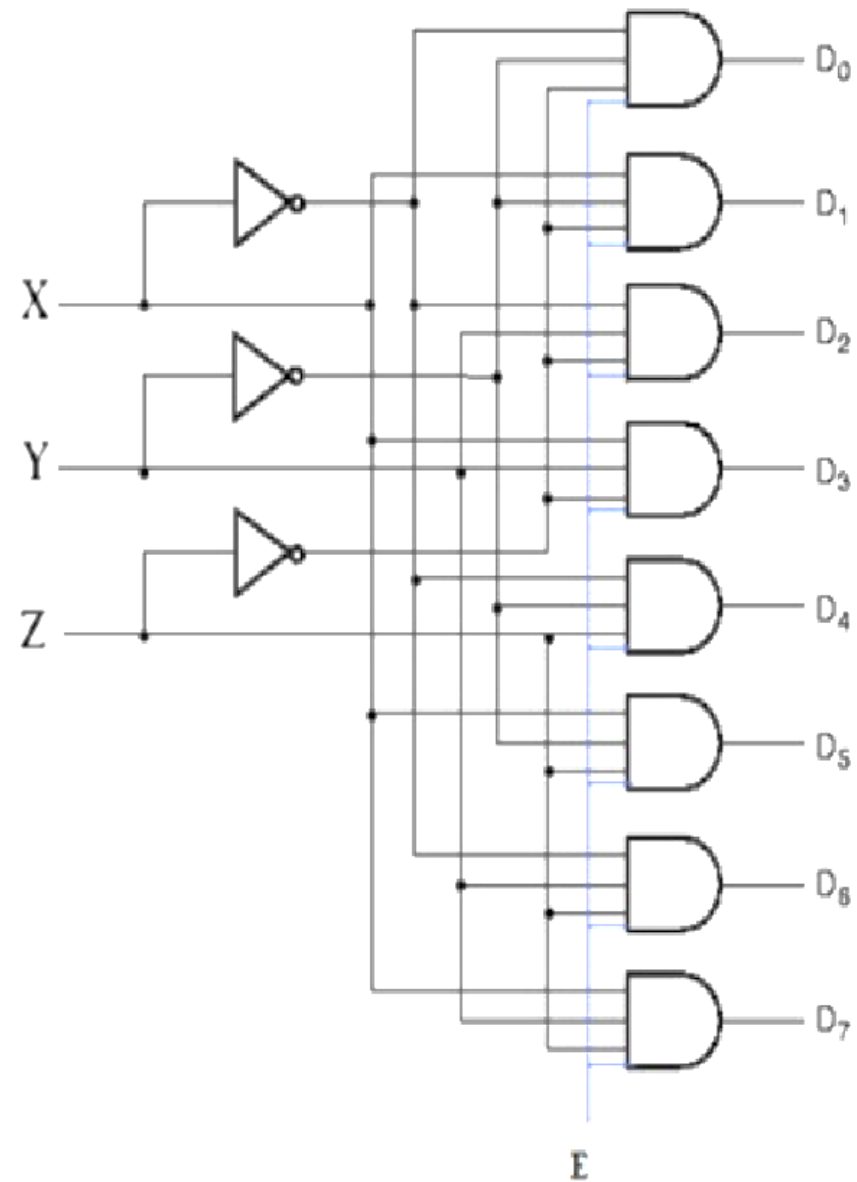


# Decoder with Enable Input

E	x	y	z	D0	D1	D2	D3	D4	D5	D6	D7
1	0	0	0	1	0	0	0	0	0	0	0
1	0	0	1	0	1	0	0	0	0	0	0
1	0	1	0	0	0	1	0	0	0	0	0
1	0	1	1	0	0	0	1	0	0	0	0
1	1	0	0	0	0	0	0	1	0	0	0
1	1	0	1	0	0	0	0	0	1	0	0
1	1	1	0	0	0	0	0	0	0	1	0
1	1	1	1	0	0	0	0	0	0	0	1
0	x	x	x	0	0	0	0	0	0	0	0

