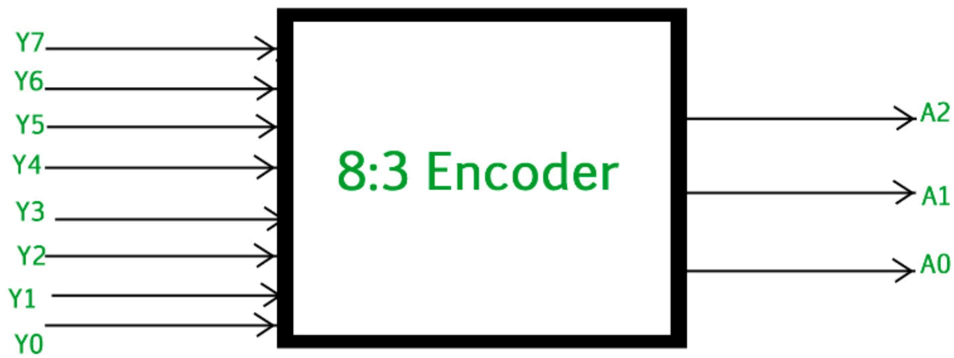
Encoder, Decoder, DeMUX

Encoder

Octal to Binary Encoder (8 to 3 Encoder)

The 8 to 3 Encoder or octal to Binary encoder consists of **8 inputs**: Y7 to Y0 and **3 outputs**: A2, A1 & A0. Each input line corresponds to each octal digit and three outputs generate corresponding binary code. The figure below shows the logic symbol of octal to the binary encoder.

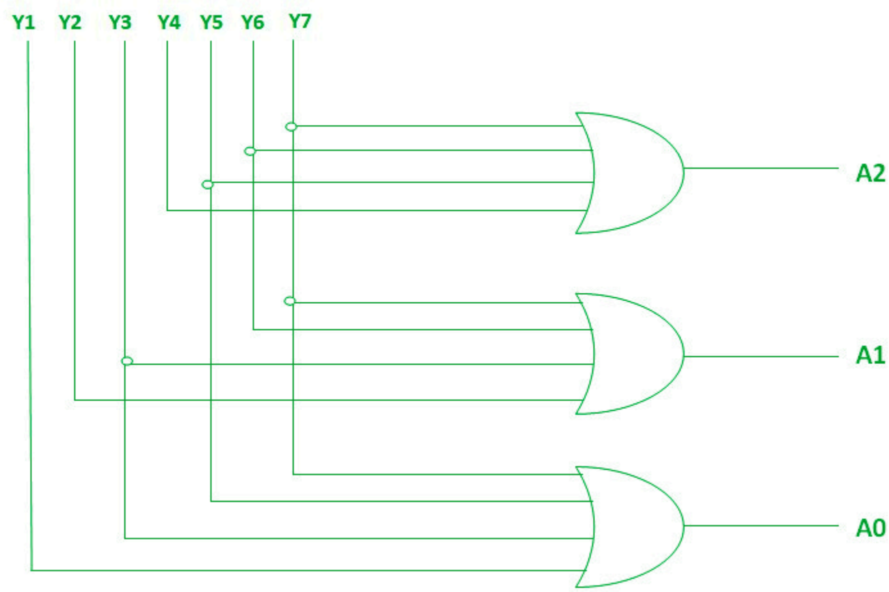


Octal to Binary Encoder (8 to 3 Encoder)

INPUTS								OUTPUTS		
Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0	A2	A1	A0
0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	1	0	0	0	1
0	0	0	0	0	1	0	0	0	1	0
0	0	0	0	1	0	0	0	0	1	1
0	0	0	1	0	0	0	0	1	0	0
0	0	1	0	0	0	0	0	1	0	1
0	1	0	0	0	0	0	0	1	1	0
1	0	0	0	0	0	0	0	1	1	1

```
A2 = Y7 + Y6 + Y5 + Y4
A1 = Y7 + Y6 + Y3 + Y2
A0 = Y7 + Y5 + Y3 + Y1
```

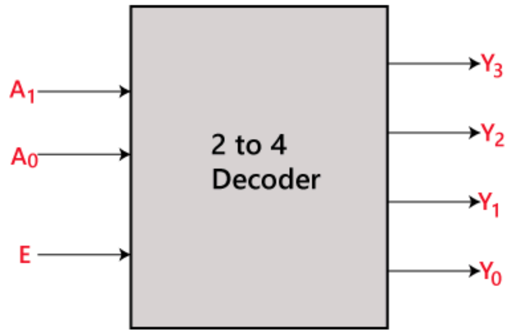
The above two Boolean functions A2, A1, and A0 can be implemented using four input OR gates.



