

Basic Electrical and Electronics Engineering

Module 5

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LECTURE 6

Module 5
Digital Systems
Lecture 5
Topics to be covered

- **MULTIPLEXER**
- **DE-MULTIPLEXER**

Multiplexers

MUX

MULTIPLEXERS (Data Selectors)

A multiplexers (MUX) is a device that allows digital information from several sources to be routed onto a single line for transmission over that line to a common destination.

The basic multiplexers has several data input lines and a single output line. It also has data-select inputs, which permit digital data on any one of the inputs to be switched to the output line.

MUX-continued...

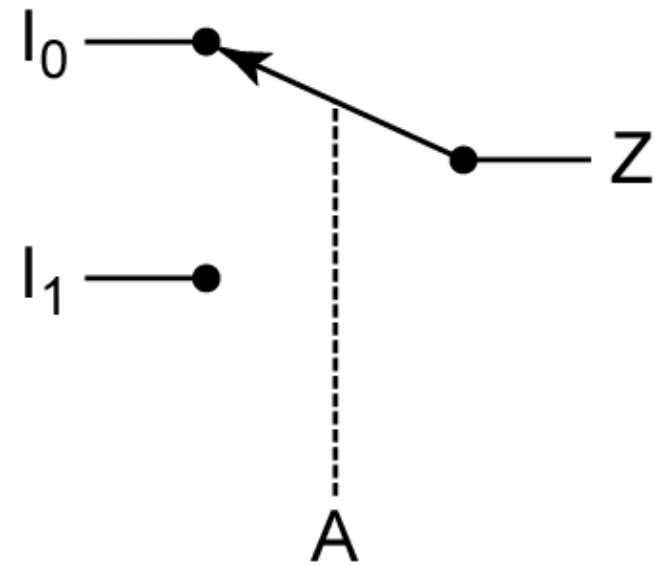
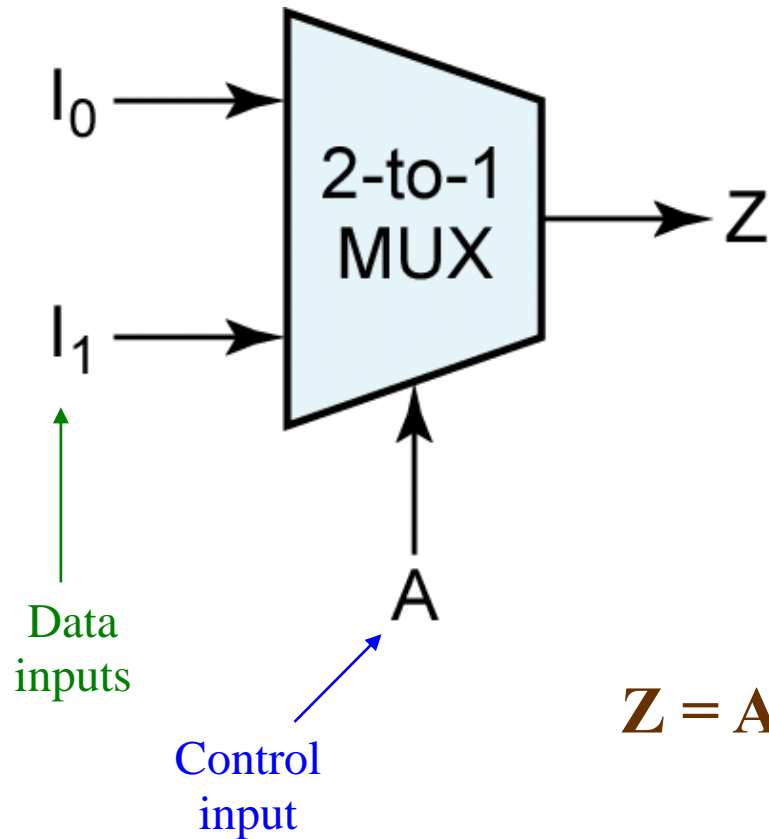
A modern stereo system may have a switch that selects music from one of four sources: a cassette tape, CD, a radio tuner , or an auxiliary input such as audio from a VCR or DVD. The switch selects one of the electronic signals from one of these four sources and sends it to the power amplifier and speakers.

