

A1)  $\Sigma_1=1$   $Count_1=0$   $\Sigma_2=0$   $Count_2=1$   $\Sigma_3=0$   $\Sigma_4=1$  Ans: 1001

Verification:  $\begin{array}{r} 111 \\ + 010 \end{array}$

$\begin{array}{r} 1001 \\ + 010 \end{array}$

1001 - Verified

b)  $\Sigma_1=1$   $Count_1=0$   $\Sigma_2=1$   $Count_2=0$   $\Sigma_3=1$   $Count_3=0$   $\Sigma_4=1$   $Count_4=0$   $\Sigma_5=0$   $\Sigma_6=1$

Ans: 101111

Verification:  $\begin{array}{r} 10110 \\ + 11001 \end{array}$

$\begin{array}{r} 101111 \\ + 11001 \end{array}$

101111 - Verified

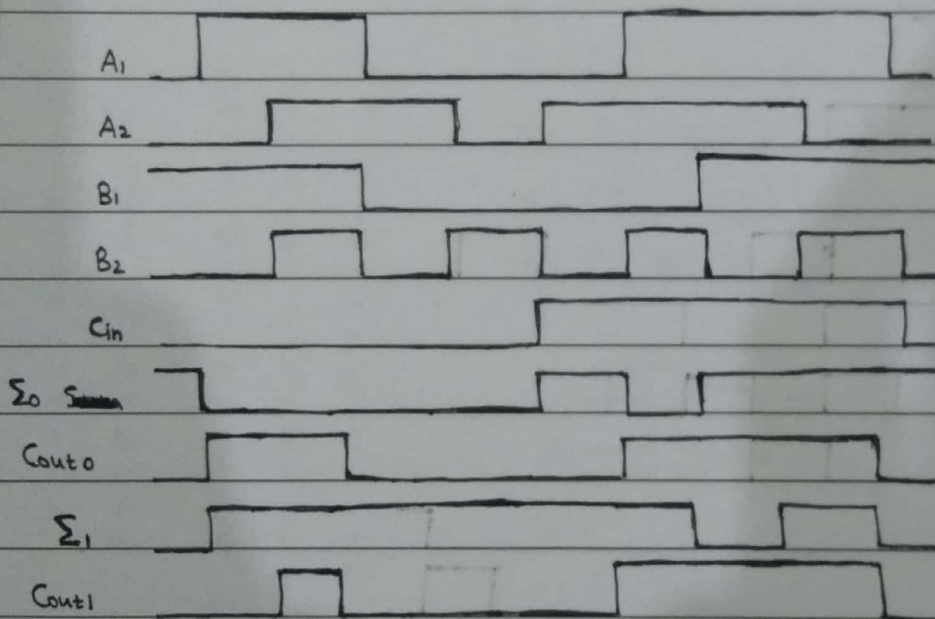
A2a) The output of XNOR gates will be HIGH only if  $B_0, B_1, B_2$ , and  $B_3$  are also HIGH.

b) The output of XNOR gates will be HIGH only if  $B_0, B_1, B_2$ , and  $B_3$  are also LOW.

c)  $\Sigma_0=0$   $Count_0=1$   $\Sigma_1=0$   $Count_1=1$   $\Sigma_2=0$   $Count_2=1$   $\Sigma_3=1$   $Count_3=1$

Output: 11000

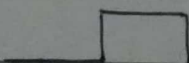
A3



A4  $\Sigma_1 = \overset{1110}{1001}$   $\Sigma_2 = \overset{1110}{1011}$   $\Sigma_3 = \overset{0011}{0101}$   $\Sigma_4 = \overset{1110}{1011}$

