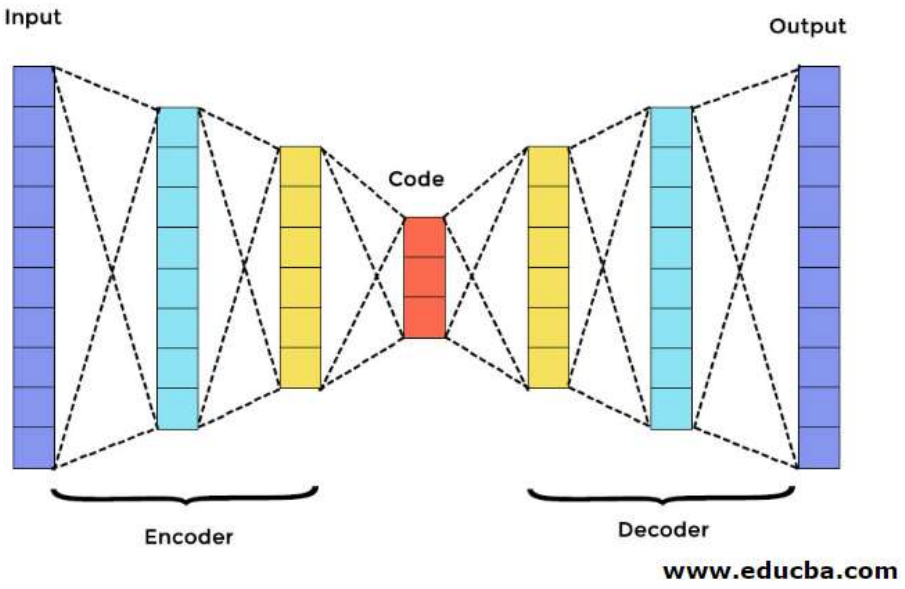
SNS COLLEGE OF ENGINEERING

(Autonomous)

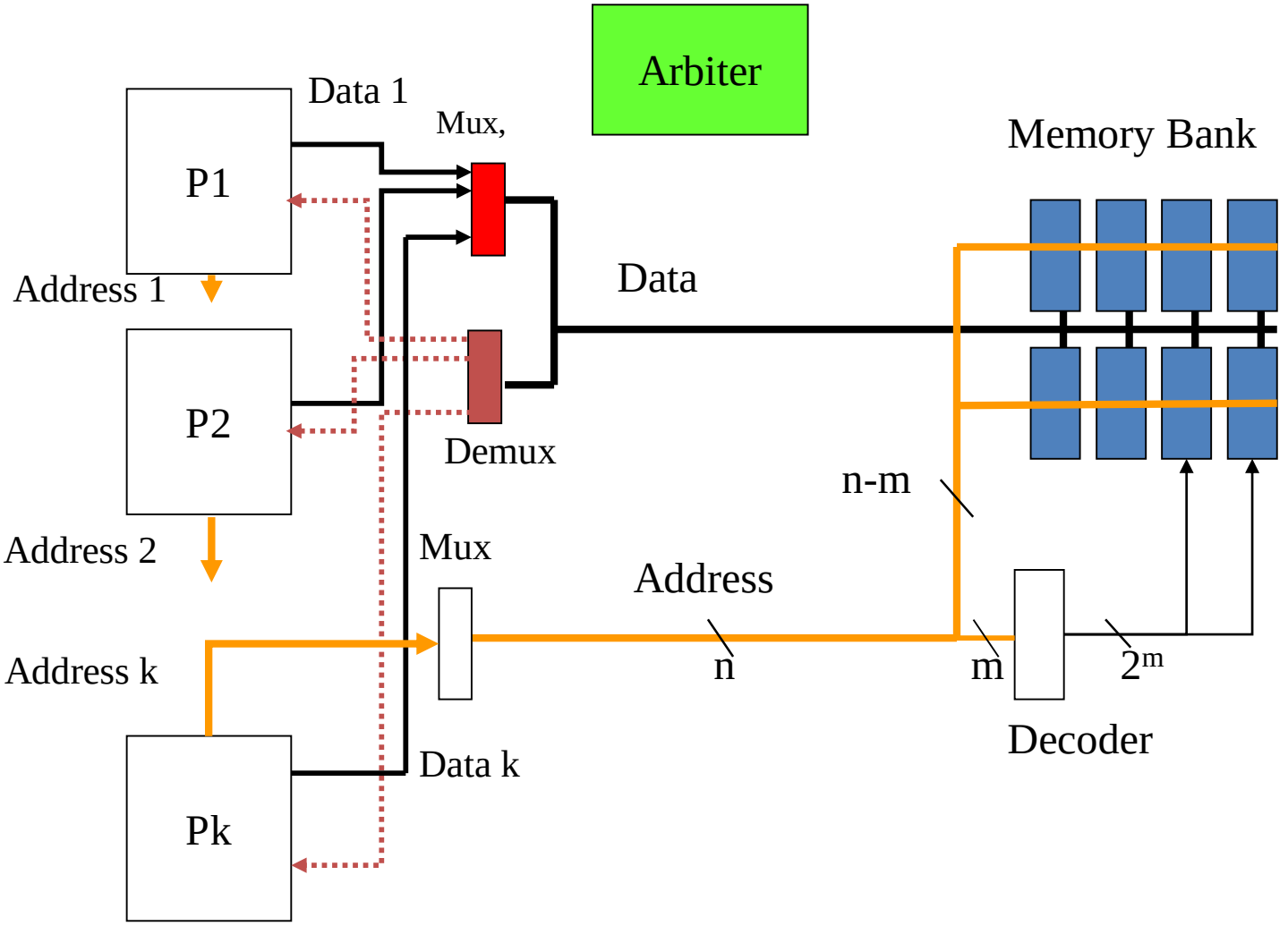
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

