

DECODER:

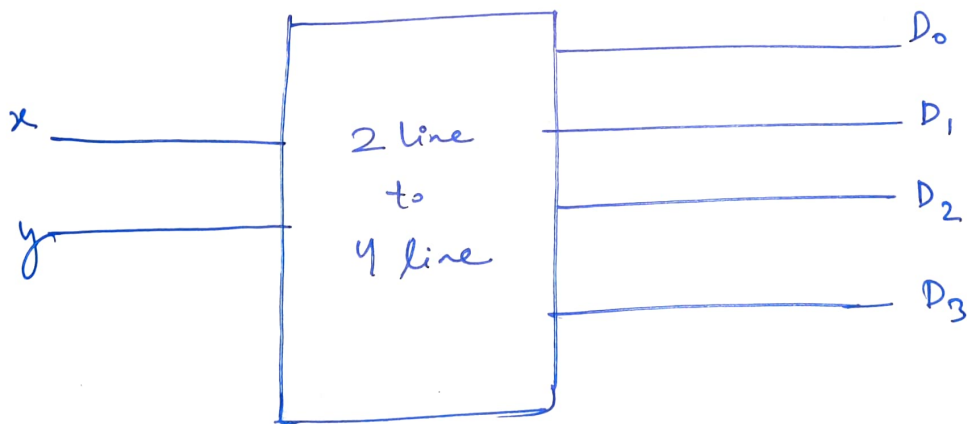
(Reverse of Encoder)

- convert n no. of binary inputs and give 2^n no. of output line (unique).
- if n bits coded information has unused combination, then the decoder may have less than 2^n output.

* No. of inputs = n

* No. of outputs = 2^n

* 2 to 4 line Decoder:



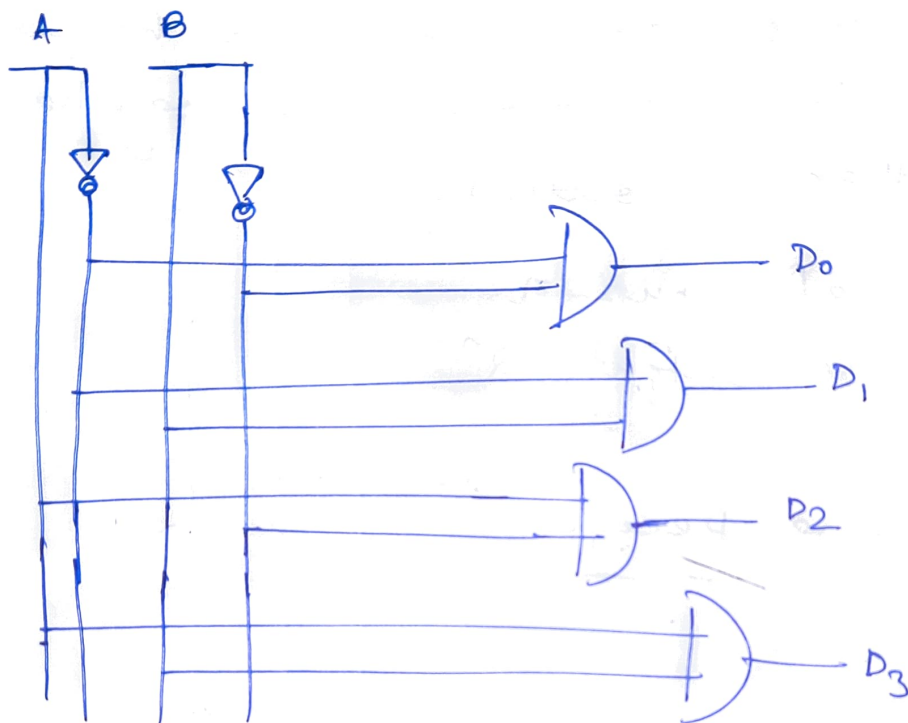
x	y	D ₀	D ₁	D ₂	D ₃
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1

