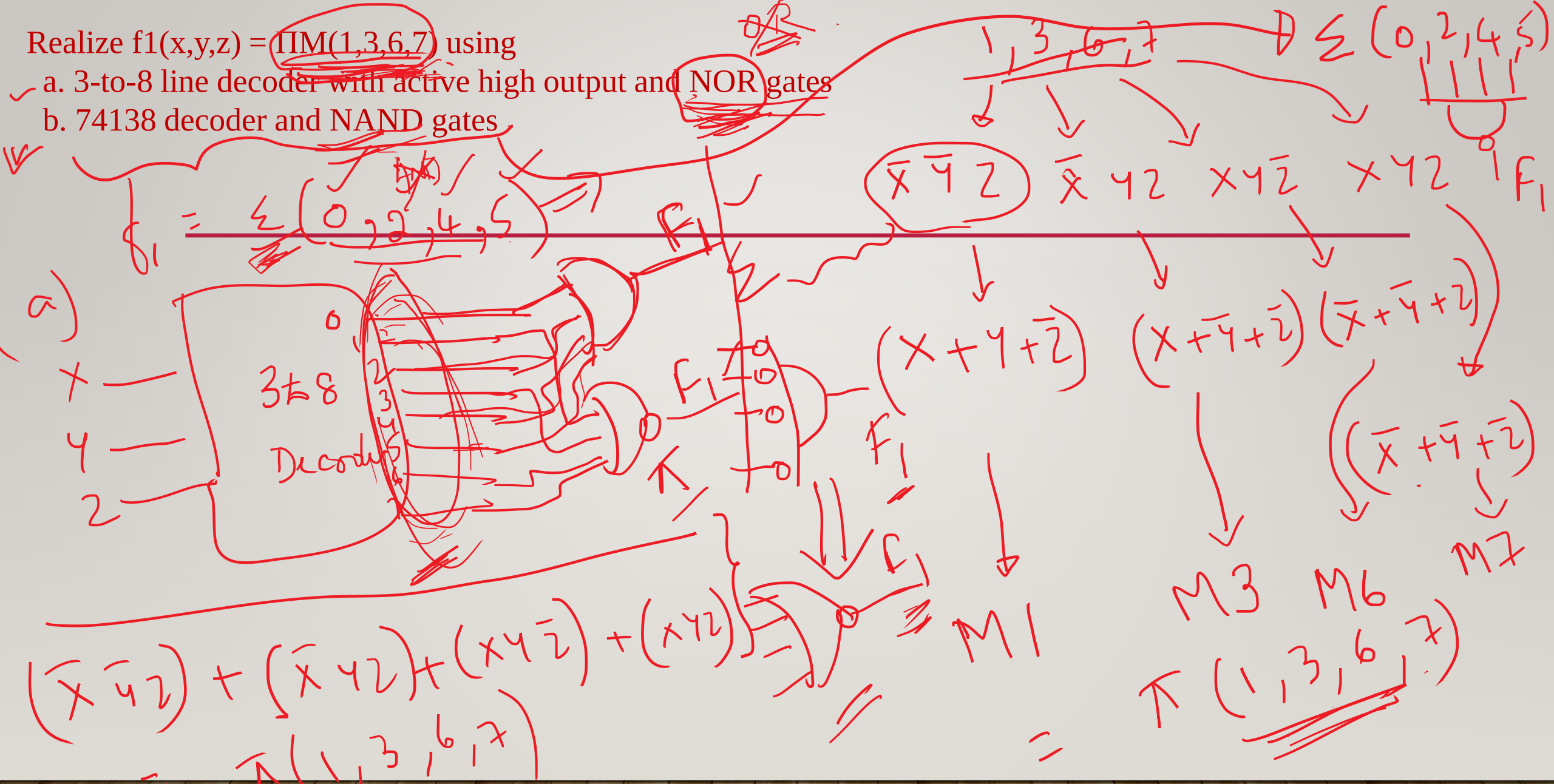
DECODERS AND ENCODERS

STUDENTS ARE ADVISED TO WRITE DOWN THE NOTES FOR EVERY LECTURE

Realize f1(x,y,z) = ΠM(1,3,6,7) using

a. 3-to-8 line decoder with active high output and NOR gates

b. 74138 decoder and NAND gates



Design a code converter to convert a decimal digit represented in 84-2-1 code to a decimal digit represented in excess-3 code using 74138 decoder and external gates.