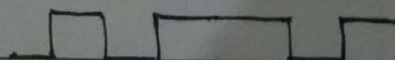
A5

$A=B$

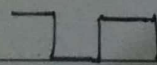


A6

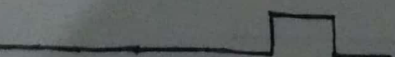
$A>B$

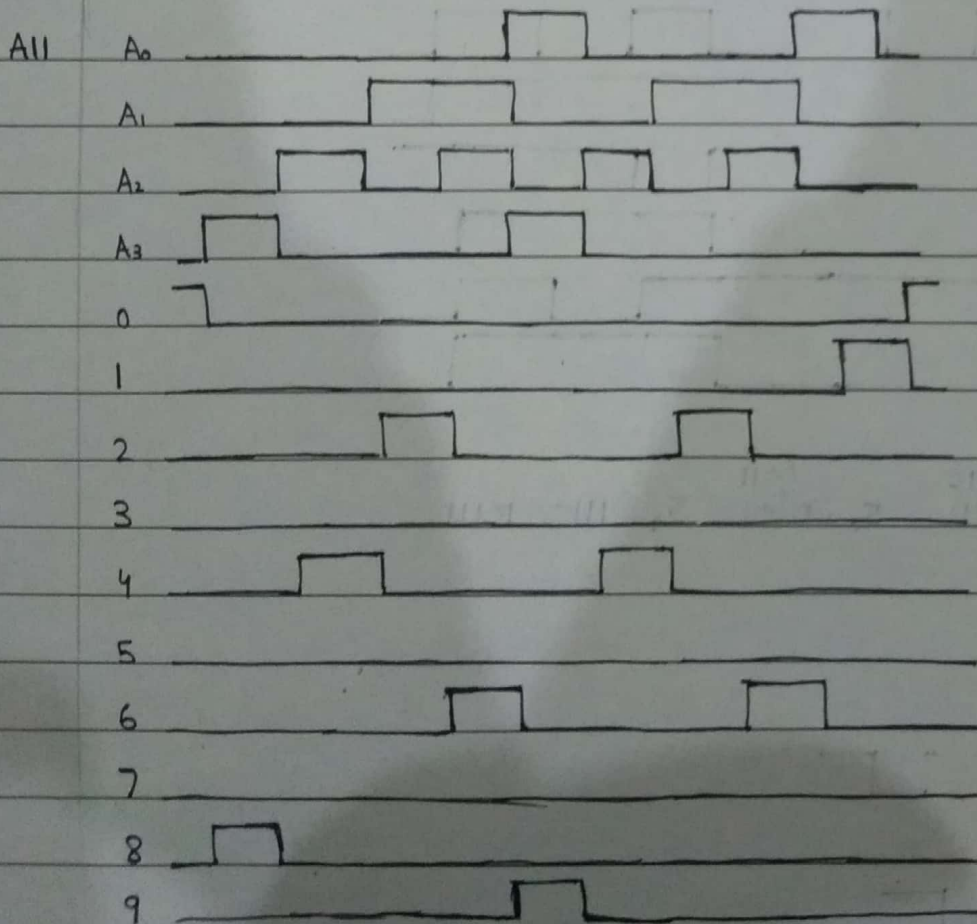
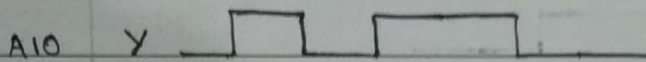
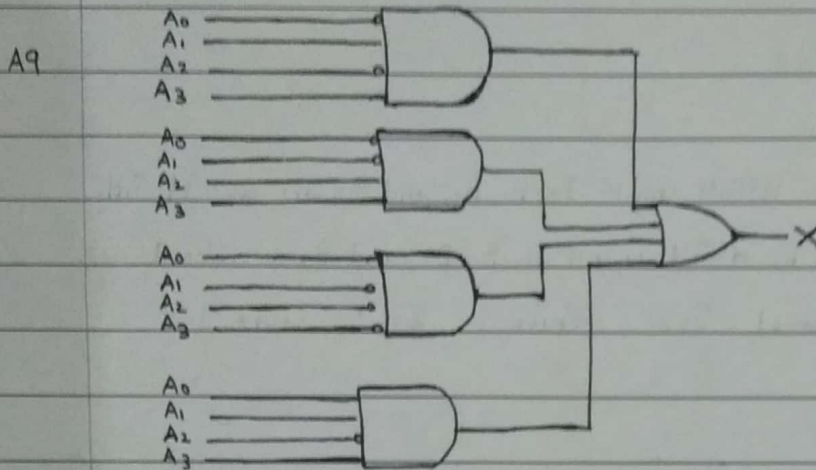
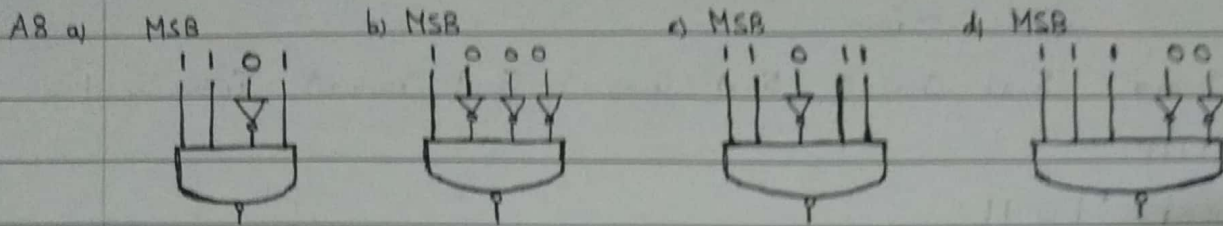
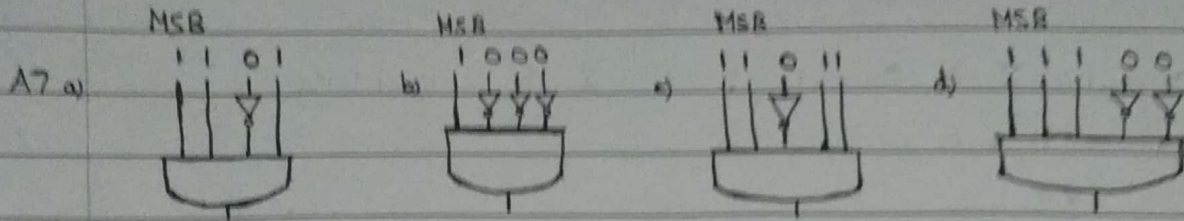