$$D_0 = \bar{x}\bar{y}$$

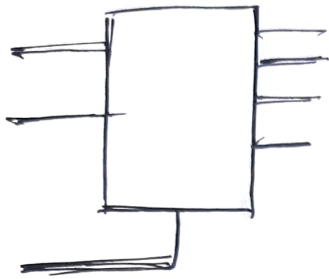
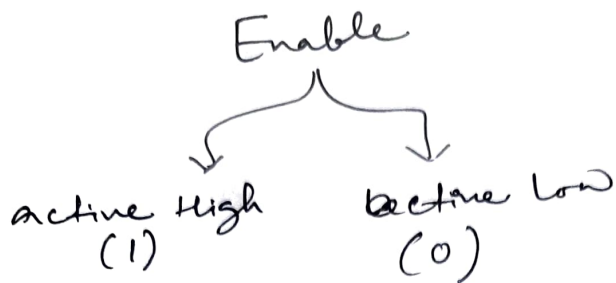
$$D_1 = \bar{x}y$$

$$D_2 = x\bar{y}$$

$$D_3 = xy$$

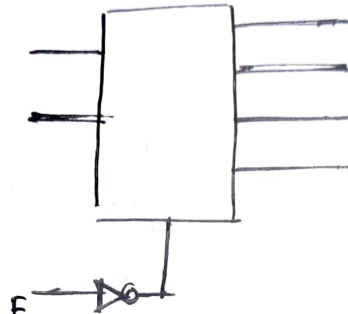


Decoder with Enabled Input:



$E = 1$ (always)

O/P \rightarrow 1 on that corresponds to Binary value.



$E = 0$ (always)

O/P: 0 on that place corresponds to Binary input value.

ex 2 to 4 line with high enabled input.

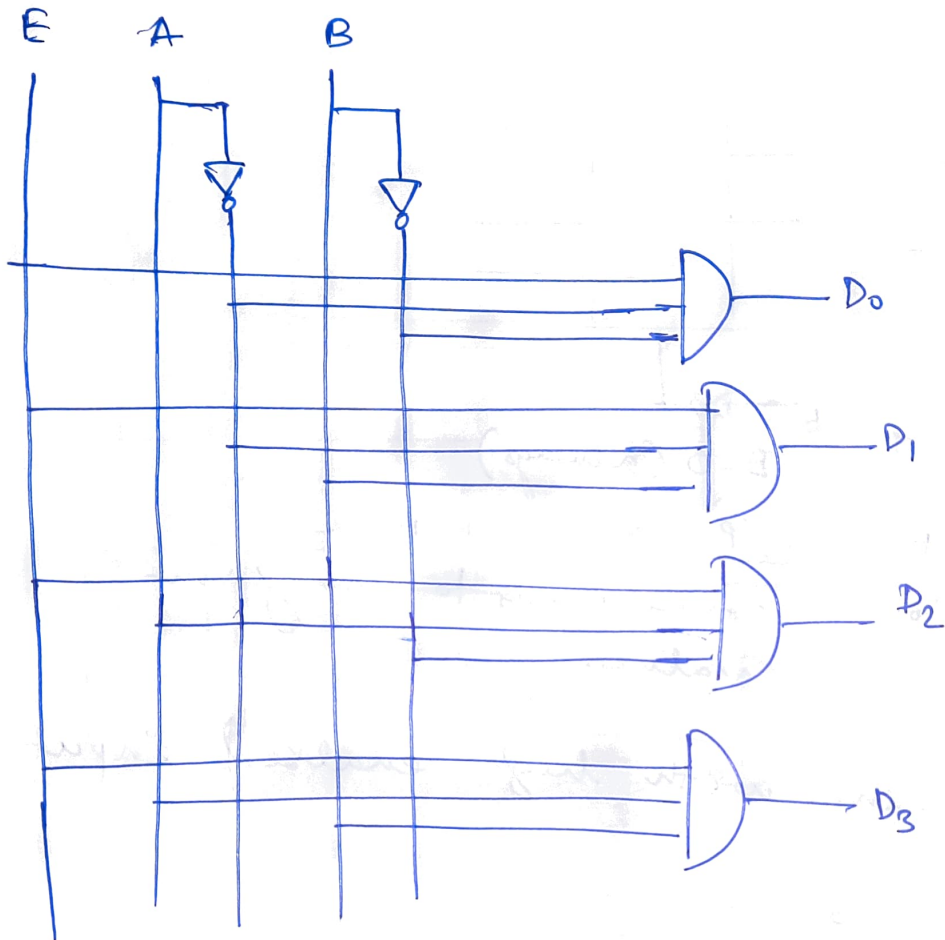
<u>E</u>	<u>A</u>	<u>B</u>				
			<u>D₀</u>	<u>D₁</u>	<u>D₂</u>	<u>D₃</u>
0	x	x	0	0	0	0
1	0	0	1	0	0	0
1	0	1	0	1	0	0
1	1	0	0	0	1	0
1	1	1	0	0	0	1