23ECB204 – DIGITAL ELECTRONICS AND MICROPROCESSOR

UNIT -1 COMBINATIONAL LOGIC



Interconnect: Decoder, Encoder, Mux, DeMux



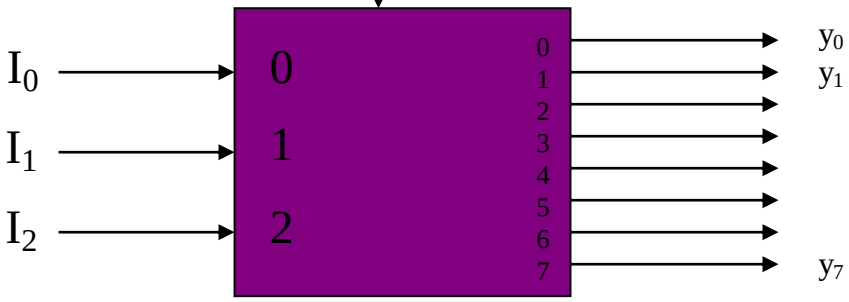
1. Decoder

- Definition
- Logic Diagram
- Application (Universal Set)
- Tree of Decoders

1. Decoder: Definition

n inputs
n= 3

EN (enable)



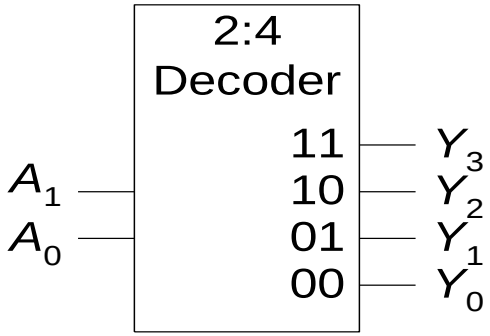
2^n outputs
2^3= 8

n to 2^n decoder function:

y_i = 1 if En= 1 & (I_2, I_1, I_0) = i
y_i= 0 otherwise

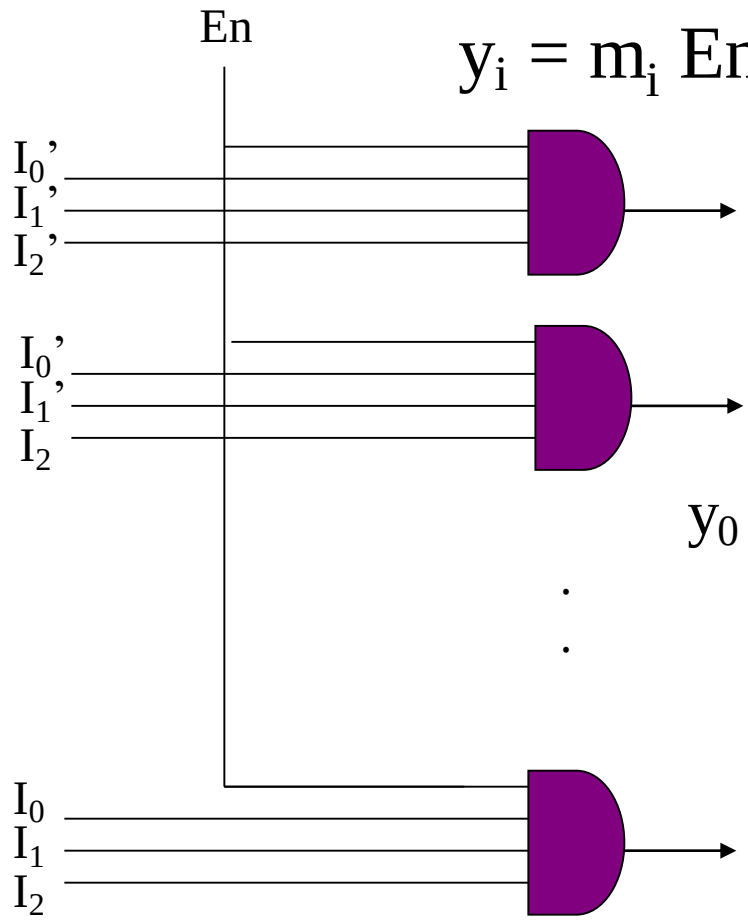
1. Decoder: Definition

- N inputs, 2^N outputs
- One-hot outputs: only one output HIGH at once



A_1	A_0	Y_3	Y_2	Y_1	Y_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

Decoder: Logic Diagram



$y_i = m_i\ En$

$y_0 = 1$ if $(I_2, I_1, I_0) = (0,0,0)$ & $En = 1$

$y_7 = I_2 I_1 I_0 En$

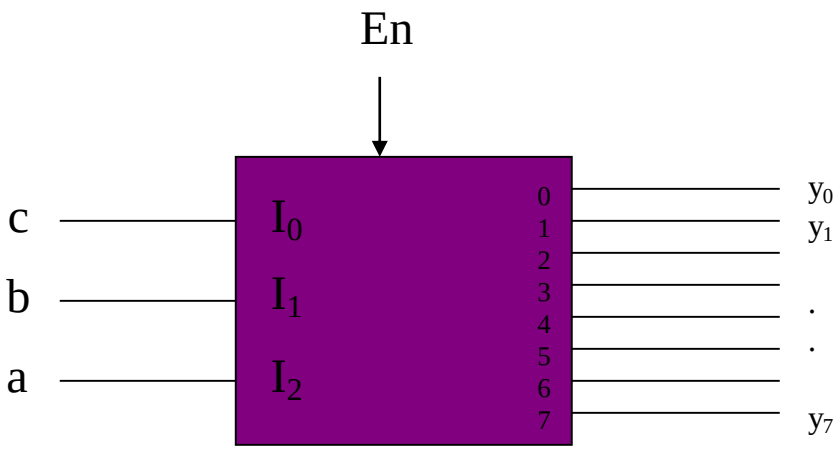
$y_7 = I_2 I_1 I_0 En$

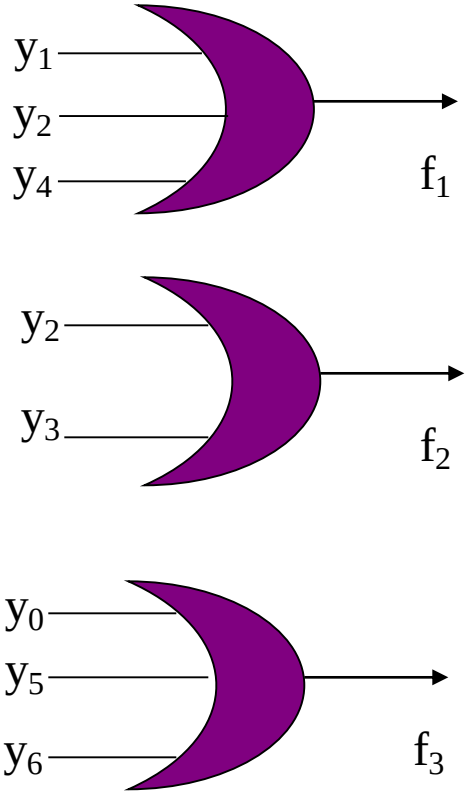
Decoder Application: universal set {Decoder, OR}

Example: Implement functions $f_1(a,b,c) = \Sigma m(1,2,4)$

$f_2(a,b,c) = \Sigma m(2,3)$, and $f_3(a,b,c) = \Sigma m(0,5,6)$

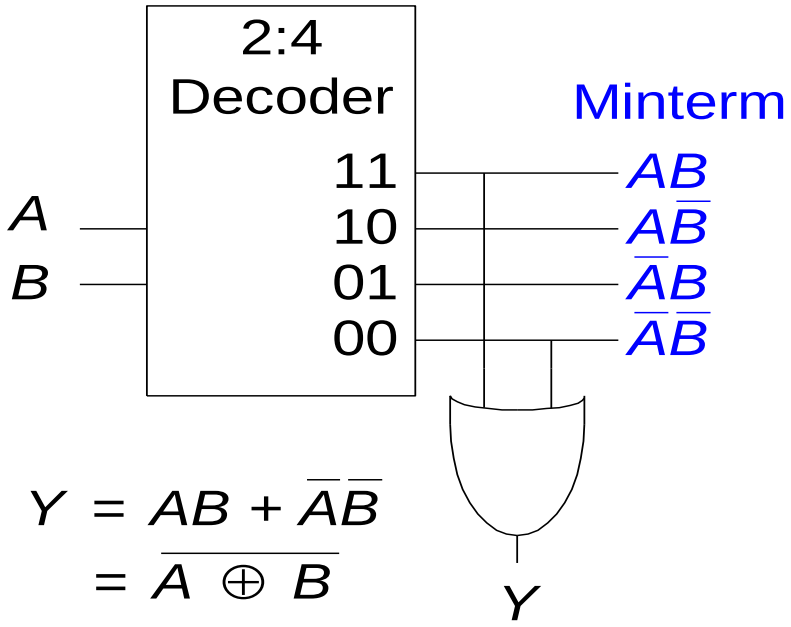
with a 3-input decoder and OR gates.