In simple terms, this is what a multiplexer (MUX) does; it selects one of several input signals and passes it on to the output.

Multiplexers

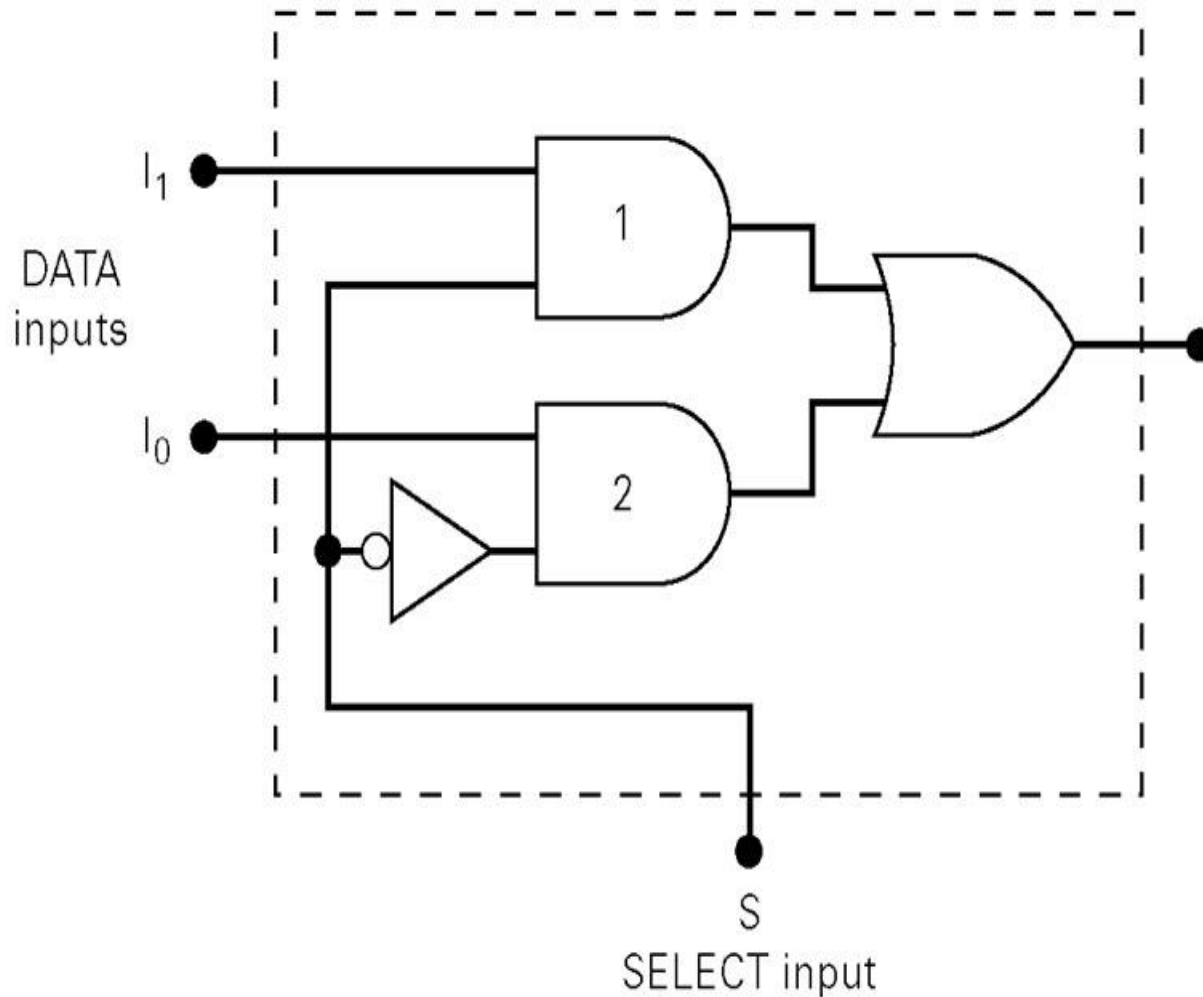
- A multiplexer has
 - N control inputs
 - 2^N data inputs
 - 1 output
- A multiplexer routes (or connects) the selected data input to the output.
 - The value of the control inputs determines the data input that is selected.