$A=B$



$A<B$







A12 0, 1, 6, 9, 4, 4, 4, 8, 0

A13 1001. Yes, it is a valid BCD code

A14 1001 0101

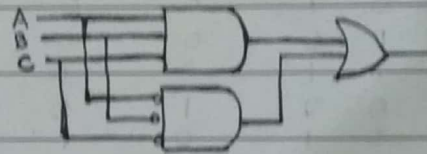
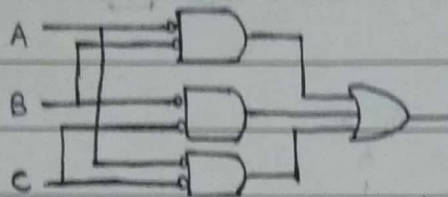
A15

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

Logic circuit:

	$\bar{C}$	$C$
$\bar{A}\bar{B}$	1	1
$\bar{A}B$	1	0
$AB$	0	0
$A\bar{B}$	1	0

A	B	C	X
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0



A16  $X = \bar{A}\bar{B}\bar{C} + ABC$  Logic circuit:

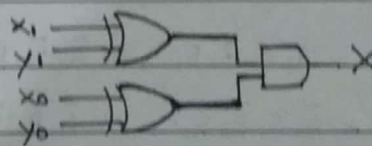
$x_1$	$x_0$	$y_1$	$y_0$	X
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

$$X = \bar{x}_1\bar{x}_0y_1y_0 + x_1x_0\bar{y}_1\bar{y}_0 + \bar{x}_1x_0y_1\bar{y}_0 + x_1\bar{x}_0\bar{y}_1y_0$$

$$X = \bar{x}_1y_1(\bar{x}_0y_0 + x_0\bar{y}_0) + x_1\bar{y}_1(x_0\bar{y}_0 + \bar{x}_0y_0)$$

$$X = (\bar{x}_1y_1 + x_1\bar{y}_1)(\bar{x}_0y_0 + x_0\bar{y}_0)$$

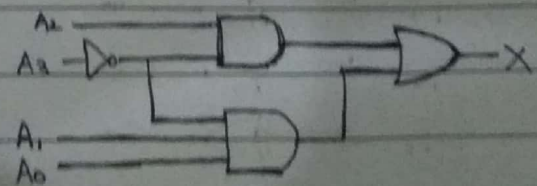
$$X = (x_1 \oplus y_1)(x_0 \oplus y_0)$$