Decoders

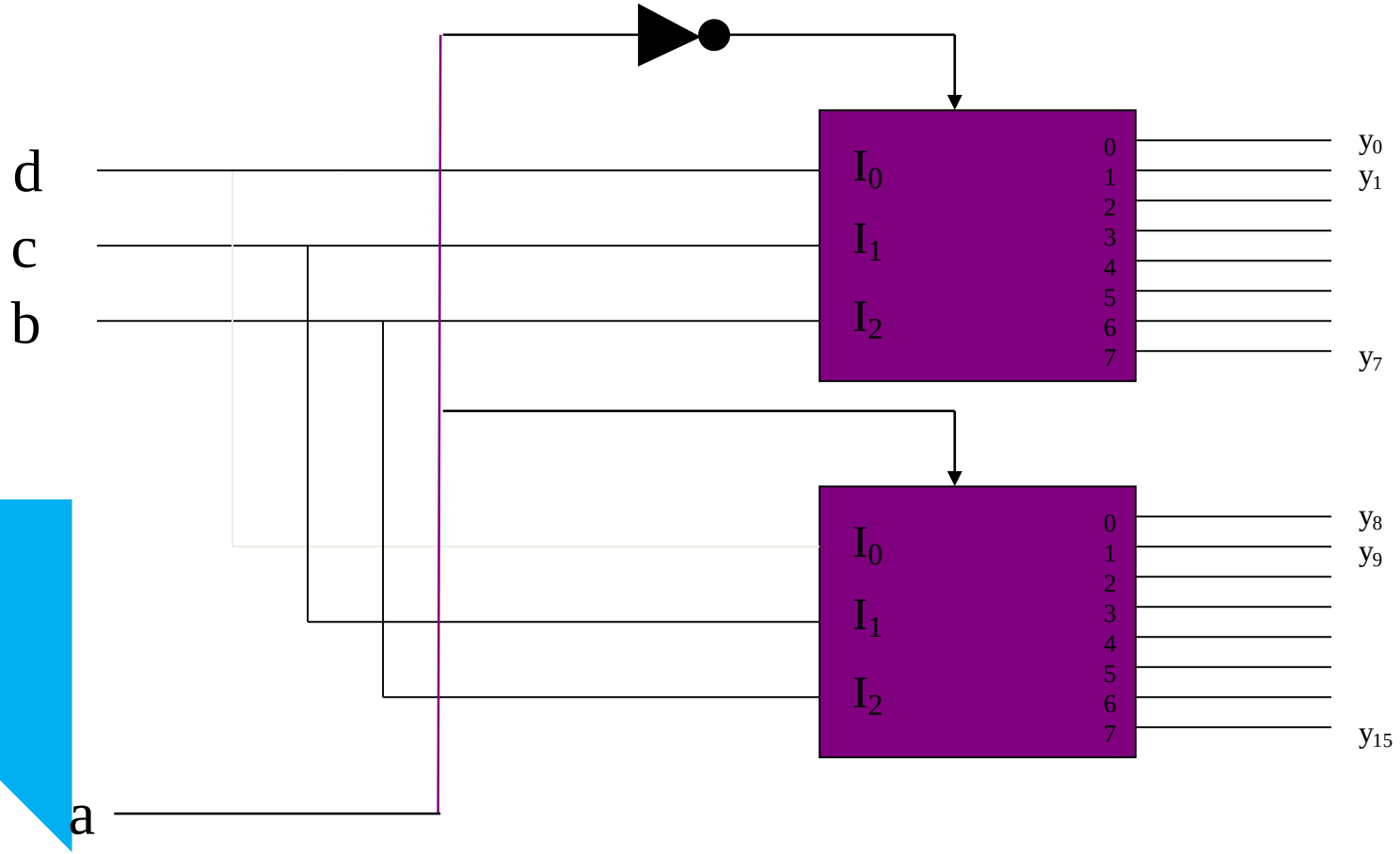
- OR minterms



$$Y = AB + \bar{A}\bar{B}$$
$$= \overline{A \oplus B}$$