8 4 -2 -1 A B C D	$E_3E_2E_1E_0$
0 0 0 0 0	0 0 1 1
x 0 0 0 1	x
x 0 0 1 0	x
x 0 0 1 1	x
4 0 1 0 0	0 1 1 1
3 0 1 0 1	0 1 1 0
2 0 1 1 0	0 1 0 1
1 0 1 1 1	0 1 0 0
8 1 0 0 0	1 0 0 0
7 1 0 0 1	1 0 1 0
6 1 0 1 0	1 0 0 1
5 1 0 1 1	1 0 0 0
x 1 1 0 0	x
x 1 1 0 1	x
x 1 1 1 0	x
9 1 1 1 1	1 1 0 0

$E_3 = \pi(0,4,5,6,7)$

$= \Sigma(8,9,10,11,15)$

$E_2 = \pi(0,8,9,10,11)$

$= \Sigma(4,5,6,7,15)$

$E_1 = \pi(6,7,10,11,15)$

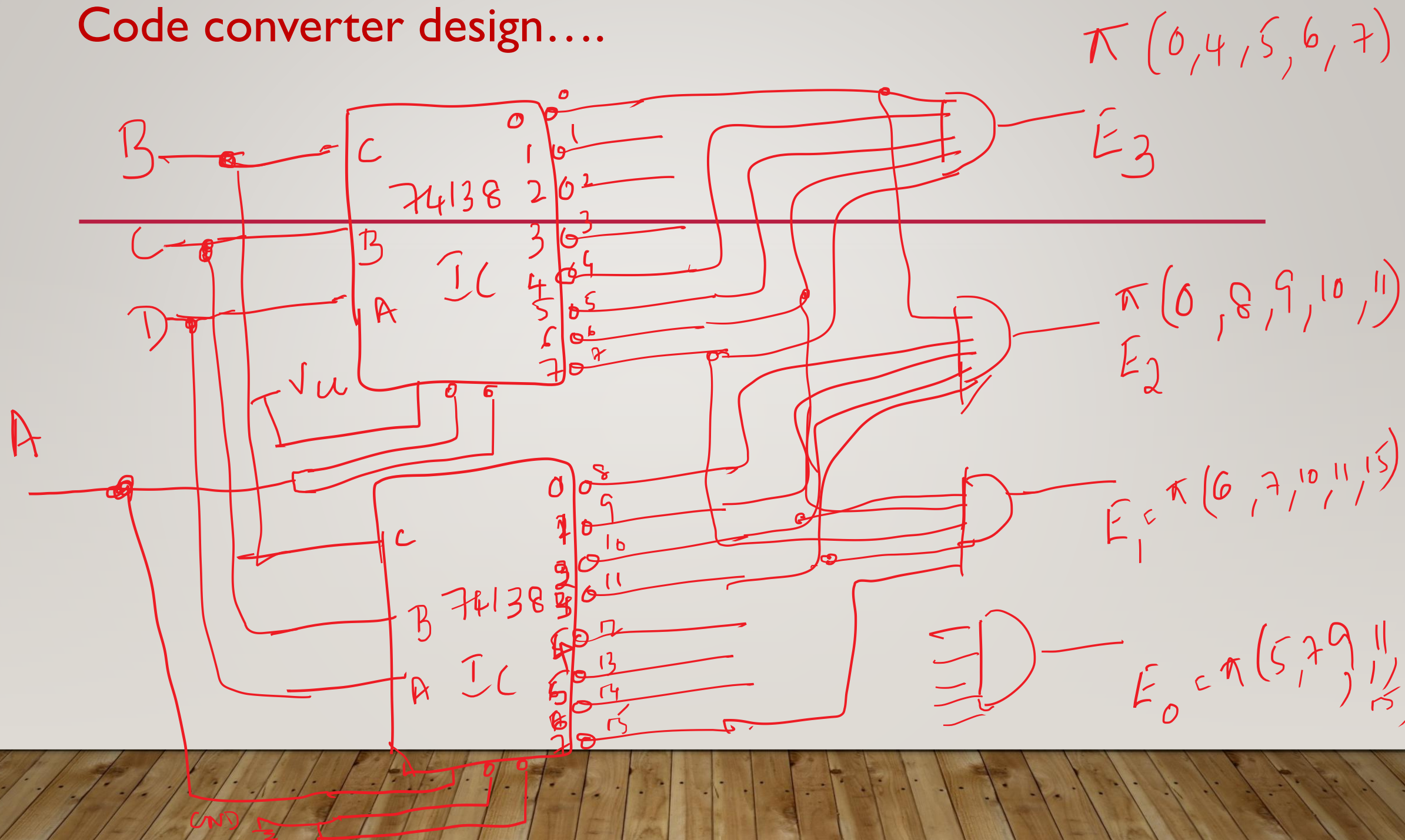
$= \Sigma(0,4,5,8,9)$

$E_0 = \pi(5,7,9,11,15)$

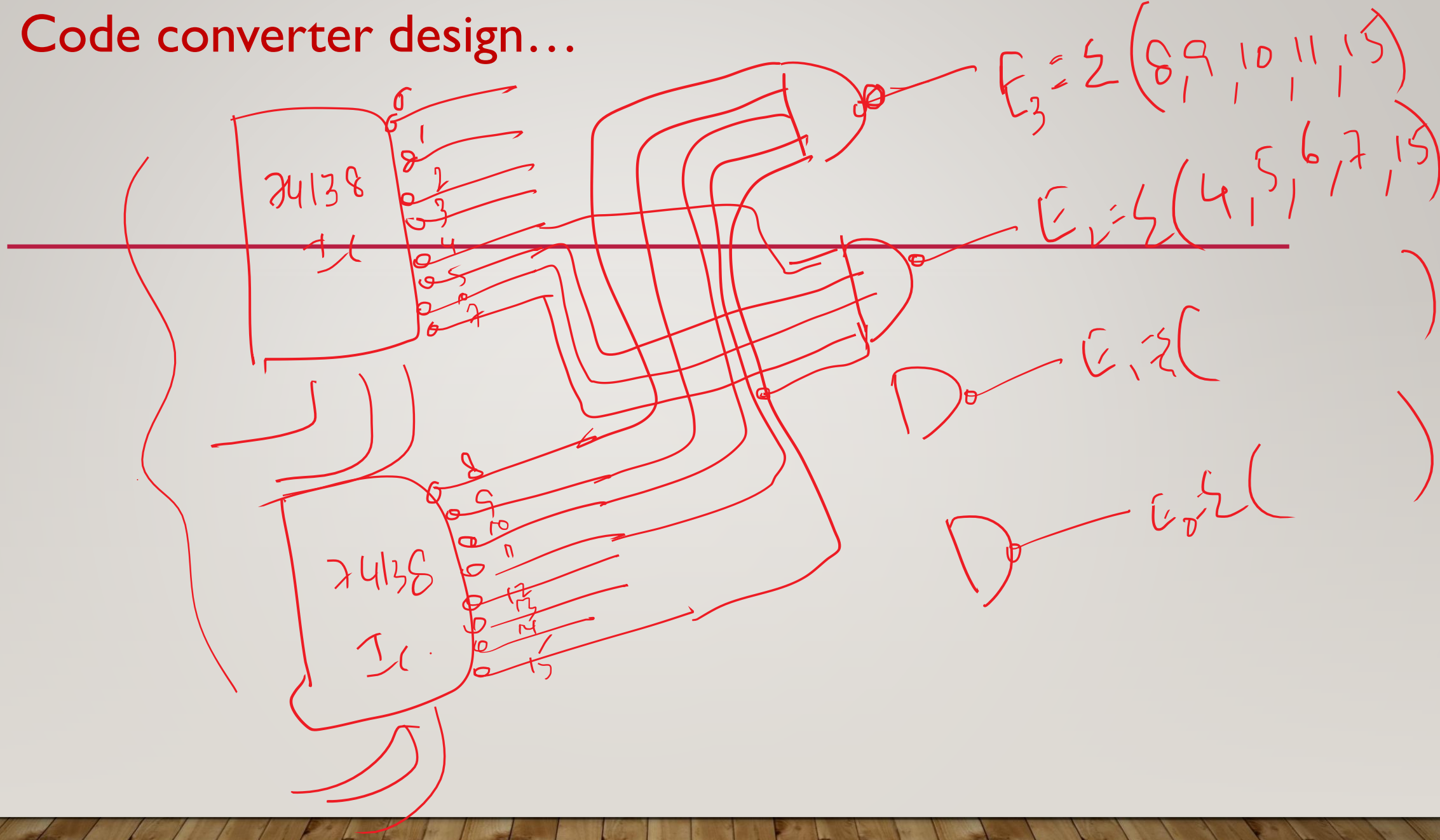
$= \Sigma(0,4,6,8,10)$

4 to 16 Decoder

Code converter design….