A18

$A_3A_2$	$A_1A_0$	$\bar{A}_1\bar{A}_0$	$\bar{A}_1A_0$	$A_1\bar{A}_0$
$\bar{A}_3\bar{A}_2$	0	0	1	0
$\bar{A}_3A_2$	1	1	1	1
$A_3A_2$	0	0	0	0
$A_3\bar{A}_2$	0	0	0	0

$$X = \bar{A}_3A_2 + \bar{A}_2A_1A_0$$

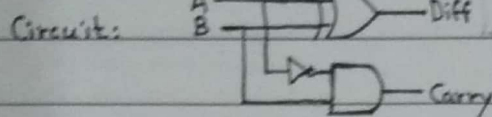


Function table for A-B

A19	A	B	Diff	Carry
	0	0	0	0
	0	1	1	1
	1	0	1	0
	1	1	0	0

$$\text{Diff: } \bar{A}B + A\bar{B} = A \oplus B$$

$$\text{Carry: } \bar{A}B$$

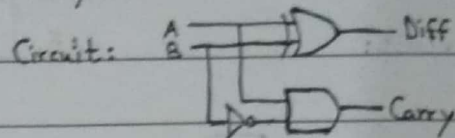


Function table for B-A

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

$$\text{Diff: } \bar{B}A + B\bar{A} = B \oplus A$$

$$\text{Carry: } \bar{B}A$$



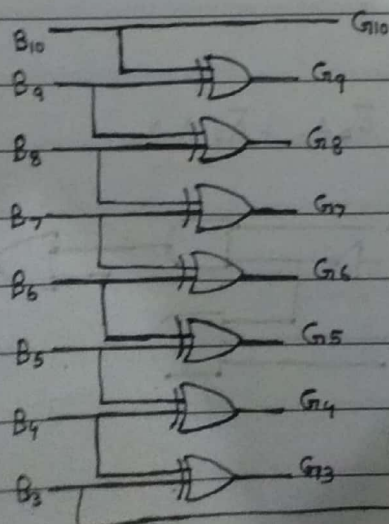
A20	A2	A1	B2	B1	A>B	A=B	A<B
	0	0	0	0	0	1	0
	0	0	0	1	0	0	1
	0	0	1	0	0	0	1
	0	0	1	1	0	0	1
	0	1	0	0	1	0	0
	0	1	0	1	0	1	0
	0	1	1	0	0	0	1
	0	1	1	1	0	0	1
	1	0	0	0	1	0	0
	1	0	0	1	1	0	0
	1	0	1	0	0	1	0
	1	0	1	1	0	0	1
	1	1	0	0	1	0	0
	1	1	0	1	1	0	0
	1	1	1	0	1	0	0
	1	1	1	1	0	1	0

$$A > B: X = \bar{A}_2 A_1 \bar{B}_2 \bar{B}_1 + \bar{A}_2 \bar{A}_1 \bar{B}_2 \bar{B}_1 + \bar{A}_2 \bar{A}_1 \bar{B}_2 B_1 + \bar{A}_2 A_1 \bar{B}_2 \bar{B}_1 + \bar{A}_2 A_1 \bar{B}_2 B_1 + \bar{A}_2 A_1 B_2 \bar{B}_1$$

$$A = B: X = \bar{A}_2 \bar{A}_1 \bar{B}_2 \bar{B}_1 + \bar{A}_2 A_1 \bar{B}_2 \bar{B}_1 + \bar{A}_2 \bar{A}_1 B_2 \bar{B}_1 + \bar{A}_2 A_1 B_2 \bar{B}_1$$

$$A < B: X = \bar{A}_2 \bar{A}_1 \bar{B}_2 B_1 + \bar{A}_2 \bar{A}_1 B_2 \bar{B}_1 + \bar{A}_2 \bar{A}_1 B_2 B_1 + \bar{A}_2 A_1 B_2 \bar{B}_1 + \bar{A}_2 A_1 B_2 B_1 + \bar{A}_2 \bar{A}_1 B_2 B_1$$

A22



$$a) 1010111100 \rightarrow 111100010$$

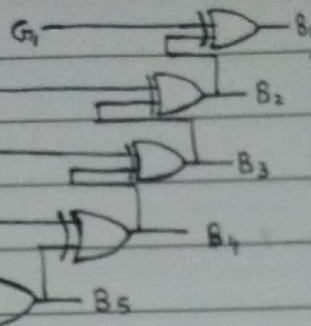
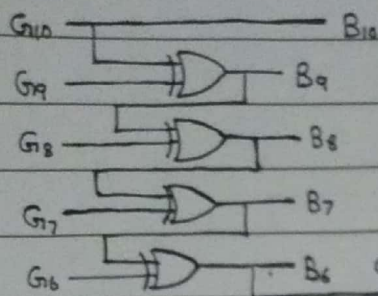
$$b) 1111000011 \rightarrow 1000100010$$