$$D_0 = E \bar{A} \bar{B}$$

$$D_1 = E \bar{A} B$$

$$D_2 = E A \bar{B}$$

$$D_3 = E A B$$



ex. 2 to 4 line with Active ^{low} high input.

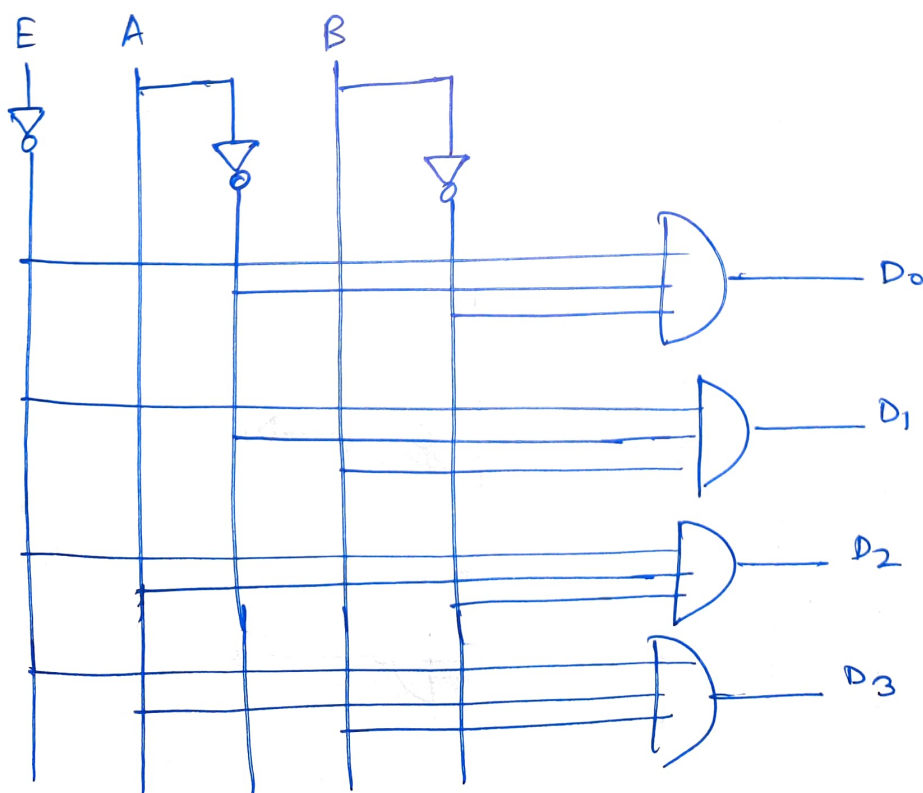
<u>E</u>	<u>A</u>	<u>B</u>	<u>D₀</u>	<u>D₁</u>	<u>D₂</u>	<u>D₃</u>
1	X	X	1	1	1	1
0	0	0	0	1	1	1
0	0	1	1	0	1	1
0	1	0	1	1	0	1
0	1	1	1	1	1	0