Multiplexers



$$Z = A'.I_0 + A.I_1$$

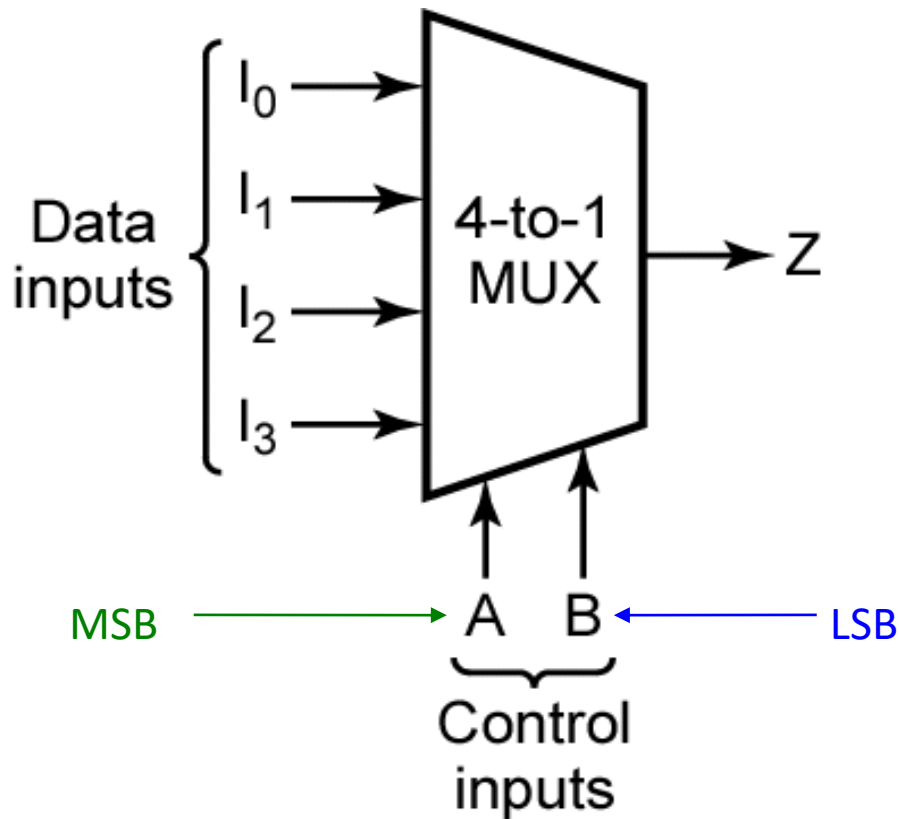
Two-input multiplexer



$$Z = I_0 \cdot \bar{S} + I_1 \cdot S$$

S	Output
0	$Z = I_0$
1	$Z = I_1$

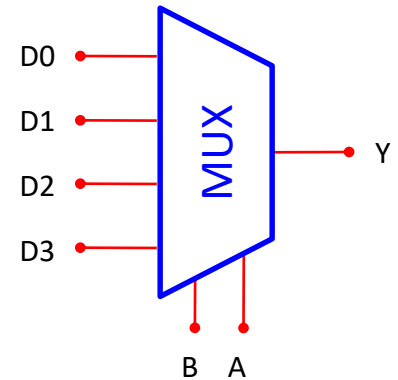
