

Multiplexers and Decoders

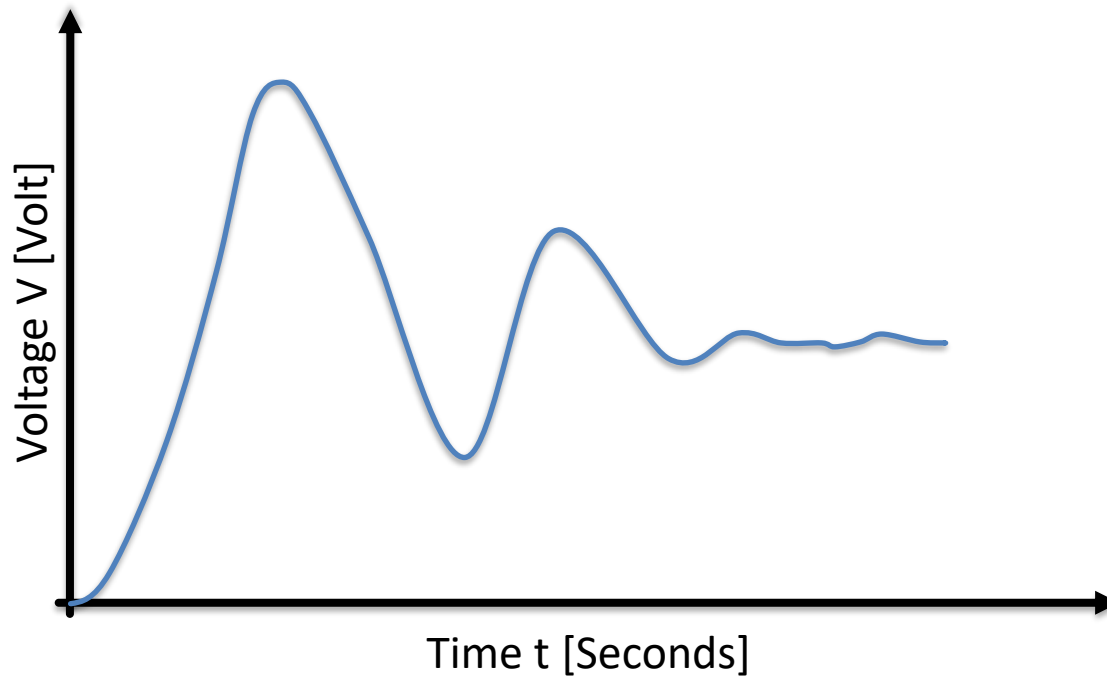
Networks and Embedded Systems

First Grade Level

Wolfgang Neff

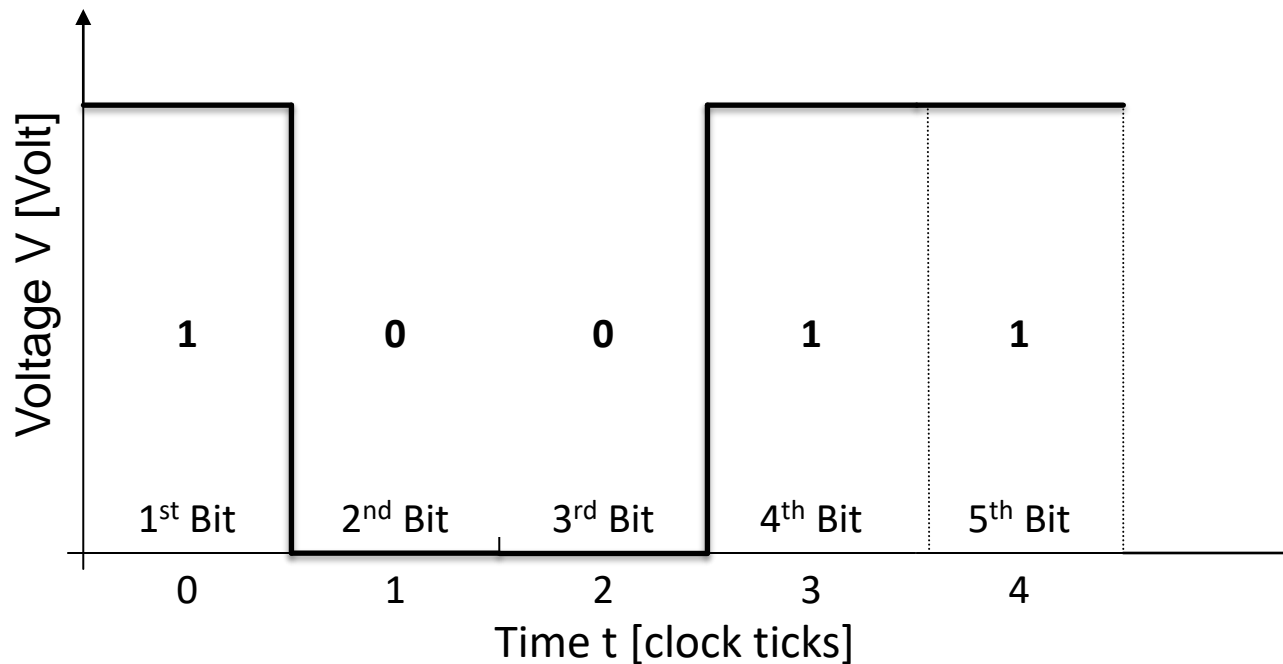
Signals (1)