Implementation using OR Gate

Decoder

Block Diagram:



Truth Table:

Enable	INPUTS		OUTPUTS			
E	A_1	A_0	Y_3	Y_2	Y_1	Y_0
0	X	X	0	0	0	0
1	0	0	0	0	0	1
1	0	1	0	0	1	0
1	1	0	0	1	0	0
1	1	1	1	0	0	0

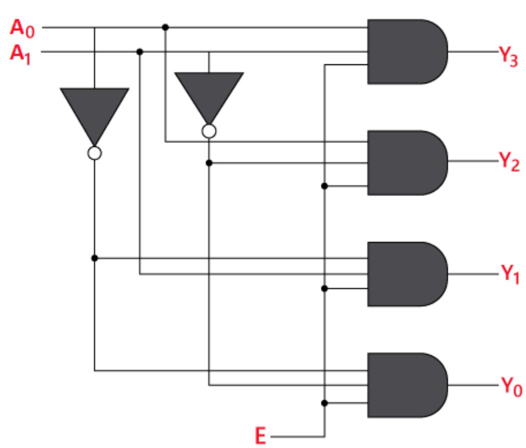
$Y_3=E.A_1.A_0$

$Y_2=E.A_1.A_0'$

$Y_1=E.A_1'.A_0$

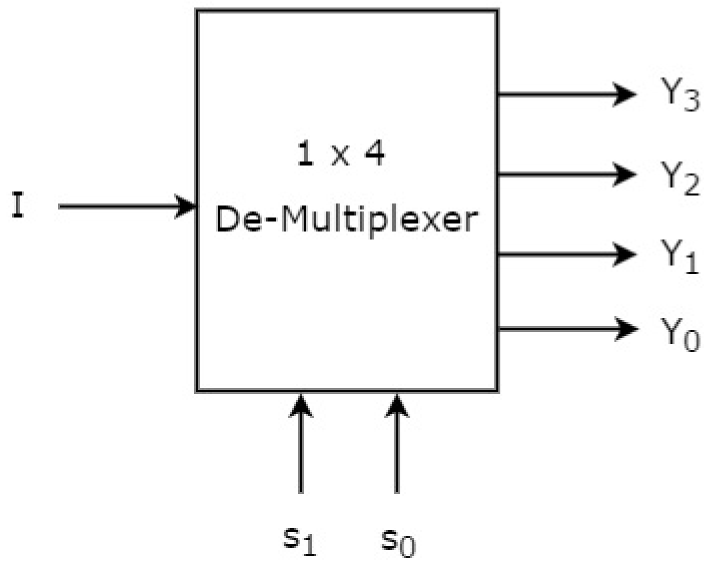
$Y0=E.A_1'.A_0'$

Logical circuit of the above expressions is given below:



Demux

1x4



Selection Inputs		Outputs			
S_1	S_0	Y_3	Y_2	Y_1	Y_0
0	0	0	0	0	**I**
0	1	0	0	**I**	0
1	0	0	**I**	0	0
1	1	**I**	0	0	0

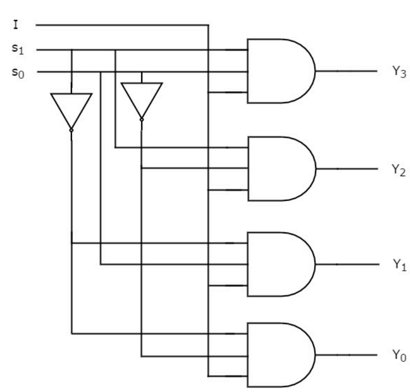
From the above Truth table, we can directly write the **Boolean functions** for each output as

$$Y_3 = s_1 s_0 I$$

$$Y_2 = s_1 s_0' I$$

$$Y_1 = s_1' s_0 I$$

$$Y_0 = s_1' s_0' I$$



1x8 using 2 1x4

Selection Inputs			Outputs							
s_2	s_1	s_0	Y_7	Y_6	Y_5	Y_4	Y_3	Y_2	Y_1	Y_0
0	0	0	0	0	0	0	0	0	0	I
0	0	1	0	0	0	0	0	0	I	0
0	1	0	0	0	0	0	0	I	0	0
0	1	1	0	0	0	0	I	0	0	0
1	0	0	0	0	0	I	0	0	0	0
1	0	1	0	0	I	0	0	0	0	0
1	1	0	0	I	0	0	0	0	0	0
1	1	1	I	0	0	0	0	0	0	0