$$D_0 = \bar{E} \bar{A} \bar{B}$$

$$D_1 = \bar{E} \bar{A} B$$

$$D_2 = \bar{E} \bar{A} B$$

$$D_3 = \bar{E} A B$$



Q. Design 2 to 4 line ~~using~~ decoder using active low enabled NAND gate.

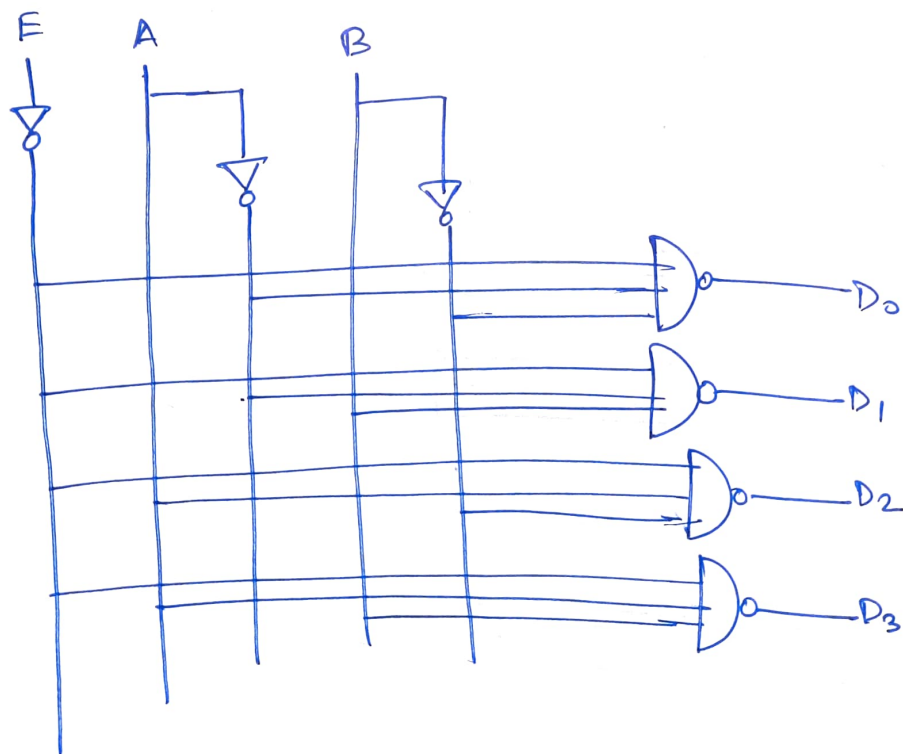
E	A	B	D_0	D_1	D_2	D_3
1	X	X	1	1	1	1
0	0	0	0	1	1	1
0	0	1	1	0	1	1
0	1	0	1	1	0	1
0	1	1	1	1	1	0

$$D_0 = \overline{\overline{E} \overline{A} \overline{B}}$$

$$D_1 = \overline{\overline{E} \overline{A} B}$$

$$D_2 = \overline{\overline{E} A \overline{B}}$$

$$D_3 = \overline{\overline{E} A B}$$



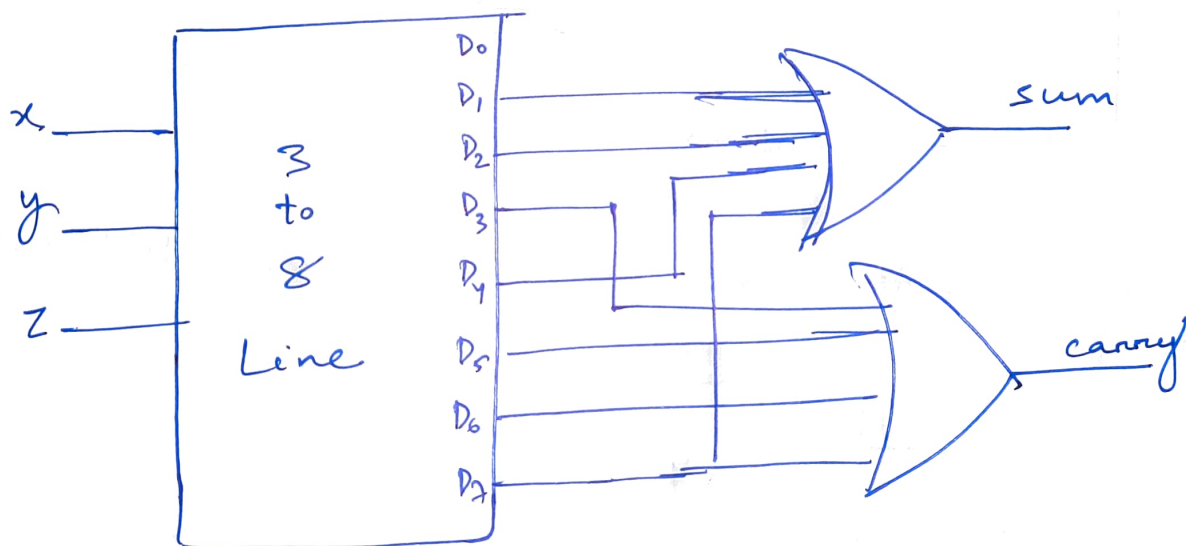
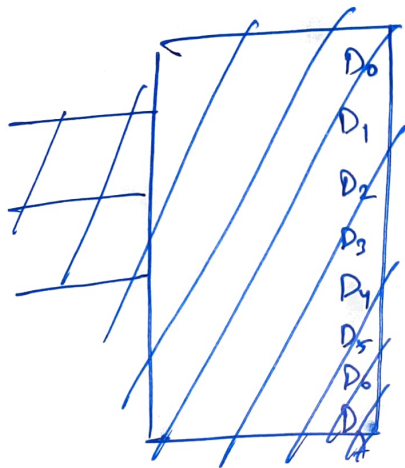
Q. Design a full adder using decoder.