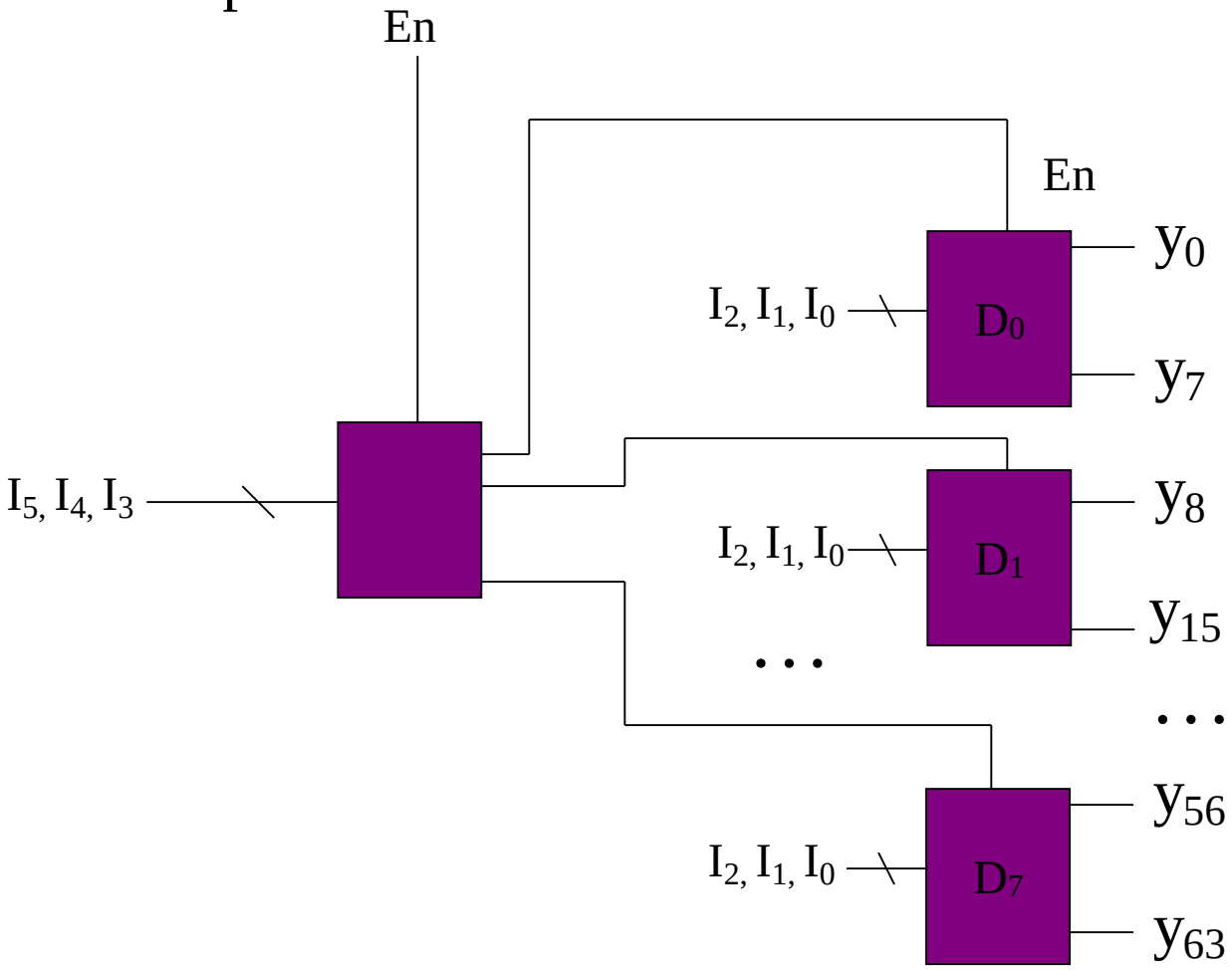
Tree of Decoders

Implement a 4-2^4 decoder with 3-2^3 decoders.