- Analog Signals
 - Any value at any time



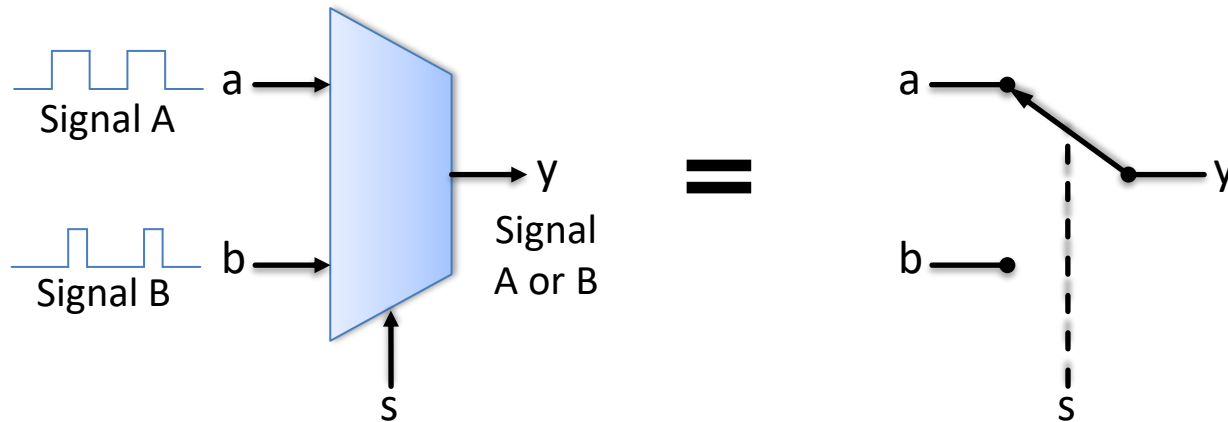
Signals (2)

- Digital Signals
 - Just 0 and 1 at certain times (clock ticks)



Multiplexers (1)

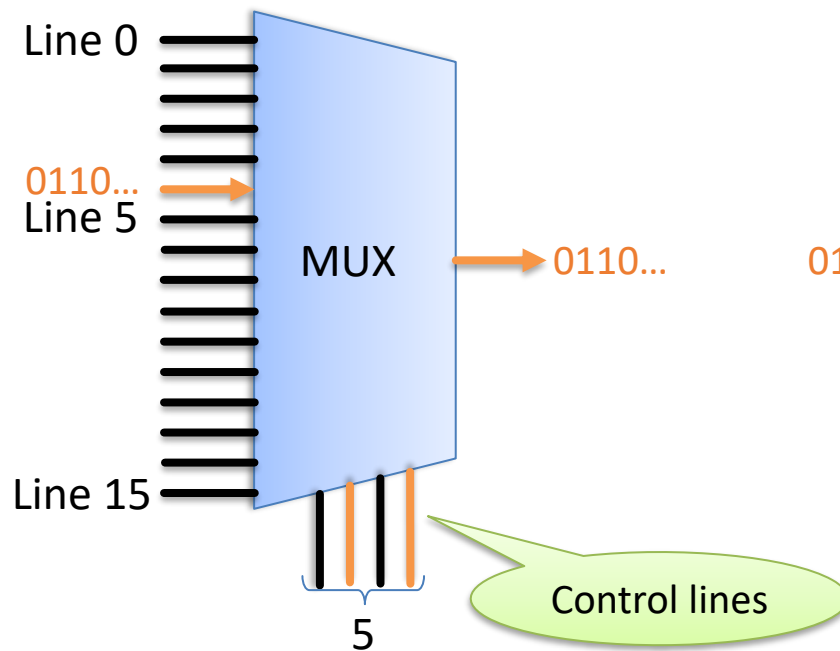
- Multiple-input, single-output switch
 - Selects one of several input line
 - Forwards the selected input to an output line



