

DECODER.

A decoder is a combinational circuit that converts 'n' number of input lines to a maximum of 2^n number of output lines.

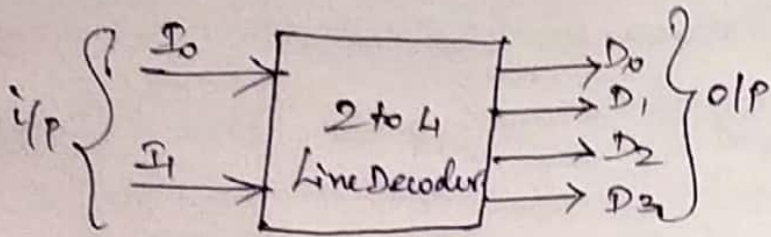
The decoders given here are n-to-m line decoders where $m \leq 2^n$. Based on no. of o/p & i/p decoders can be classified as.

* 2 to 4 line decoder

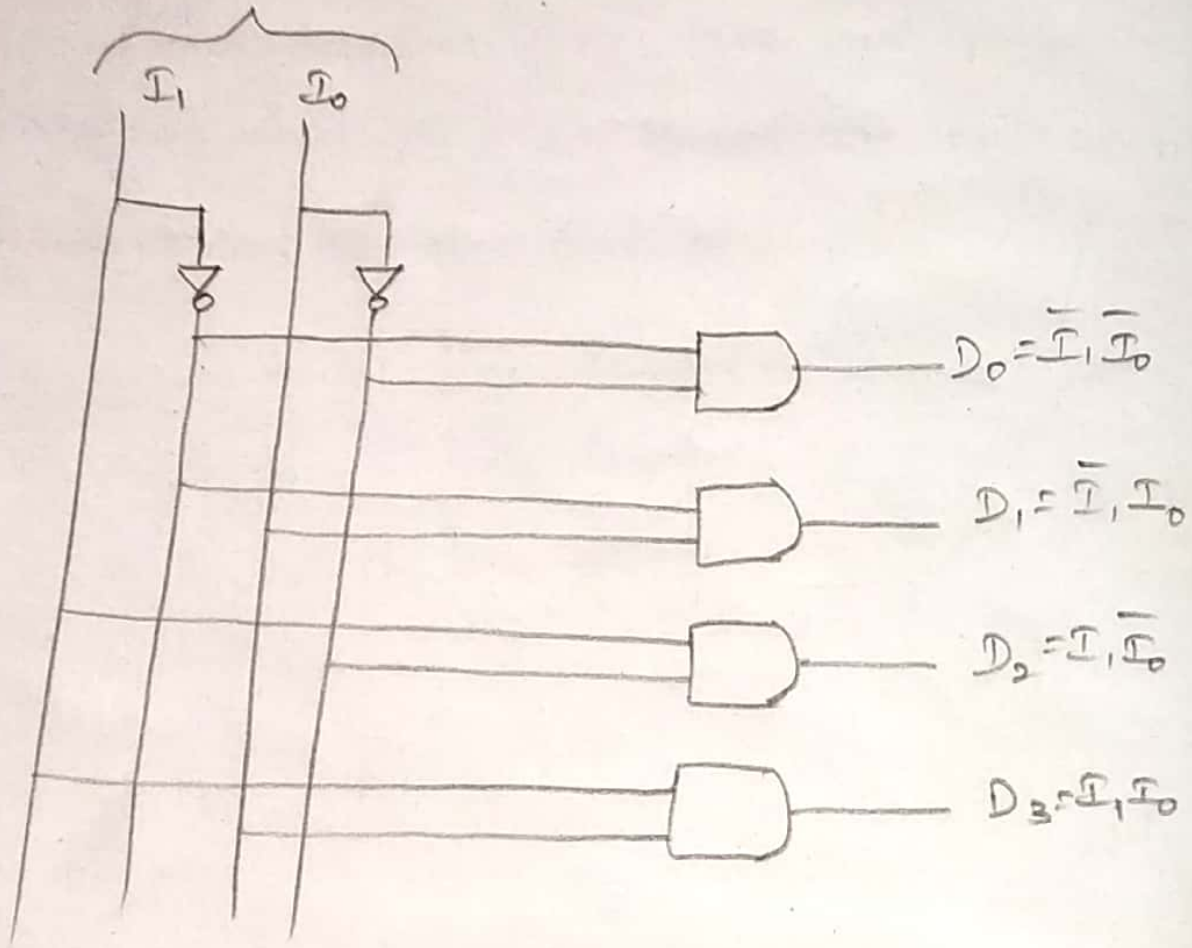
* 3 to 8 line decoder

* 4 to 16 line decoder

2-to 4 Line Decoder



i/p		o/p			
I ₁	I ₀	D ₃	D ₂	D ₁	D ₀
0	0	0	0	0	1
0	1	0	0	1	0
1	0	0	1	0	0
1	1	1	0	0	0



Similarly for 3 to 8 Line Decoder

4 to 16 Line Decoder.