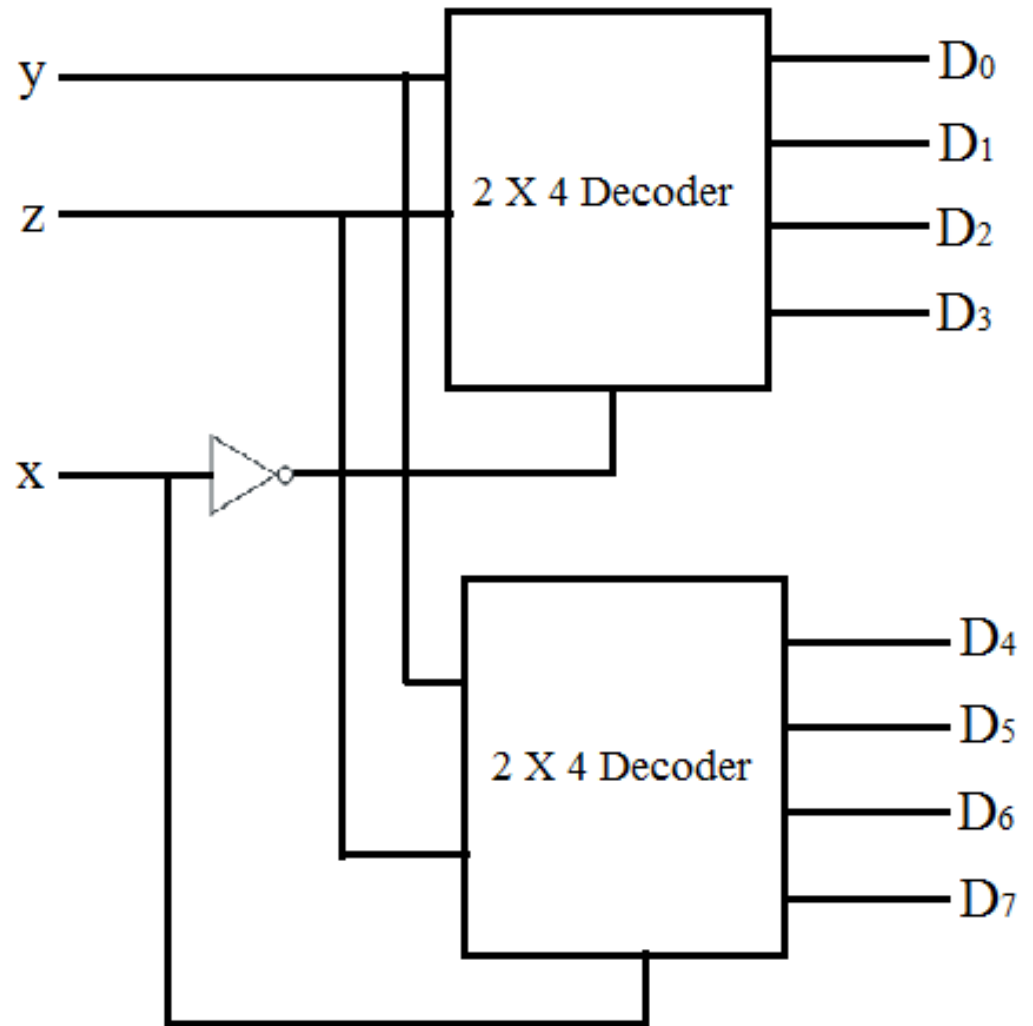


# Decoder using Decoder

- Decoders with enable input can be connected together to form a larger decoder circuit
  - Required number of lower order decoders =  $m_2/m_1$ 
    - $m_1$ - number of outputs of lower order
    - $m_2$  - number of outputs of higher order