Multiplexers (2)

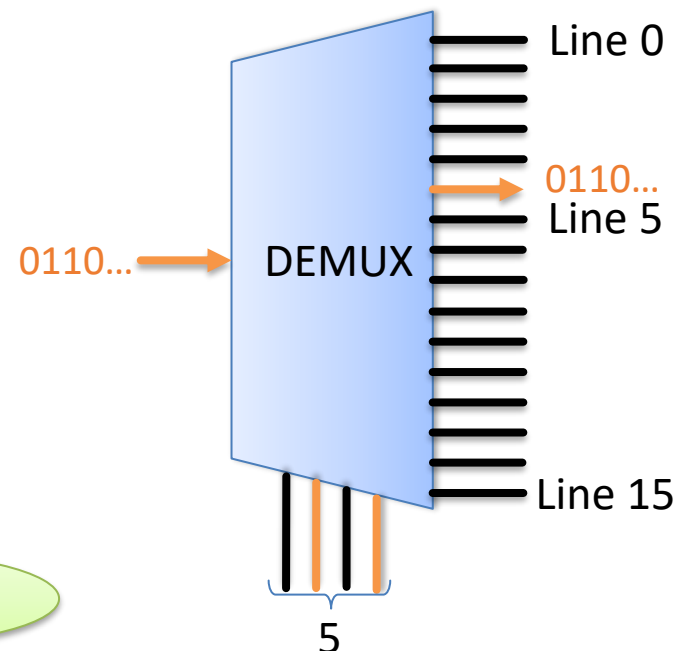
- Multiplexer

One input line is selected



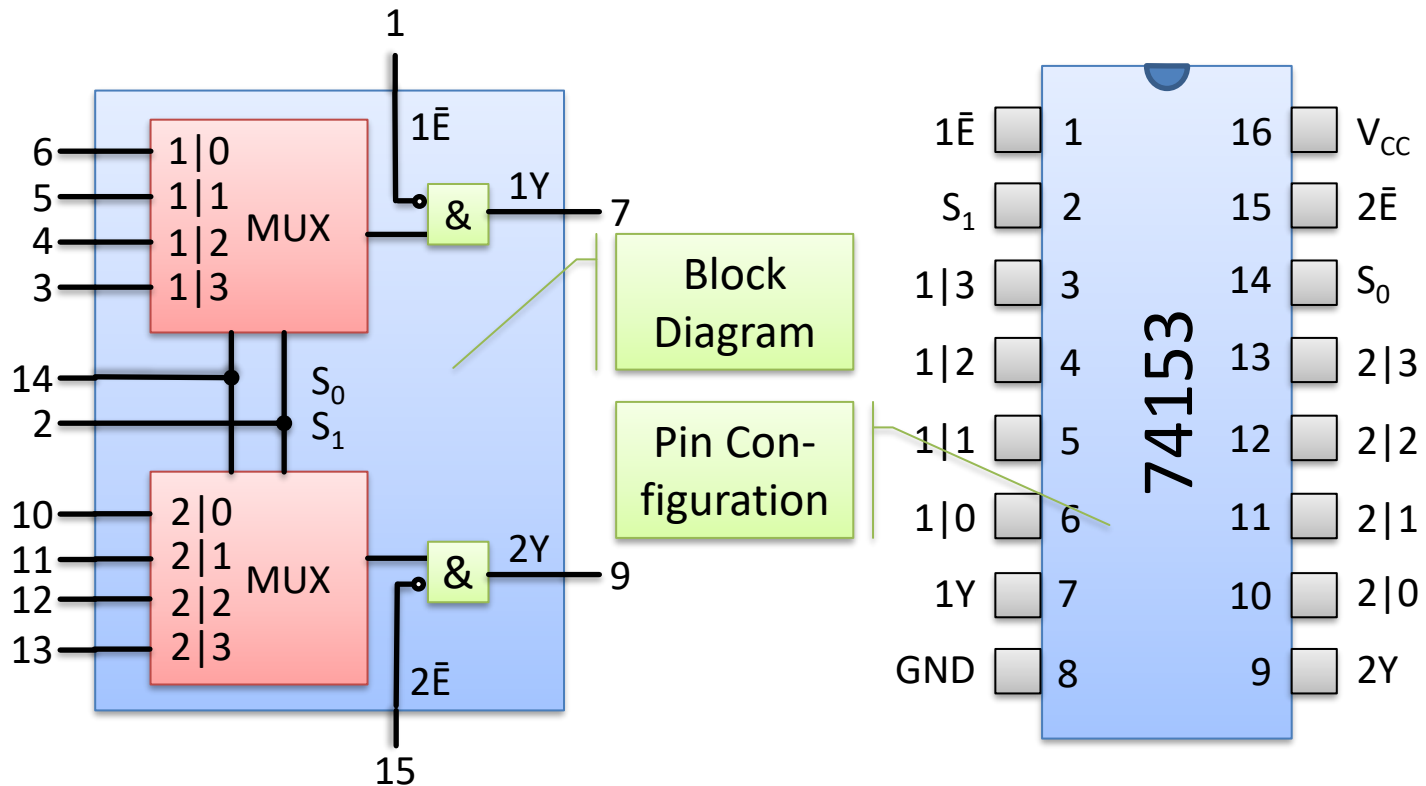
- Demultiplexer

One output line is selected



Multiplexers (3)

- 74153 – Dual 4-input multiplexer



Multiplexers (4)

- 74153 – Dual 4-input multiplexer (continued)

Symbol	Pin	Description