ENCODER.

Encoder performs the Inverse operation of decoder.

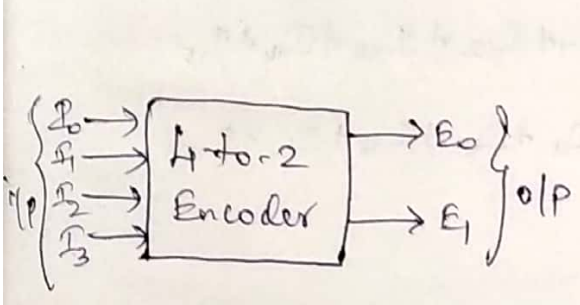
An encoder is a combinational circuit that converts 2^n number of input lines to 'n' number of output lines.

* 4-to-2 Line Encoder

* 8-to-3 Line Encoder

* 16-to-4 Line Encoder.

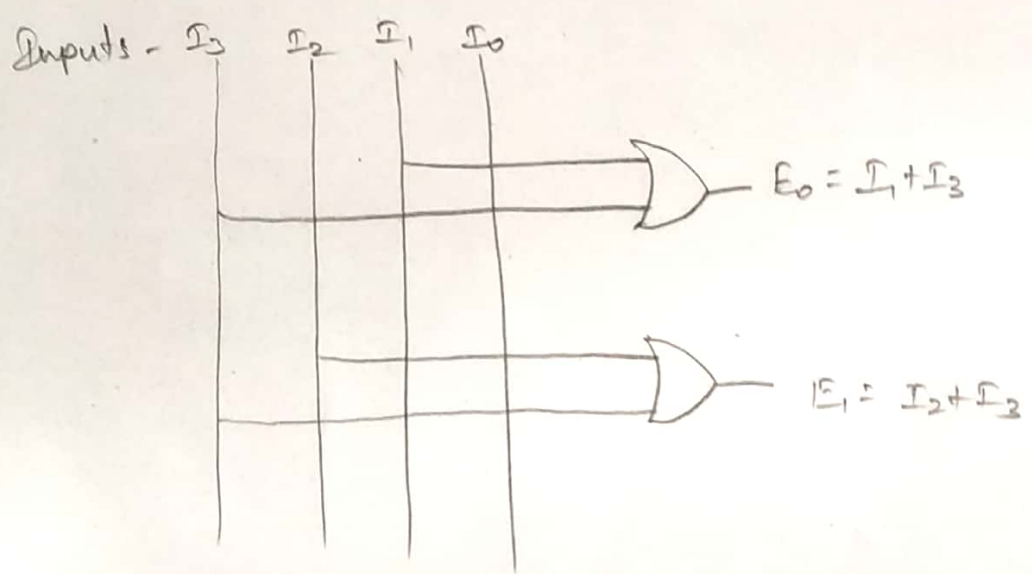
4-to-2 Line Encoder



Inputs				Outputs.	
I_3	I_2	I_1	I_0	E_1	E_0
0	0	0	1	0	0
0	0	1	0	0	1
0	1	0	0	1	0
1	0	0	0	1	1

(LSB) $E_0 = I_1 + I_3$

(MSB) $E_1 = I_2 + I_3$



Similarly.

8-to-3 Encoder.

$$E_0 = I_1 + I_3 + I_5 + I_7$$

$$E_1 = I_2 + I_3 + I_6 + I_7$$

$$E_2 = I_4 + I_5 + I_6 + I_7$$

16-to-4 Encoder.

$$(LSB) E_0 = I_1 + I_3 + I_5 + I_7 + I_9 + I_{11} + I_{13} + I_{15}$$

$$E_1 = I_2 + I_3 + I_6 + I_7 + I_{10} + I_{11} + I_{14} + I_{15}$$

$$E_2 = I_4 + I_5 + I_6 + I_7 + I_{12} + I_{13} + I_{14} + I_{15}$$

$$(MSB) E_3 = I_8 + I_9 + I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15}$$