Code converter design…



Design f(x,y,z) = x' +y'z using 3-to-8 line decoder and external gates.

x	y	z	F
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

$= \bar{x}[y+\bar{y}] + \bar{y}z[x+\bar{x}]$

$= \bar{x}y + \bar{x}\bar{y} + x\bar{y}z + \bar{x}\bar{y}z$

$= \bar{x}y[z+\bar{z}] + x\bar{y}[z+\bar{z}] + \bar{x}\bar{y}z$

$= \bar{x}yz + \bar{x}y\bar{z} + x\bar{y}z + x\bar{y}\bar{z} + \bar{x}\bar{y}z$

$f = \Sigma(0,1,2,3,5)$

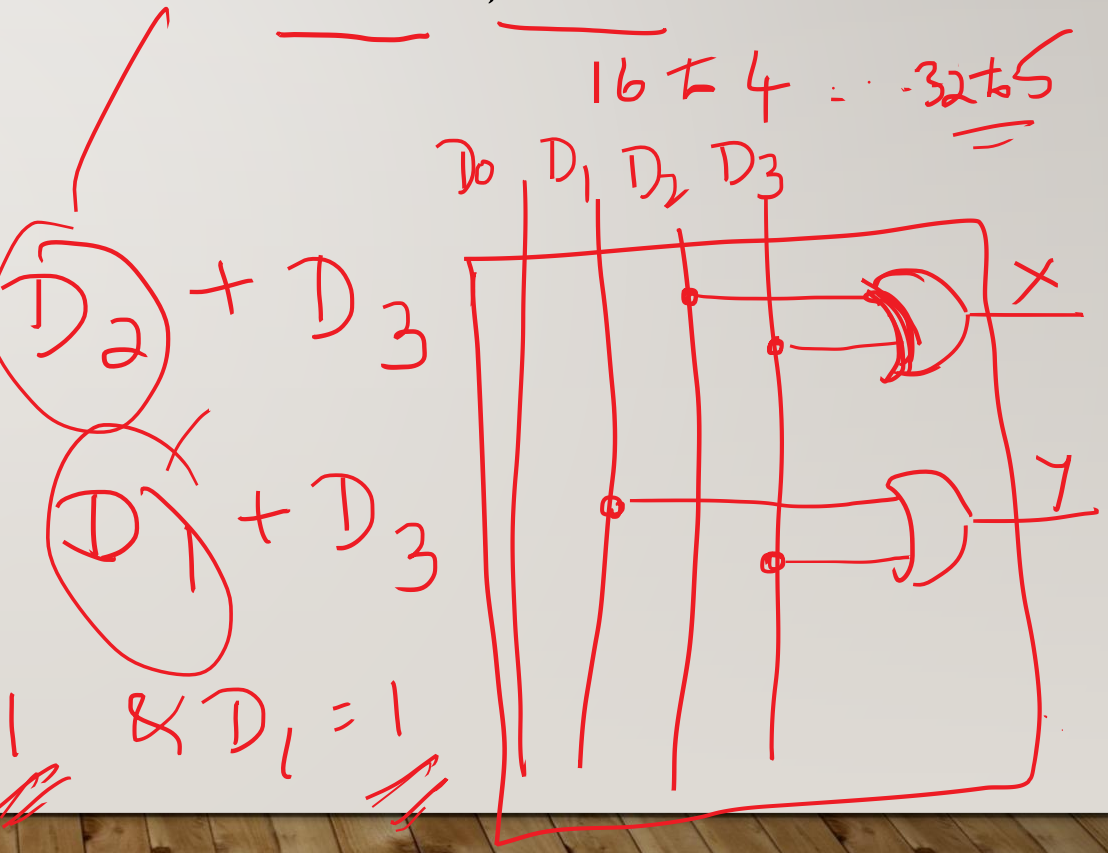
$F = \Pi(4,6,7)$

ENCODER:

- Combinational circuit that performs inverse operation of a decoder.
- Encoder has 2^n (or fewer) input lines and n output lines. Ex: 4-to-2 line, 8-to-3 line…etc
- 4-to-2 encoder is given below:

Truth table

Inputs				Outputs	
D_0	D_1	D_2	D_3	x	y
1	0	0	0	0	0
0	1	0	0	0	1
0	0	1	0	1	0
0	0	0	1	1	1