# 3x8 Decoder using 2x4 Decoders

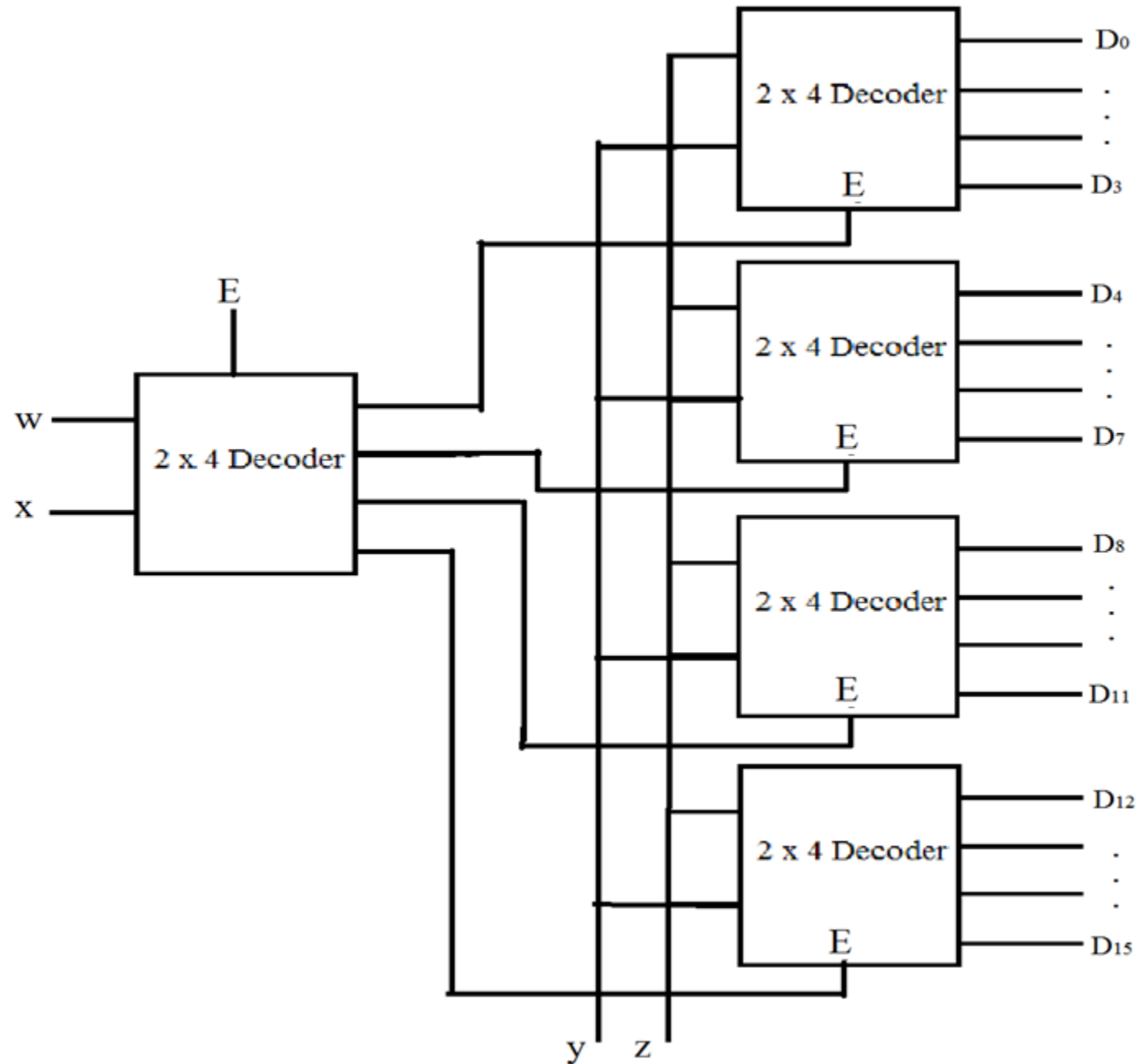
<b>x y z</b>	<b>F</b>
0 0 0	D <sub>0</sub>
0 0 1	D <sub>1</sub>
0 1 0	D <sub>2</sub>
0 1 1	D <sub>3</sub>
1 0 0	D <sub>4</sub>
1 0 1	D <sub>5</sub>
1 1 0	D <sub>6</sub>
1 1 1	D <sub>7</sub>



