Decoder Circuit, Types, Its Application, Encoder

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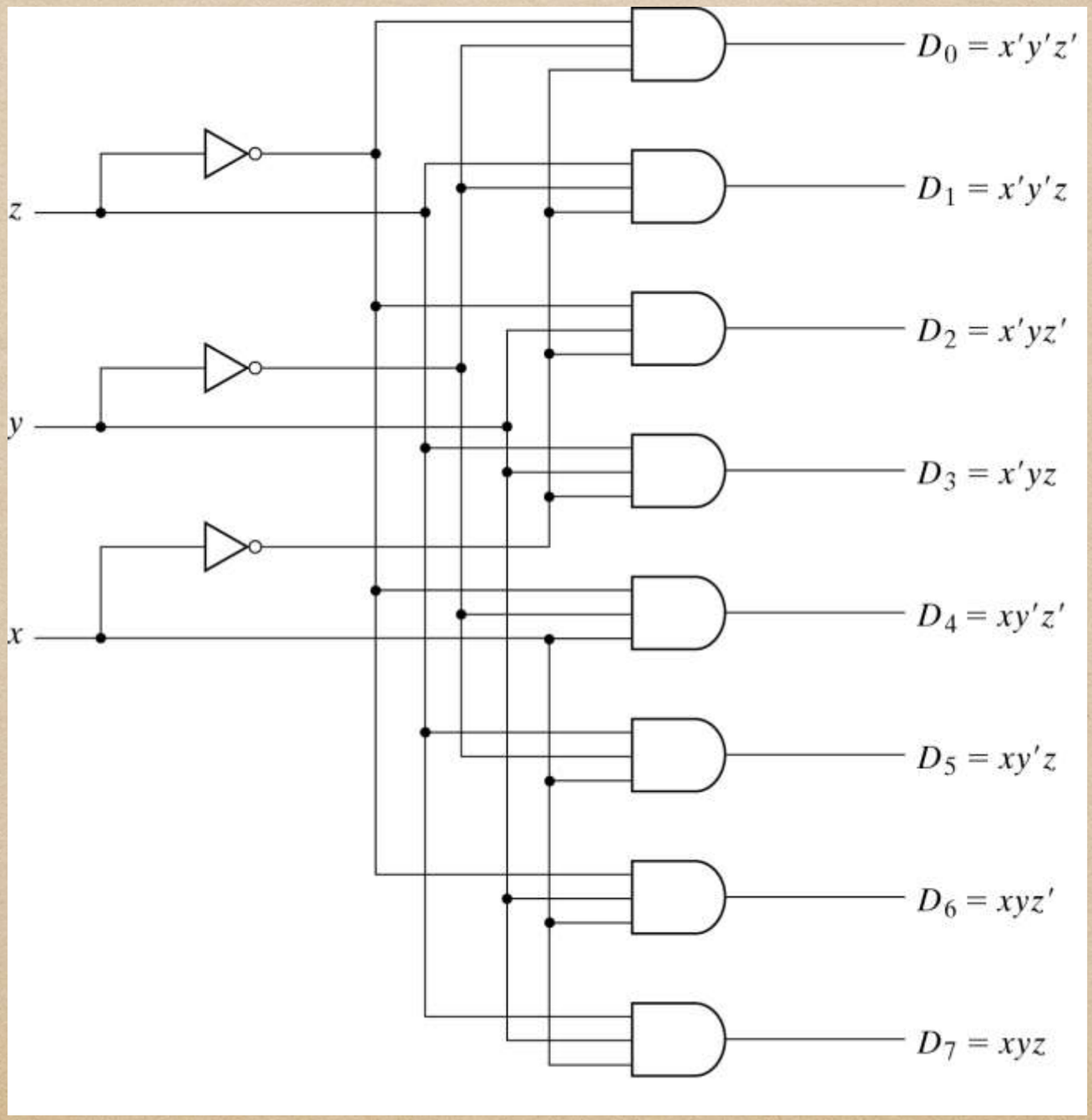
3-to-8-Line Decoder Truth Table

Inputs			Outputs							
X	Y	Z	D0	D1	D2	D3	D4	D5	D6	D7
0	0	0	1	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	0
0	1	0	0	0	1	0	0	0	0	0
0	1	1	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	1	0	0	0
1	0	1	0	0	0	0	0	1	0	0
1	1	0	0	0	0	0	0	0	1	0
1	1	1	0	0	0	0	0	0	0	1