Design a 4 –to-2 line priority encoder

D_0 has least priority

D_3 has highest priority

D_0	D_1	D_2	D_3	X	Y	V (Valid)
0	0	0	0	X	X	0
1	0	0	0	0	0	1
X	1	0	0	0	1	1
X	X	1	0	1	0	1
X	X	X	1	1	1	1

$$X = D_2\bar{D}_3 + D_3$$

$$= D_2 + D_3$$

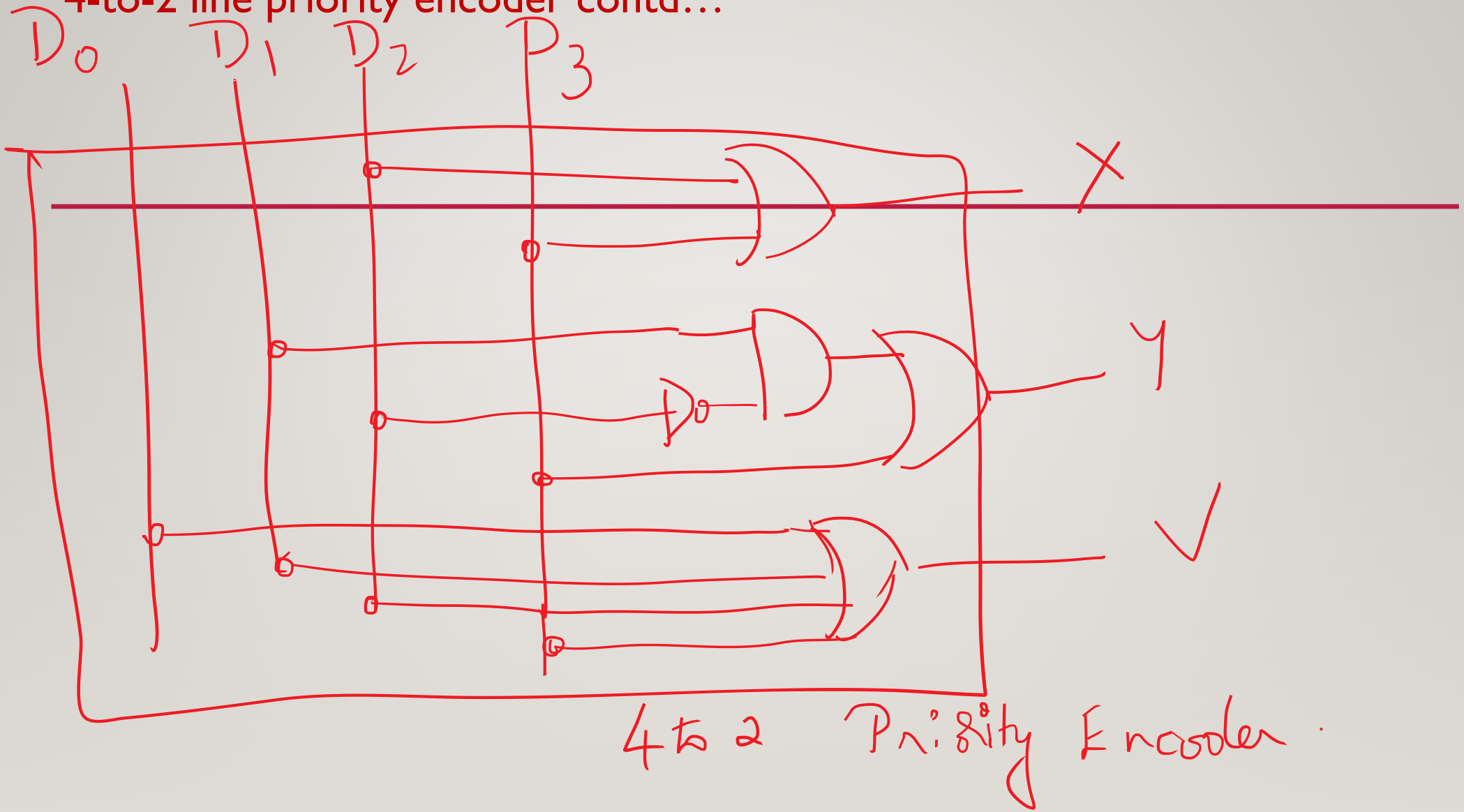
$$Y = D_1\bar{D}_2\bar{D}_3 + D_3$$