Tree of Decoders

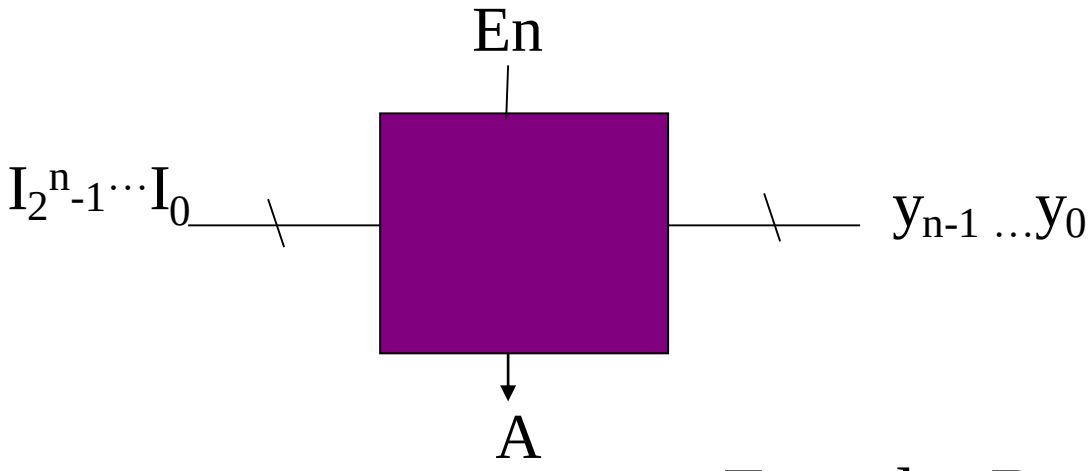
Implement a 6-2^6 decoder with 3-2^3 decoders.



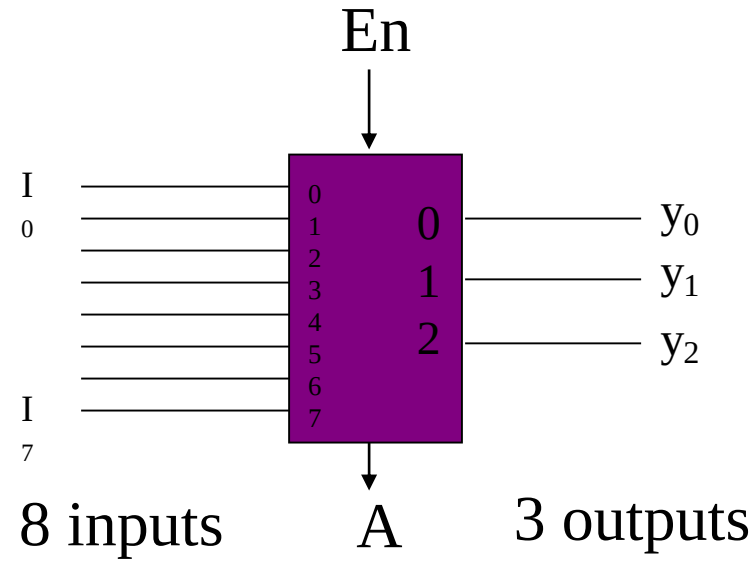
2. Encoder

- Definition
- Logic Diagram
- Priority Encoder

2. Encoder: Definition



Encoder Description:



At most one $I_i = 1$.

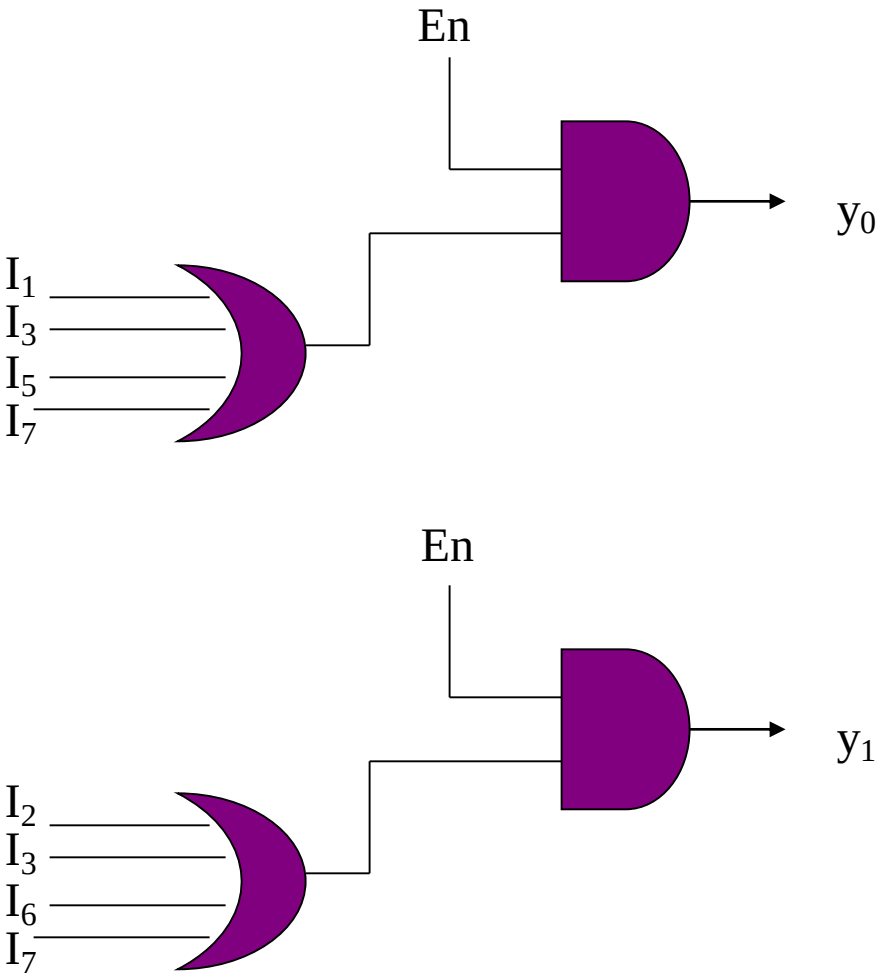
$(y_{n-1},.., y_0) = i$ if $I_i = 1$ & En = 1

$(y_{n-1},.., y_0) = 0$ otherwise.