$1\bar{E}, 2\bar{E}$	1, 15	output enable inputs (active LOW)
S_0, S_1	14, 2	data select inputs
1 0, 1 1, 1 2, 1 3	6, 5, 4, 3	data inputs source 1
1Y	7	multiplexer output source 1
GND	8	ground (0 V)
2Y	9	multiplexer output source 2
2 0, 2 1, 2 2, 2 3	10, 11, 12, 13	data inputs source 2
V_{CC}	16	supply voltage

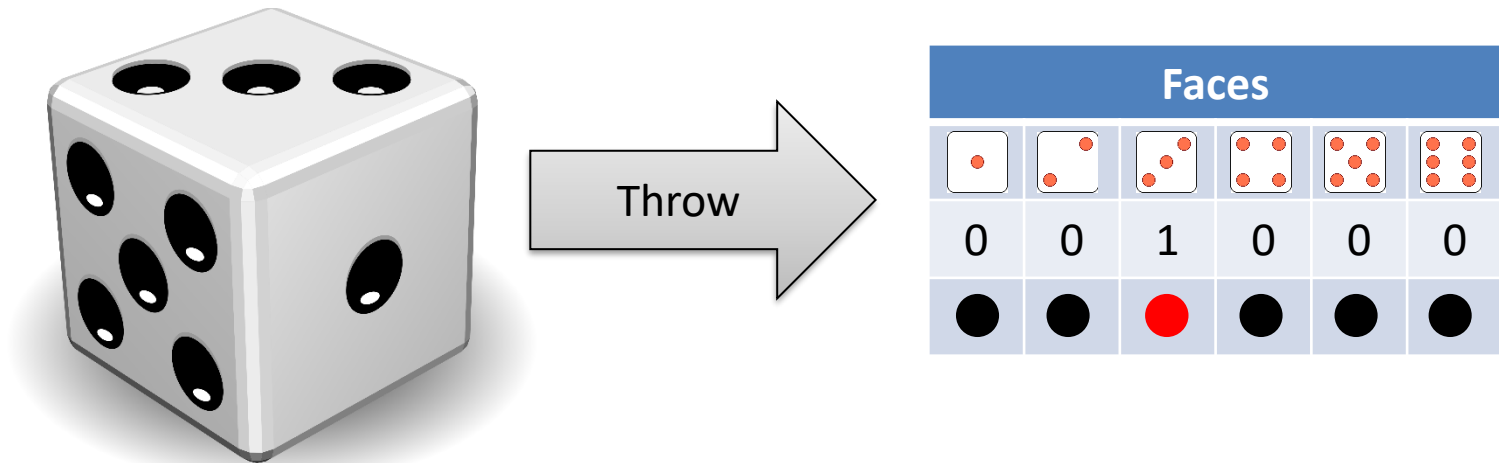
One-Hot Encoding (1)