Required number of 2x4 decoder to construct a 3x8 decoder =  $8/4 = 2$

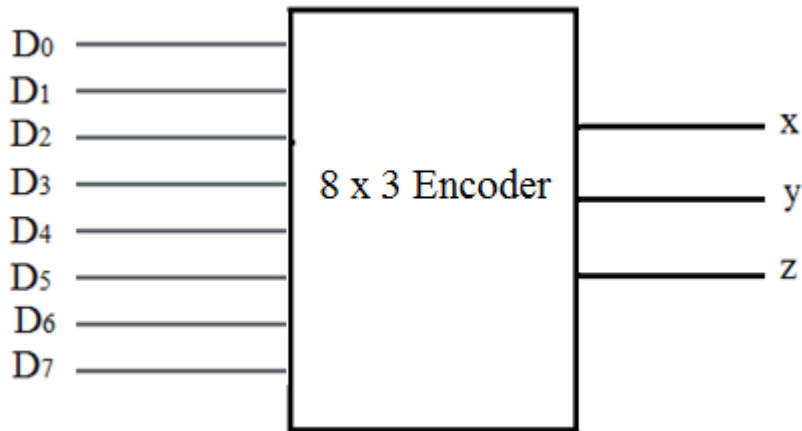
# 4x16 Decoder using 2x4 Decoders

w x y z	F
0 0 0 0	D <sub>0</sub>
0 0 0 1	D <sub>1</sub>
0 0 1 0	D <sub>2</sub>
0 0 1 1	D <sub>3</sub>
0 1 0 0	D <sub>4</sub>
0 1 0 1	D <sub>5</sub>
0 1 1 0	D <sub>6</sub>
0 1 1 1	D <sub>7</sub>
1 0 0 0	D <sub>8</sub>
1 0 0 1	D <sub>9</sub>
1 0 1 0	D <sub>10</sub>
1 0 1 1	D <sub>11</sub>
1 1 0 0	D <sub>12</sub>
1 1 0 1	D <sub>13</sub>
1 1 1 0	D <sub>14</sub>
1 1 1 1	D <sub>15</sub>



# Encoder

- An encoder is a combinational circuit that has  $2^n$  (or fewer) input lines and  $n$  output lines. The output lines generate the binary code corresponding to the input value.
- It performs the inverse operation of a decoder
- If the encoder consists of eight inputs the minimum number of output lines is three.
- Block Diagram:



D0	D1	D2	D3	D4	D5	D6	D7	x	y	z
1	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	1	0
0	0	0	1	0	0	0	0	0	1	1
0	0	0	0	1	0	0	0	1	0	0
0	0	0	0	0	1	0	0	1	0	1
0	0	0	0	0	0	1	0	1	1	0
0	0	0	0	0	0	0	1	1	1	1

- Truth Table:

# Encoder

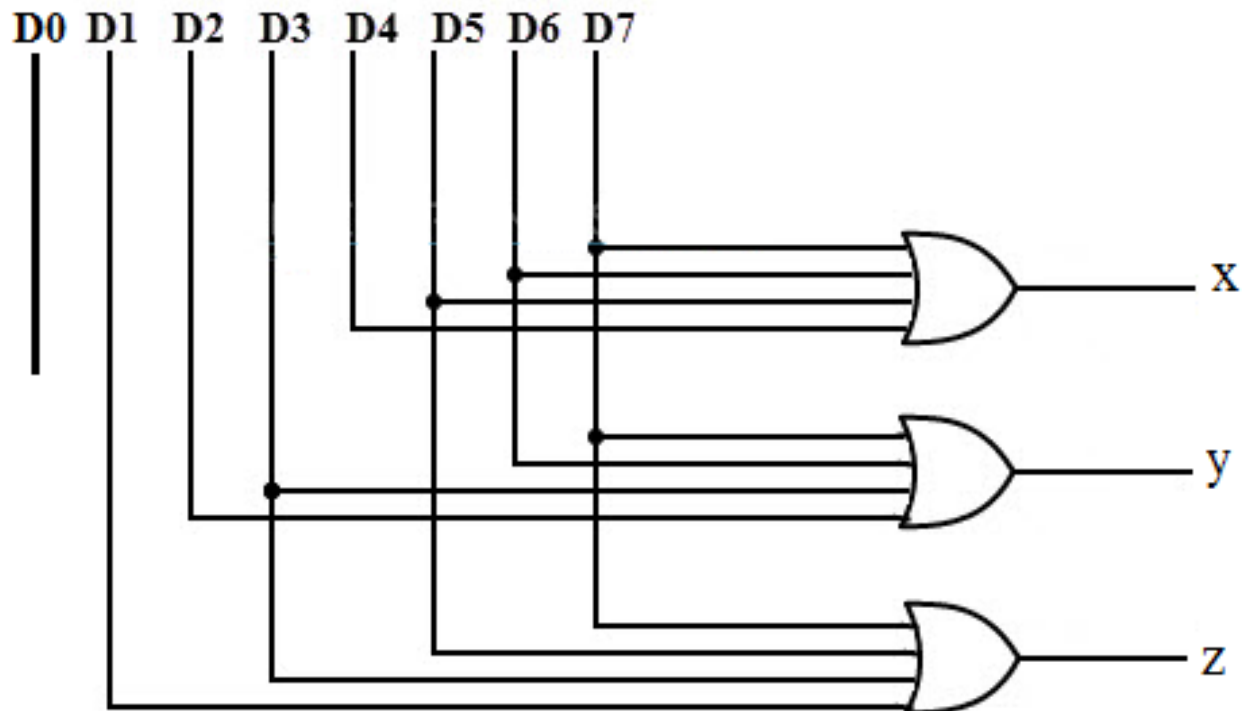
- Functions:

$$x = D_4 + D_5 + D_6 + D_7$$

$$y = D_2 + D_3 + D_6 + D_7$$

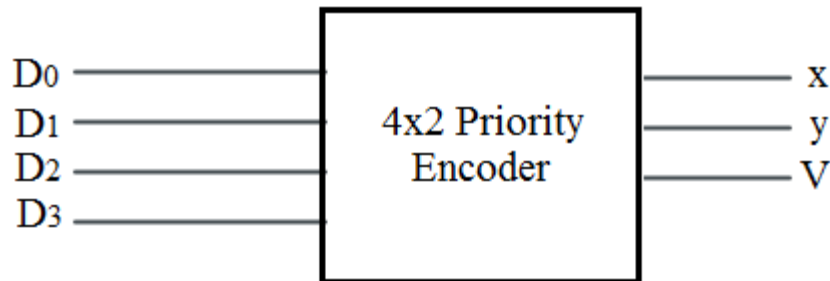
$$z = D_1 + D_3 + D_5 + D_7$$

- Circuit Diagram:



# Priority Encoder

- An encoder is a combinational circuit that has  $2^n$  (or fewer) input lines and  $n$  output lines. The output lines generate the binary code corresponding to the input value.
- It performs the inverse operation of a decoder
- If the encoder consists of eight inputs the minimum number of output lines is three.
- Block Diagram:



D0	D1	D2	D3	x	y	z
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

- Truth Table:

# Priority Encoder

- Simplification:

$D_2D_3$	00	01	11	10
$D_0D_1$				
00	X	1	1	1
01	0	1	1	1
11	0	1	1	1
10	0	1	1	1

$$x = D_2 + D_3$$

$D_2D_3$	00	01	11	10
$D_0D_1$				
00	X	1	1	0
01	1	1	1	0
11	1	1	1	0
10	0	1	1	0

$$y = D_3 + D_1D_2'$$



# Priority Encoder

- Functions:

$$x = D_2 + D_3$$

$$y = D_3 + D_1 D_2'$$

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

- Circuit Diagram:

