0$
	0	1	1	1	0	
4	1	0	0	0	1	$X=1$
	1	0	0	1	1	
5	1	0	1	0	1	$X=1$
	1	0	1	1	1	
6	1	1	0	0	0	$X=0$
	1	1	0	1	0	
7	1	1	1	0	0	$X=D$
	1	1	1	1	1	



Q17:(a): Solution:

A	B	Cin	Σ	Cout
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1



Date ____ M T W T F S S

Q17:(b): Solution:

	A	B	Cin	Σ	Cout
0	0	0	0	0	0
	0	0	1	1	0
1	0	1	0	1	0
	0	1	1	0	1
2	1	0	0	1	0
	1	0	1	0	1
3	1	1	0	0	1
	1	1	1	1	1