No. of inputs = 3

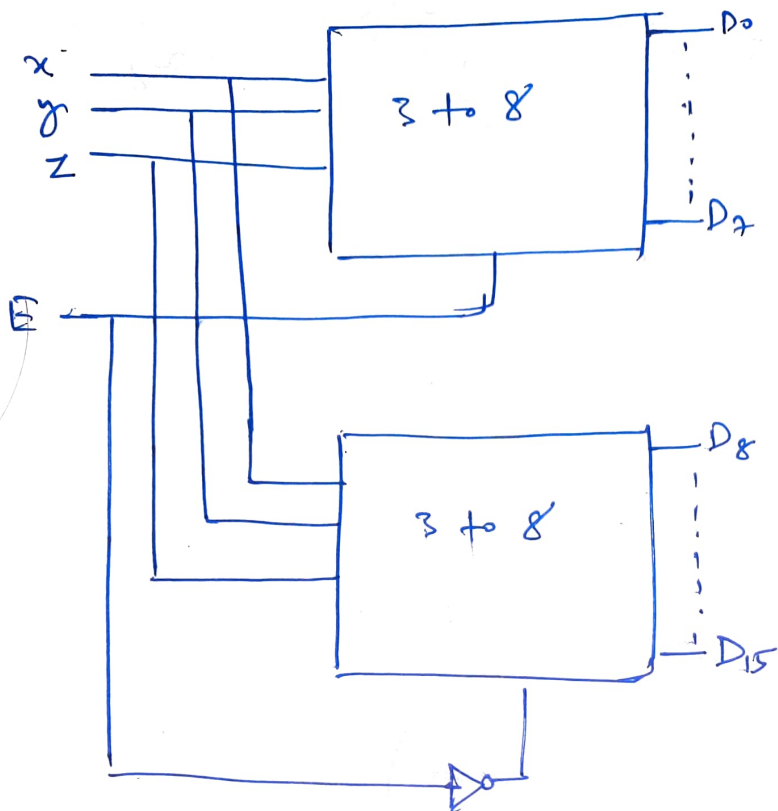
$$\text{sum} = \sum m(1, 2, 4, 7)$$

No. of output = $2^3 = 8$

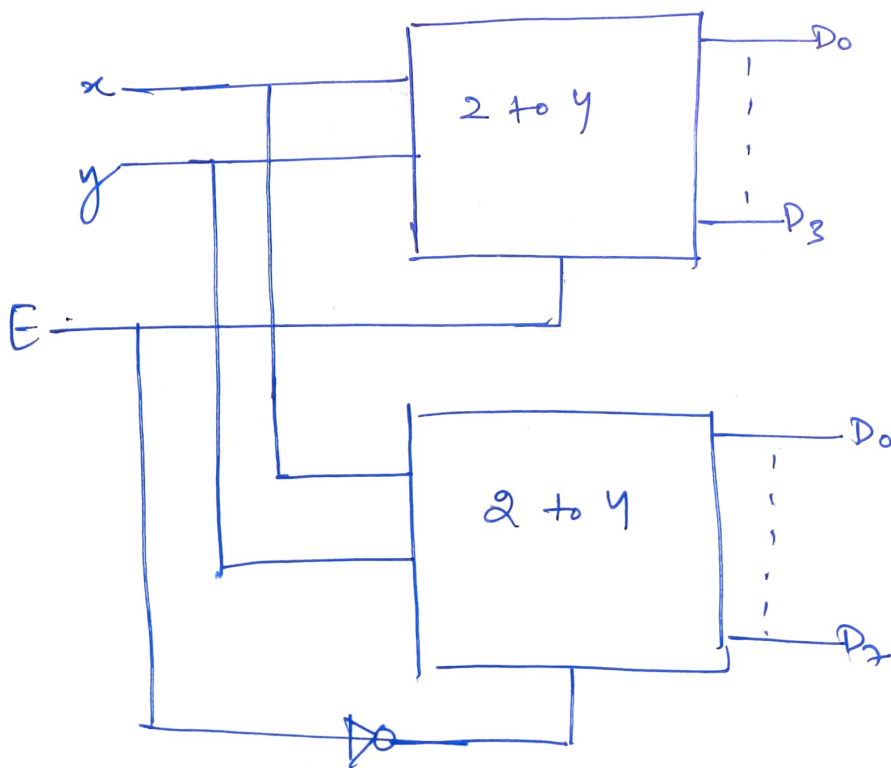
$$\text{carry} = \sum m(3, 5, 6, 7)$$



Q. Design a 4x16 decoder using two 3x8 decoder.