$$c) 1011110011 \rightarrow 1110001010$$

$$d) 1000000001 \rightarrow 1100000001$$



A23



$$a) 1010111100 \rightarrow 1100101000$$

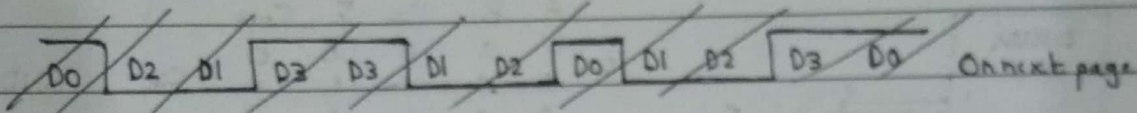
$$b) 1111000011 \rightarrow 1010000010$$

$$c) 101110011 \rightarrow 1101011101$$

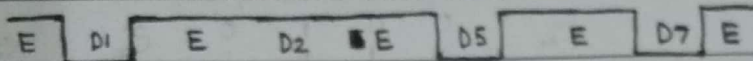
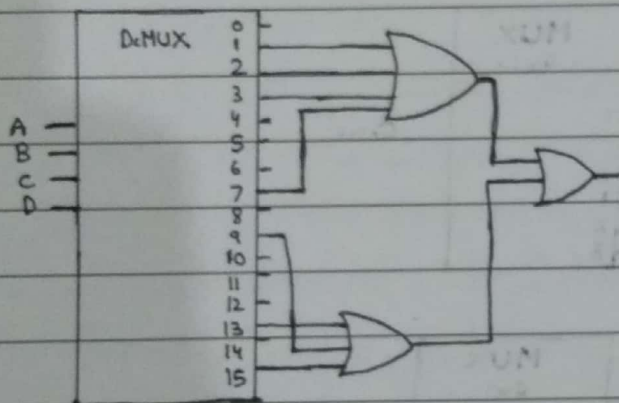
$$d) 1000000001 \rightarrow 1111111110$$

A24 a) 0(D2) b) 0(D2) c) 0(D1)

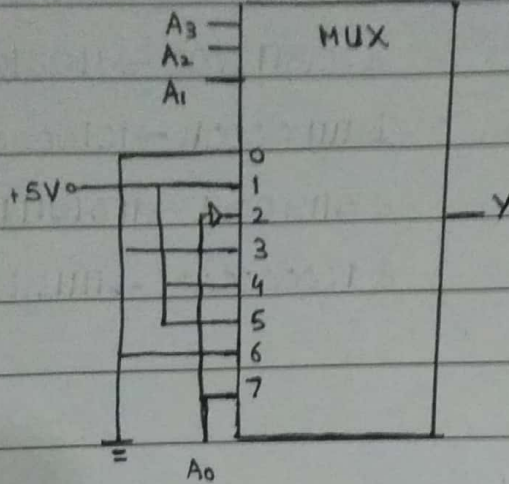
A25



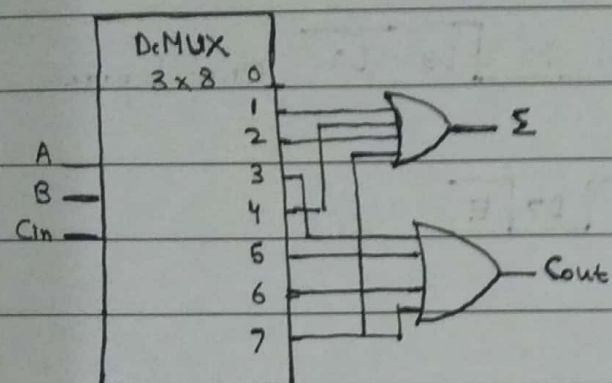
A26

A27 8  $F(A, B, C, D) = \Sigma(1, 2, 3, 7, 9, 13, 15)$ A29  $X(A_3, A_2, A_1, A_0) = \Sigma(2, 3, 4, 8, 9, 10, 11, 15)$ 