- One Bit Per State
 - Exactly one bit must be set

State	Binary Encoding	One-Hot Encoding
0	000	000001
1	001	000010
2	010	000100
3	011	001000
4	100	010000
5	101	100000

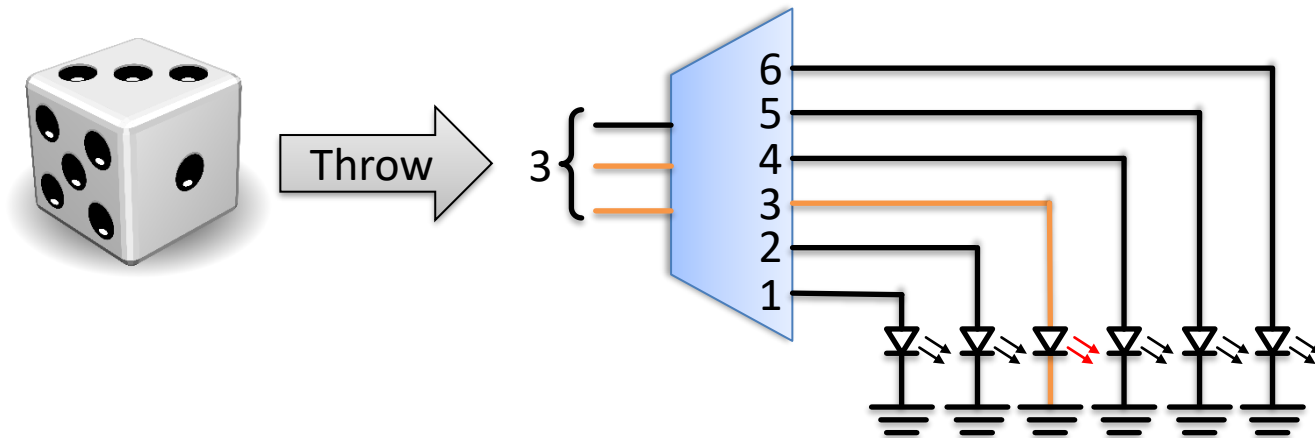
One-Hot Encoding (2)

- Example
 - A dice has been thrown
 - We want to show the result



Decoders (1)

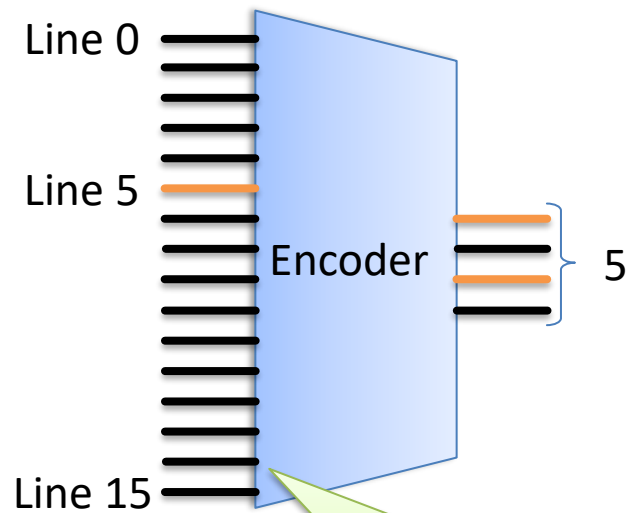
- Example (continued)
 - Realization with a decoder



Decoders (2)