$$= D_1\bar{D}_2 + D_3$$

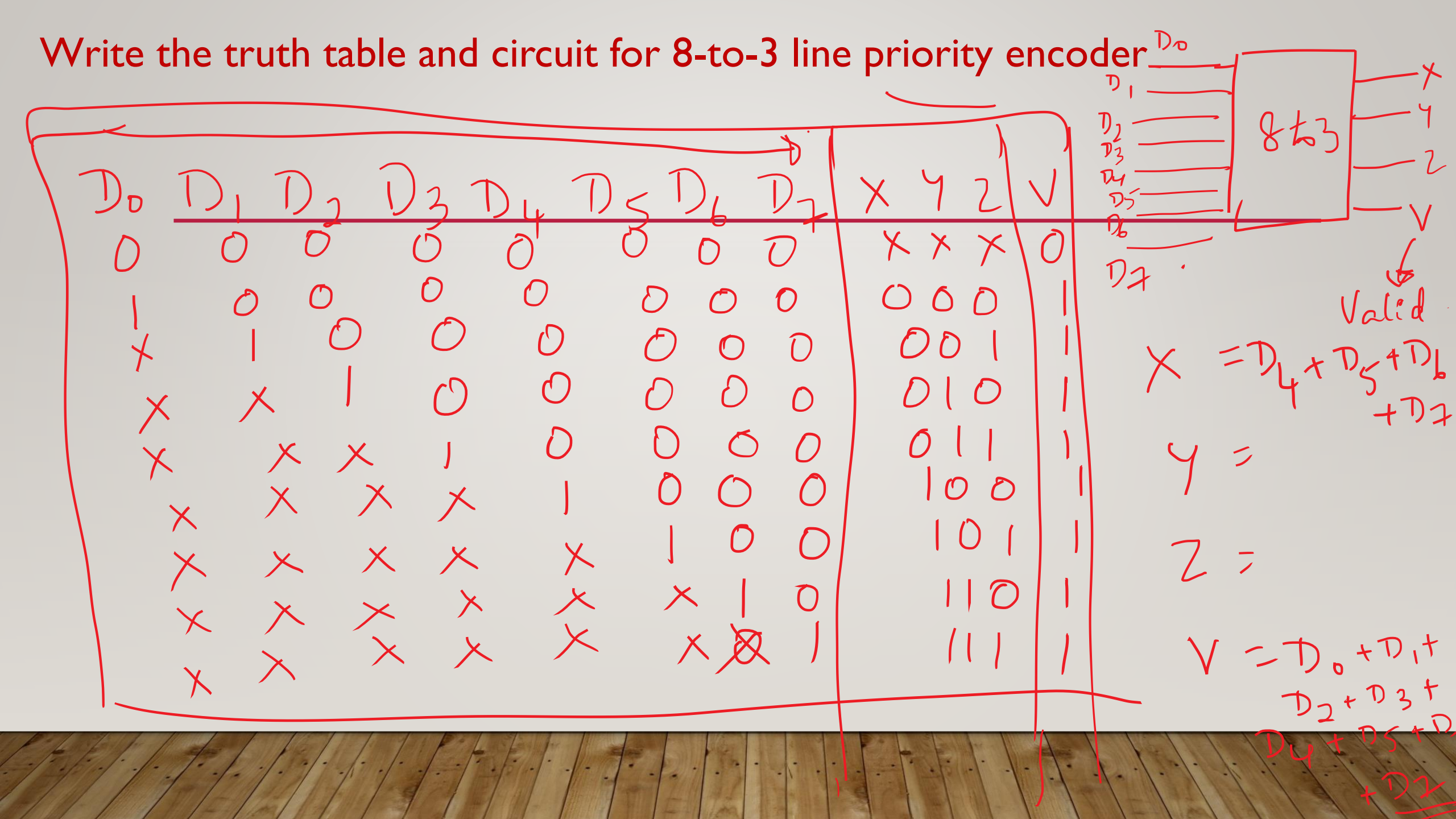
$$V = D_0\bar{D}_1\bar{D}_2\bar{D}_3 + D_1\bar{D}_2\bar{D}_3 + D_2\bar{D}_3 + D_3$$

$$V = D_0 + D_1 + D_2 + D_3$$

4-to-2 line priority encoder contd…



Write the truth table and circuit for 8-to-3 line priority encoder



- Any questions?