	Decimal digit	$A_3$	$A_2$	$A_1$	$A_0$	$Y$	
0	0	0	0	0	0	0	GND
	1	0	0	0	1	0	
	2	0	0	1	0	1	
1	3	0	0	1	1	1	VCC
	4	0	1	0	0	1	
	5	0	1	0	1	0	
2	6	0	1	1	0	0	GND
	7	0	1	1	1	0	
	8	1	0	0	0	1	
3	9	1	0	0	1	1	VCC
	10	1	0	1	0	1	
	11	1	0	1	1	1	
4	12	1	1	0	0	0	GND
	13	1	1	0	1	0	
	14	1	1	1	0	0	
7	15	1	1	1	1	1	$A_0$

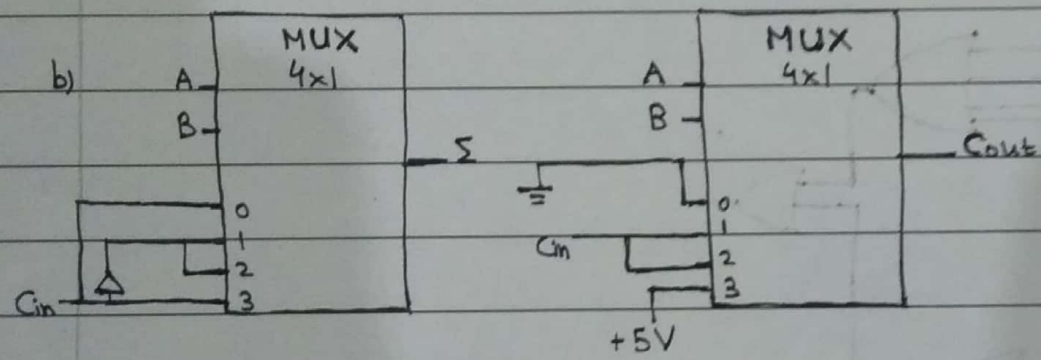


A30 a)

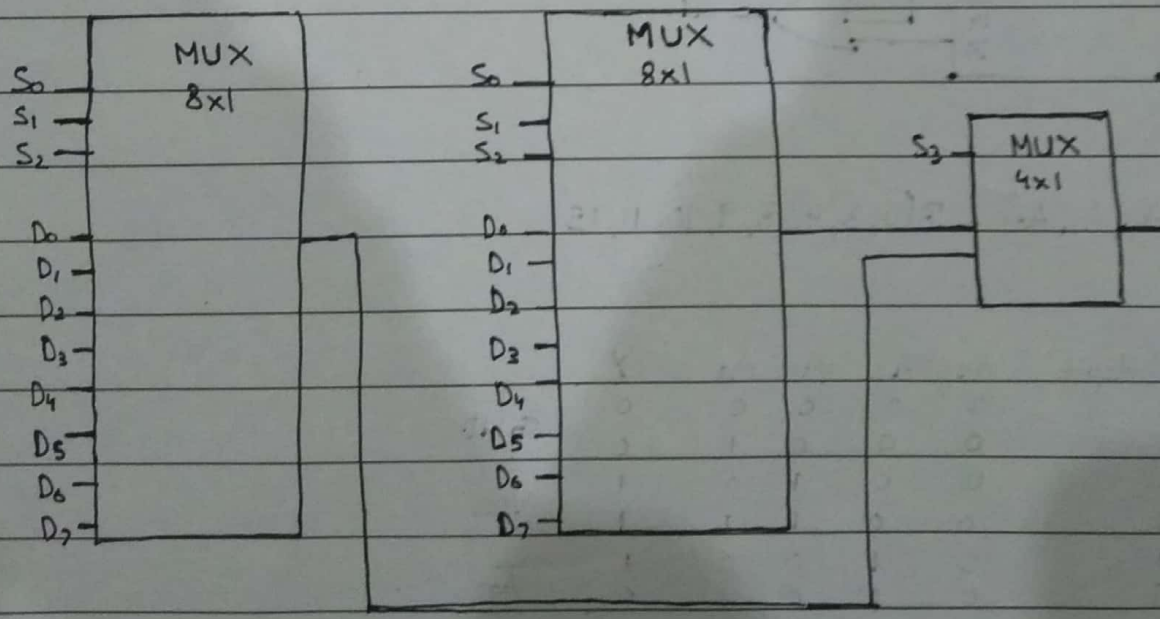


	A	B	$C_{in}$	$\Sigma$	$C_{out}$		
0	0	0	0	0	0	$C_{in}$	GND
1	0	0	1	1	0	$\overline{C_{in}}$	$C_{in}$
2	0	1	0	0	1	$\overline{C_{in}}$	$C_{in}$
3	0	1	1	1	0	$C_{in}$	VCC