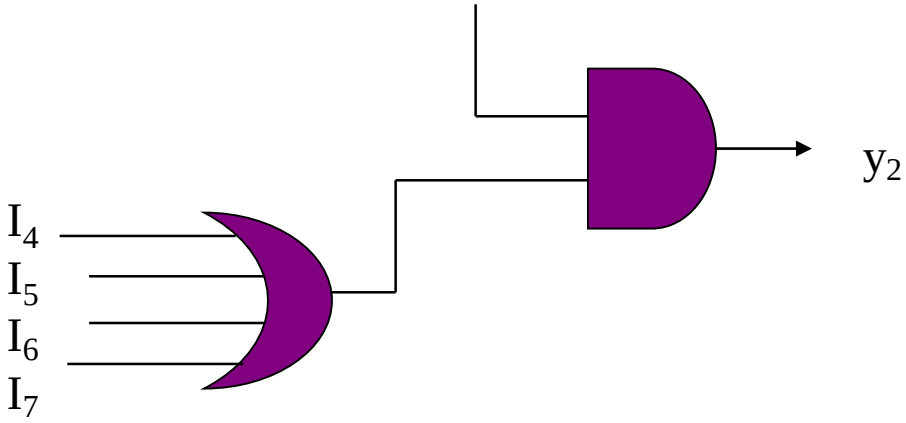
A = 1 if En = 1 and one i s.t. $I_i = 1$

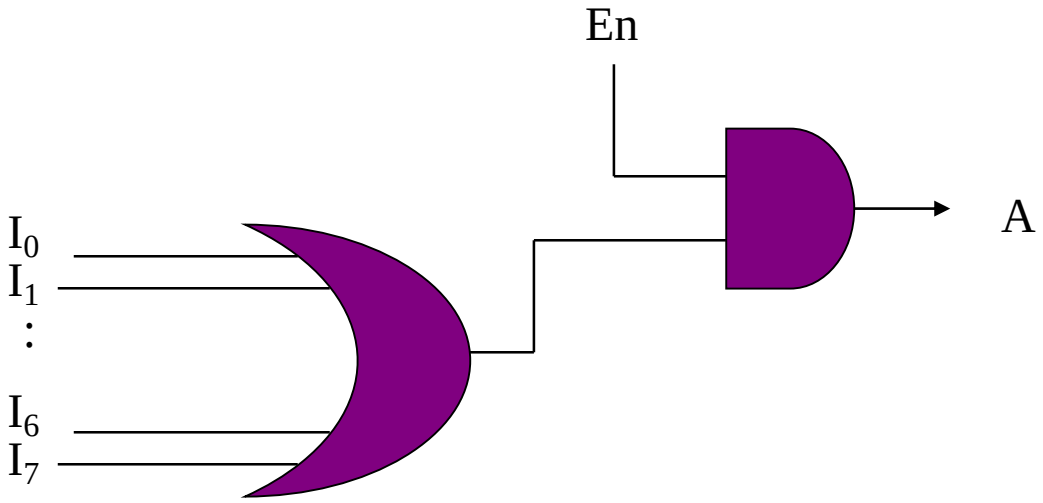
A = 0 otherwise.