- Encoder

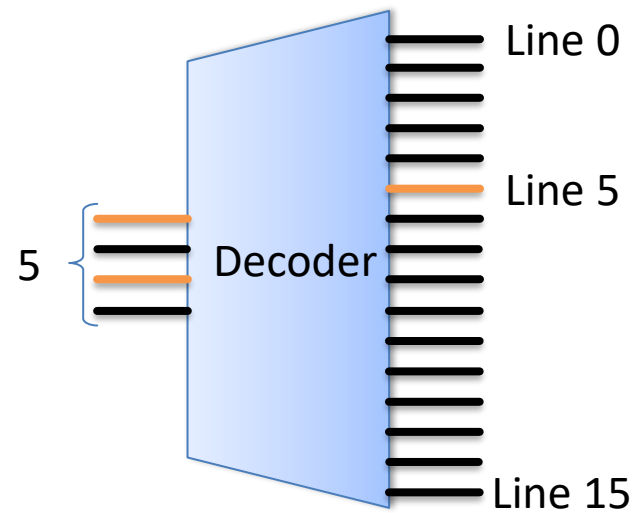
Tells which line is active



Just one line
may be active

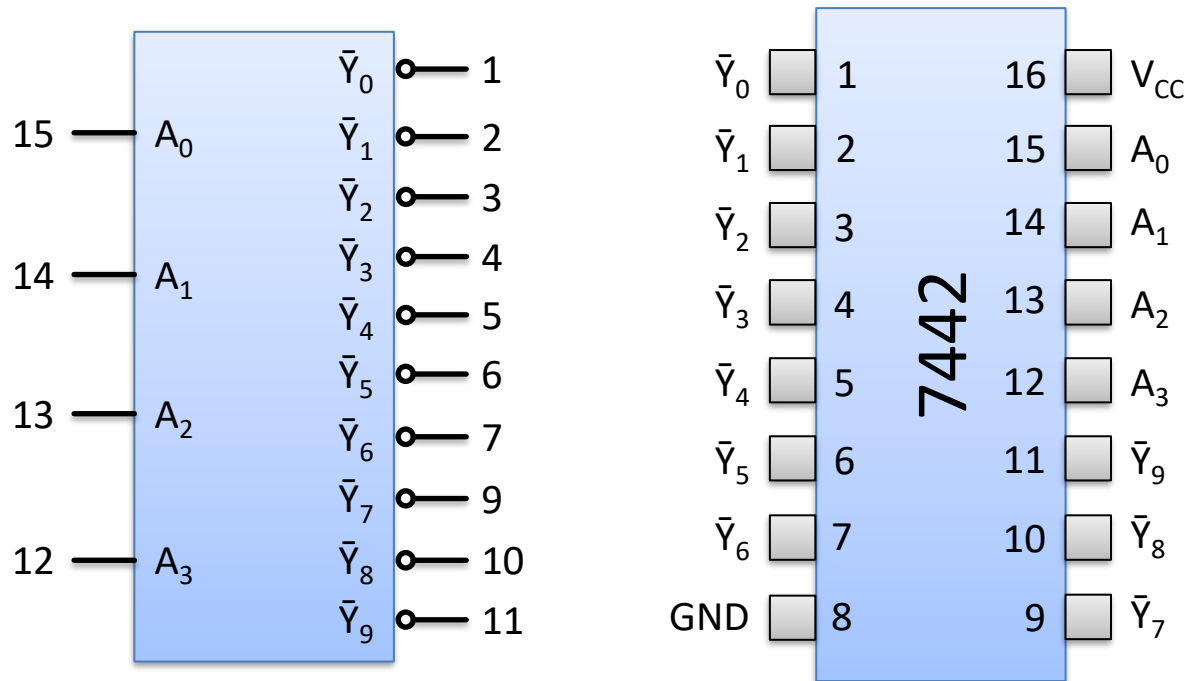
- Decoder

Activates the selected line



Decoders (3)

- 7442 – BCD to decimal decoder



Decoders (4)

- 7442 – BCD to decimal decoder (continued)

Symbol	Pin	Description
$Q_0, Q_1, Q_2, \dots, Q_9$	1, 2, 3, 4, 5, 6, 7, 9, 10, 11	multiplexer outputs
GND	8	ground
A_0, A_1, A_2, A_3	15, 14, 13, 12	data inputs
V_{SS}	16	supply voltage