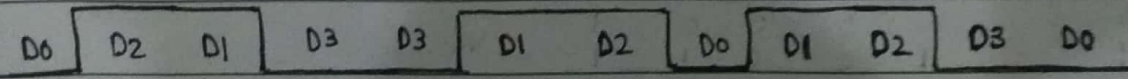
b)



A31

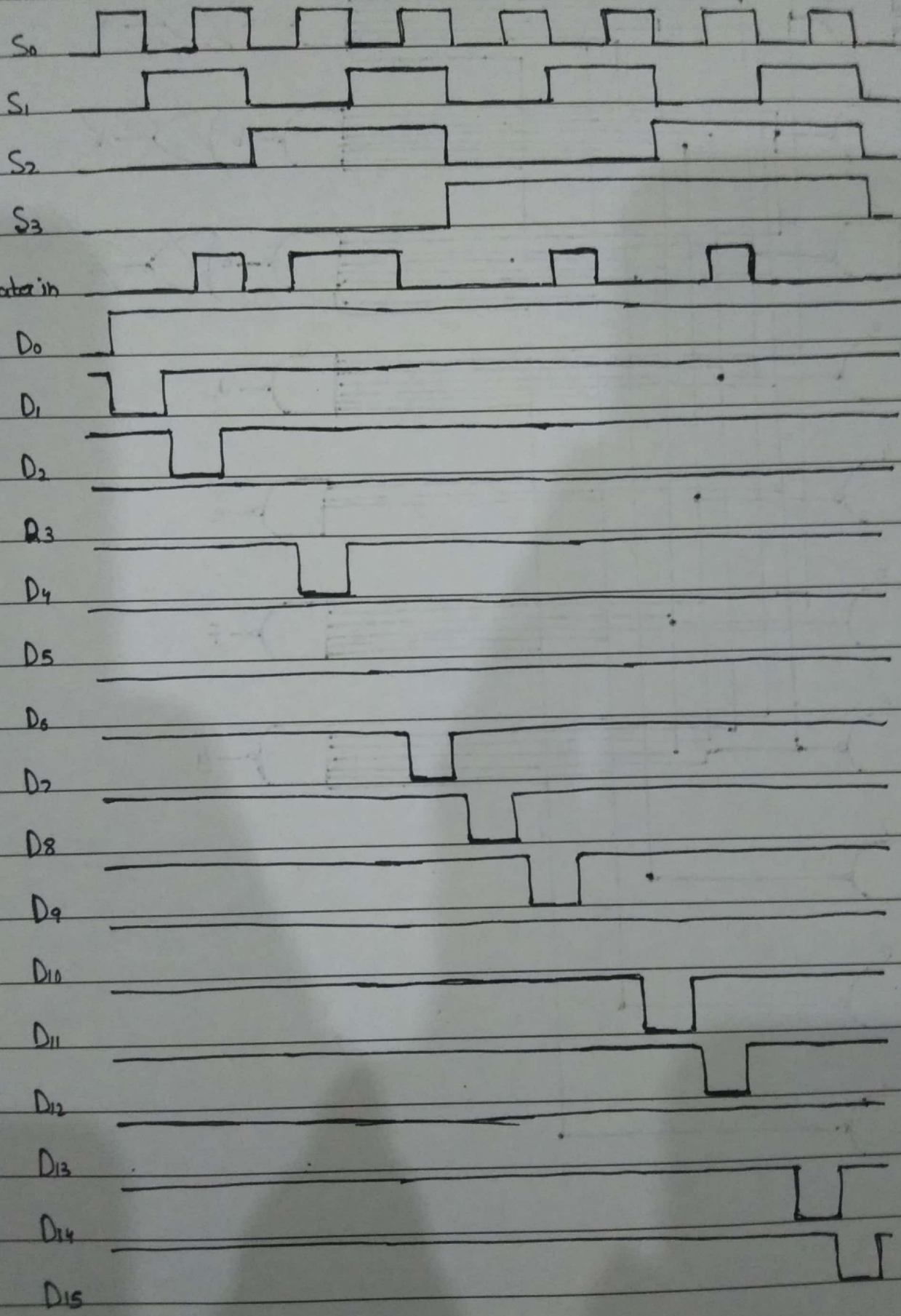


A25





A27



A21