Encoder: Logic Diagram



Encoder: Logic Diagram

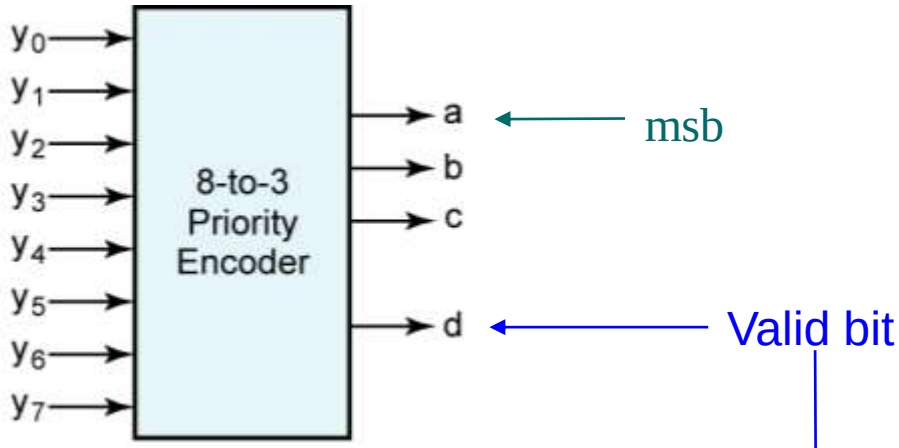




Priority Encoders

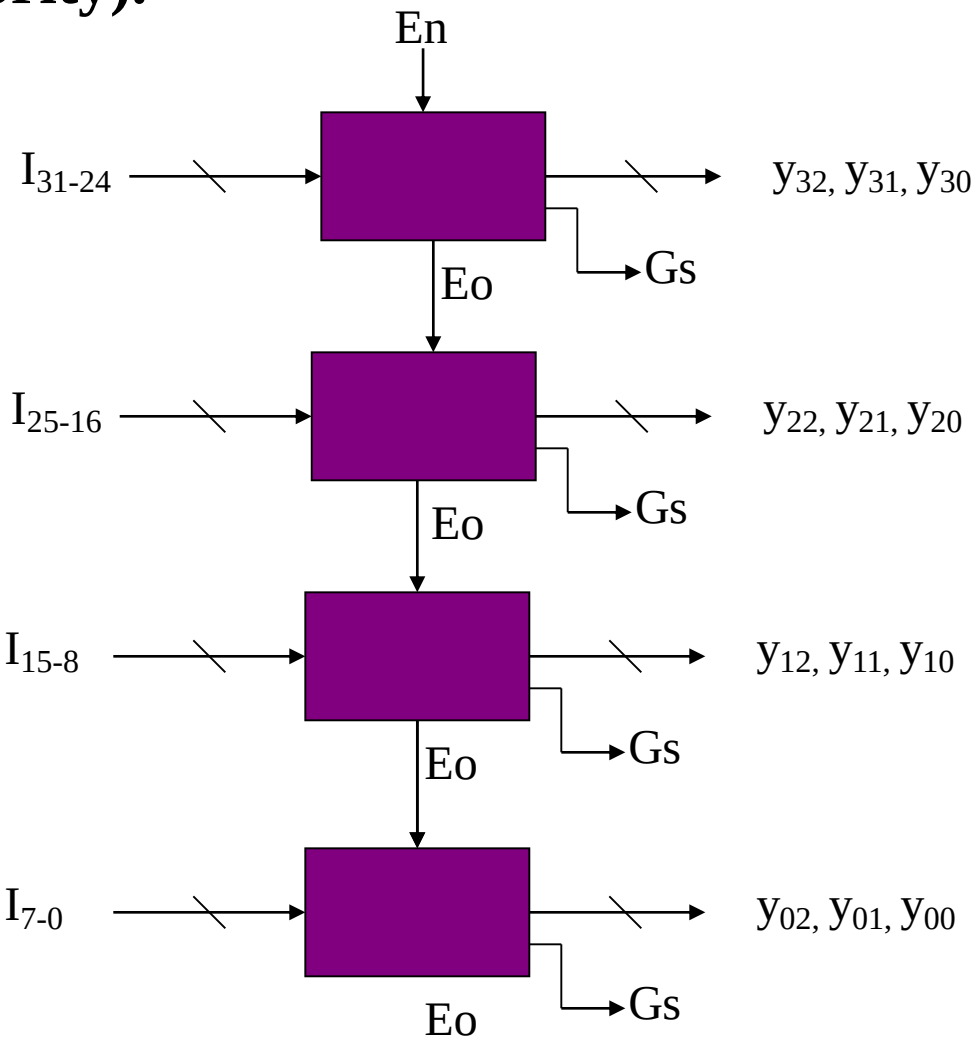
- If more than one input is active, the higher-order input has priority over the lower-order input.
  - The higher value is encoded on the output
- A valid indicator, d, is included to indicate whether or not the output is valid.
  - Output is invalid when no inputs are active
    - d = 0
  - Output is valid when at least one input is active
    - d = 1

Priority Encoders



y_0	y_1	y_2	y_3	y_4	y_5	y_6	y_7	a	b	c	d
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	1
X	1	0	0	0	0	0	0	0	0	1	1
X	X	1	0	0	0	0	0	0	1	0	1
X	X	X	1	0	0	0	0	0	1	1	1
X	X	X	X	1	0	0	0	1	0	0	1
X	X	X	X	X	1	0	0	1	0	1	1
X	X	X	X	X	X	1	0	1	1	0	1
X	X	X	X	X	X	X	1	1	1	1	1

Priority Encoder: Implement a 32-input priority encoder w/ 8 input priority encoders (high bit priority).




Thank
you