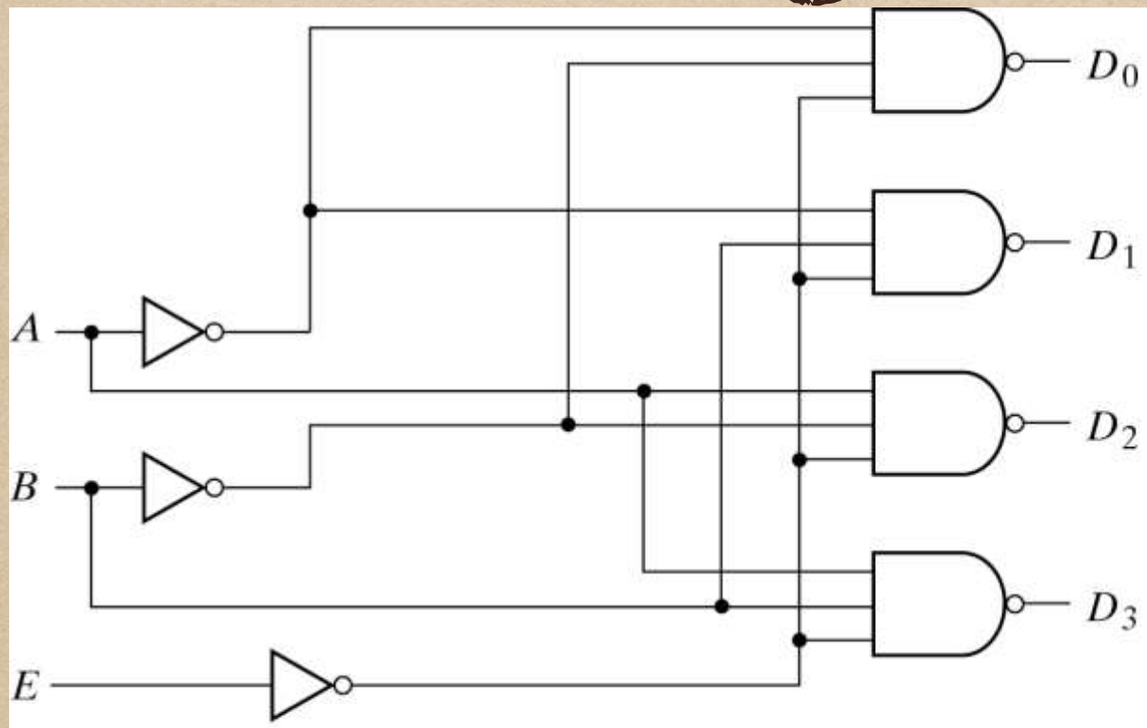
3-to-8-Line Decoder Implementation



Summary

- What is the function of a decoder?
  - It selects or de-select one of the devices