Q. Design 3 to 8 decoder using two 2 to 4 decoder.

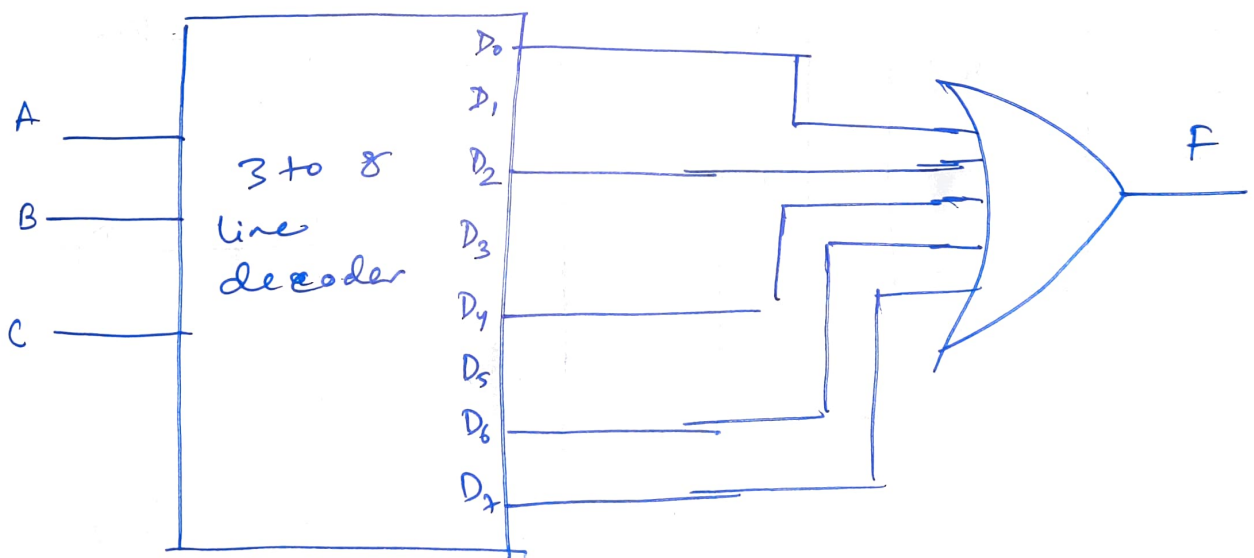


8. Design $F(A, B, C) = \bar{C} + AB$ using decoder.

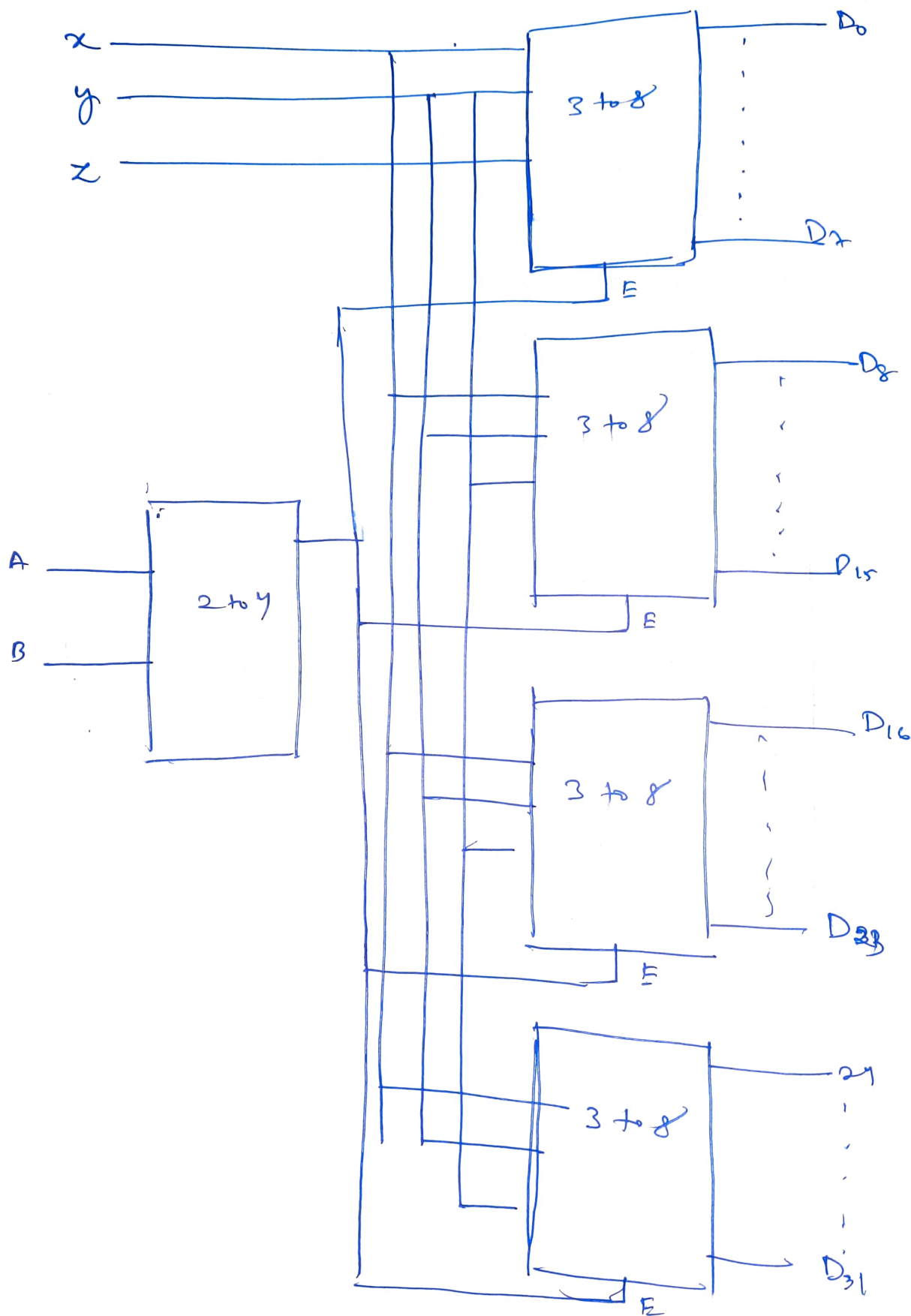
Ans

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

$$F = \sum m(0, 2, 4, 6, 7)$$



Q. Construct 5x32 decoder using four 3 to 8 line decoder with enable and 2 to 4 line decoder. Use block diagram for component.



2. Construct 4×16 decoder using five 2×4 decoder with enable.