Decoders with NAND gates



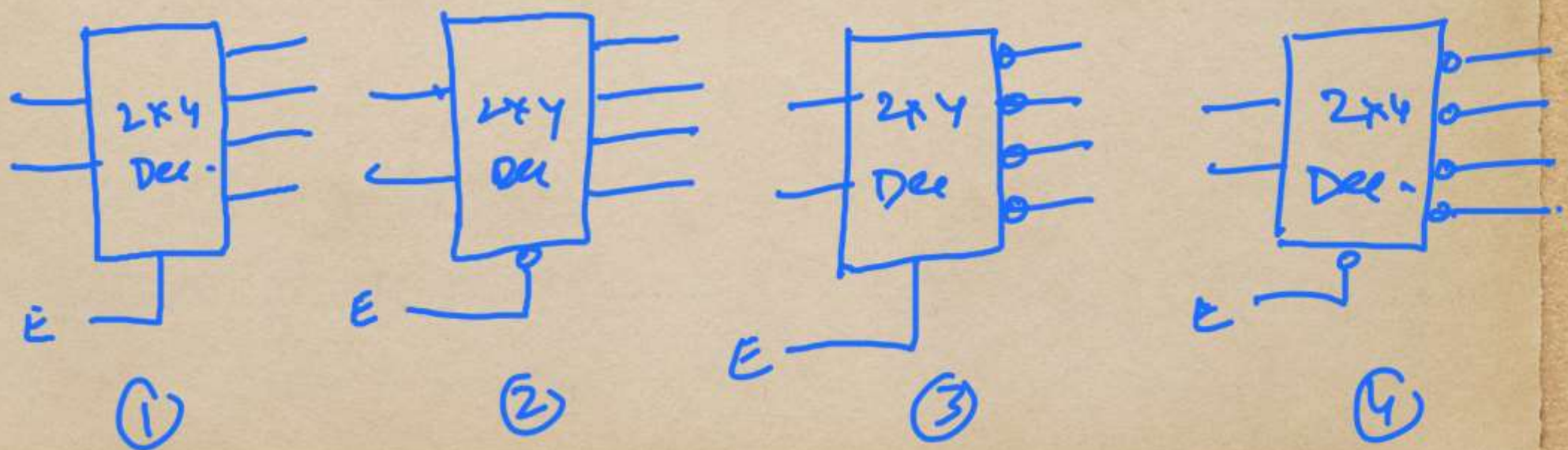
(a) Logic diagram

E	A	B	D_0	D_1	D_2	D_3
1	X	X	1	1	1	1
0	0	0	0	1	1	1
0	0	1	1	0	1	1
0	1	0	1	1	0	1
0	1	1	1	1	1	0

(b) Truth table

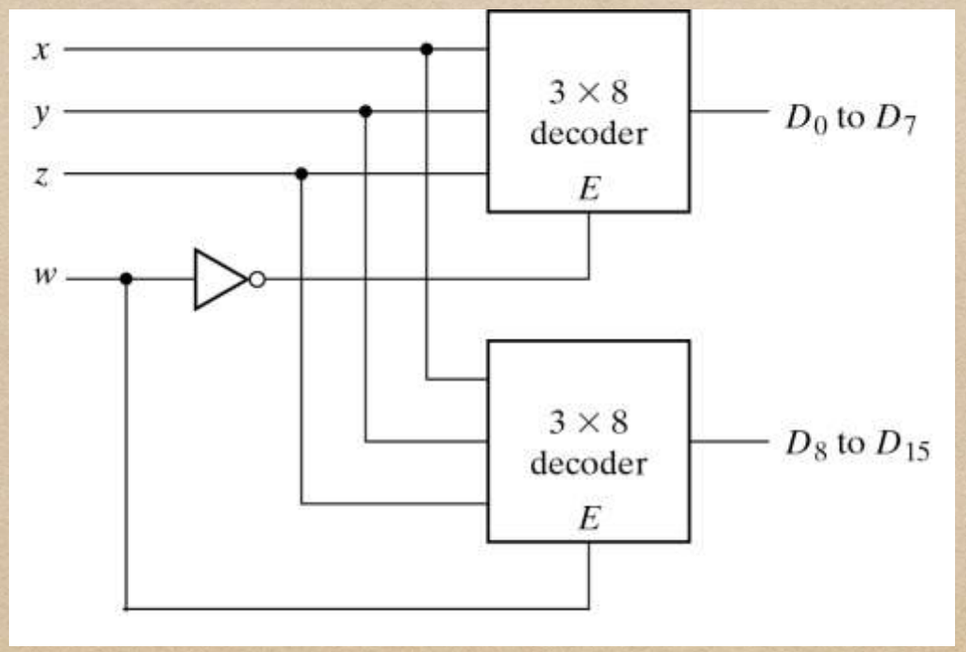
Four Type of Decoders

1. Active High Enable, Active High Output
2. Active Low Enable, Active High Output
3. Active High Enable, Active Low Output
4. Active Low Enable, Active Low Output



Constructing large Decoders

- Decoders with enable inputs can be connected together to form a larger decoder circuit.
  - two 3-to-8 decoder can be connected to form a 4-to-16 decoder
  - The top decoder outputs generates minterms 0000 to 0111 and the bottom decoder outputs generate minterms 1000 to 1111.



Decoders with NAND gates

- Some decoders are constructed with NAND gates. Since a NAND gate produces the AND operation with inverted output, it becomes more economical to generate the decoder minterms in their complemented form. Decoder include one or more enable inputs to control the circuit operation

- A 2-to4-line decoder with an enable input is shown next. (see fig).
  - The circuit operates with complement outputs and a complement enable input.
  - The decoder is enabled when E is equal to 0 and disabled when E = 1
  - The output whose value is equal to 0 represents the minterm selected by inputs A and B.
  - Only one output can be zero at any given time, all other outputs are 1

- Some decoders have two or more enable inputs that must satisfy a given logic condition

Your Turn

- Make a larger decoder of size 3 X 8 Decoder using 2 X 4 Decoders

- Make a larger decoder of size 4 X 16 Decoder using 2 X 4 Decoders

End of Lecture