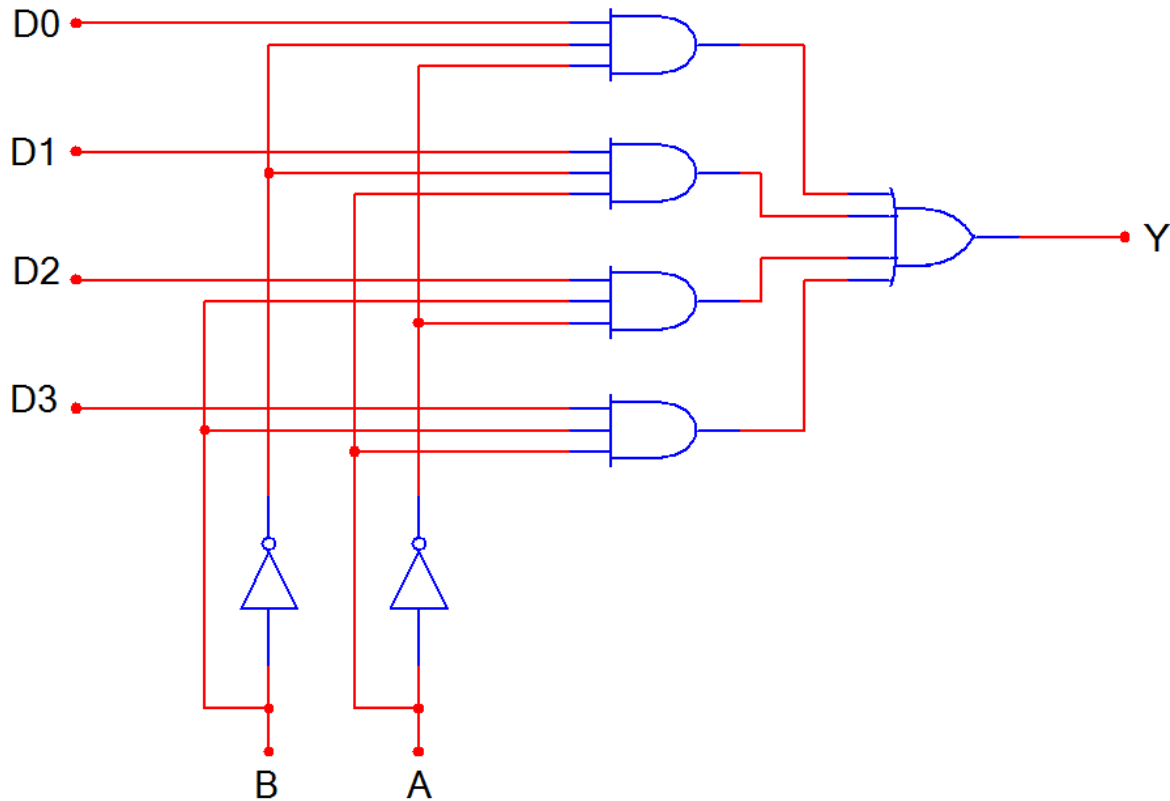
Multiplexers



A	B	F
0	0	I_0
0	1	I_1
1	0	I_2
1	1	I_3

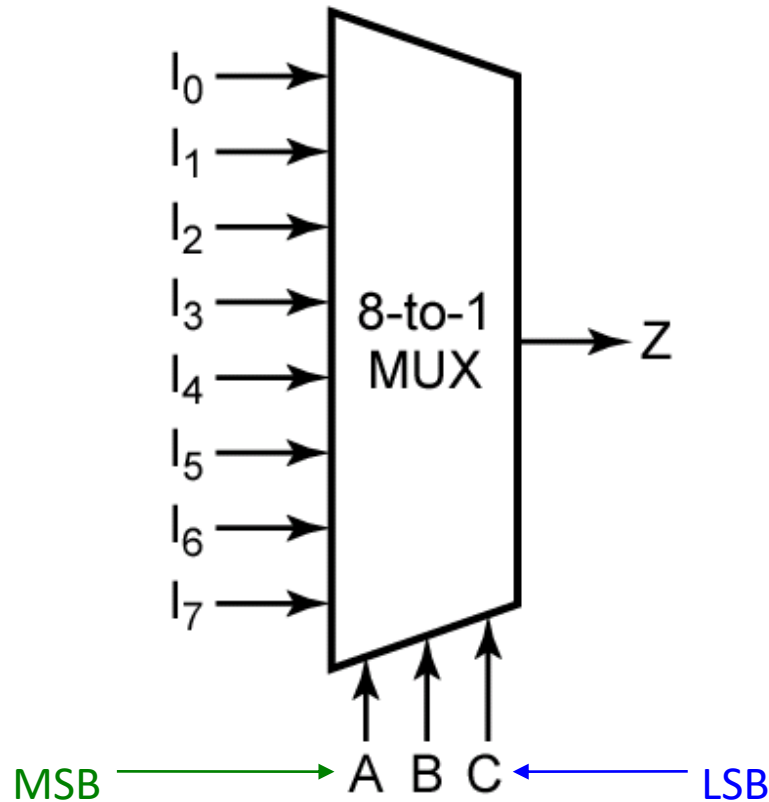
$$Z = A'.B'.I_0 + A'.B.I_1 + A.B'.I_2 + A.B.I_3$$

4-to-1 Multiplexer (MUX)



B	A	Y
0	0	D0
0	1	D1
1	0	D2
1	1	D3

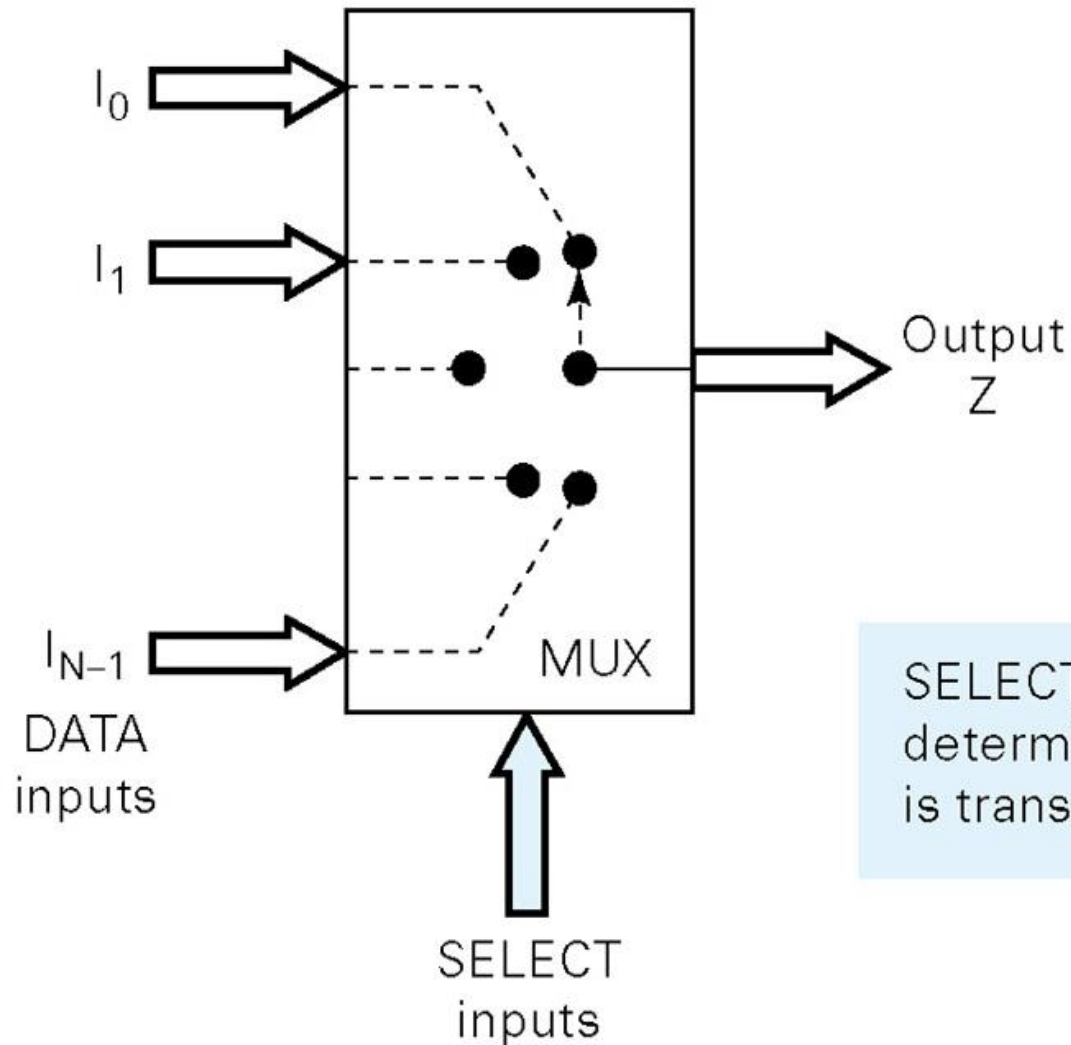
Multiplexers



A	B	C	F
0	0	0	I_0
0	0	1	I_1
0	1	0	I_2
0	1	1	I_3
1	0	0	I_4
1	0	1	I_5
1	1	0	I_6
1	1	1	I_7

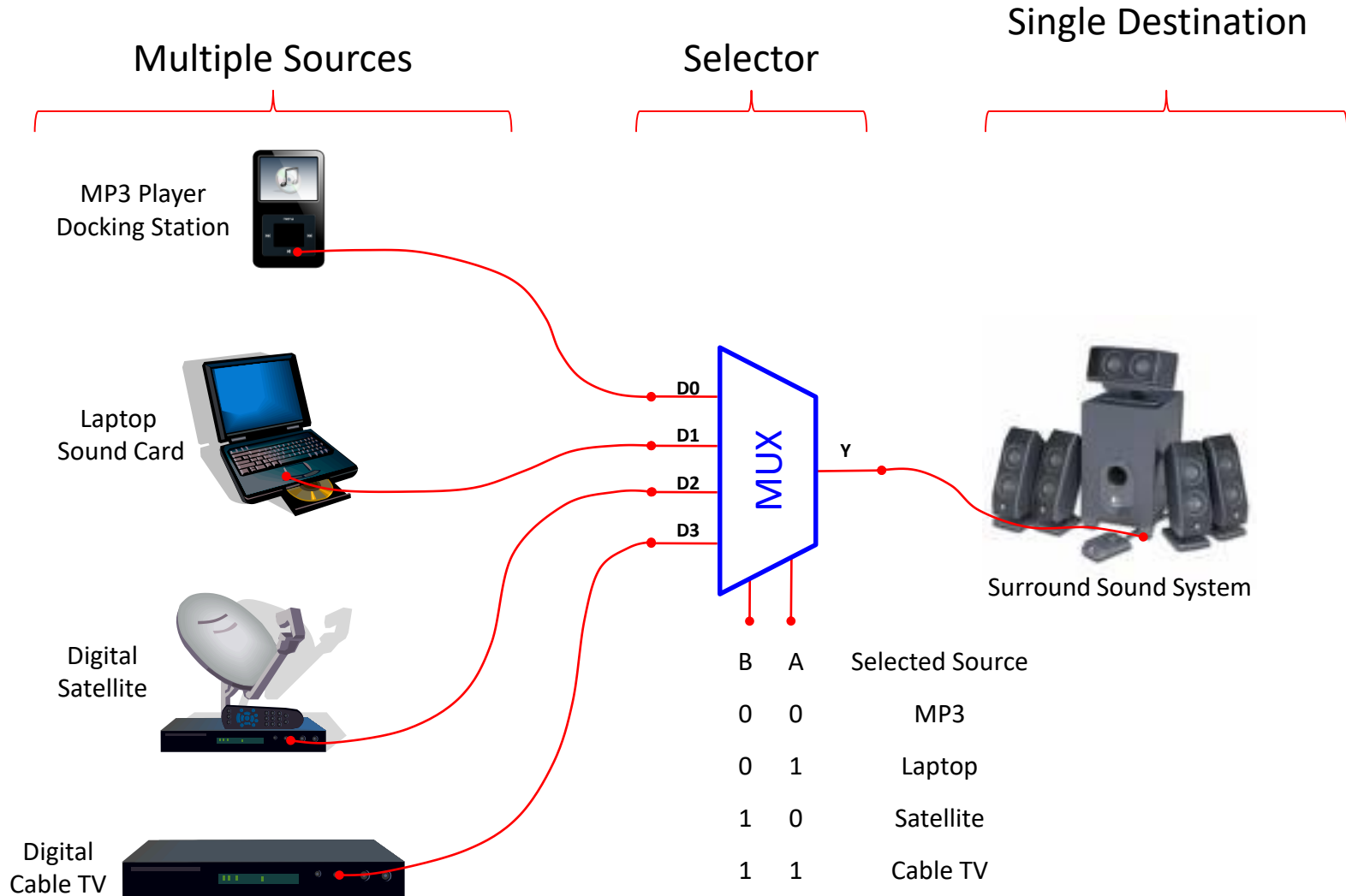
$$Z = A'.B'.C'.I_0 + A'.B'.C.I_1 + A'.B.C'.I_2 + A'.B.C.I_3 + A.B'.C'.I_4 + A.B'.C.I_5 + A.B.C'.I_6 + A.B.C.I_7$$

Functional diagram of MUX



SELECT input code determines which input is transmitted to output Z.

Typical Application of a MUX



Demultiplexers

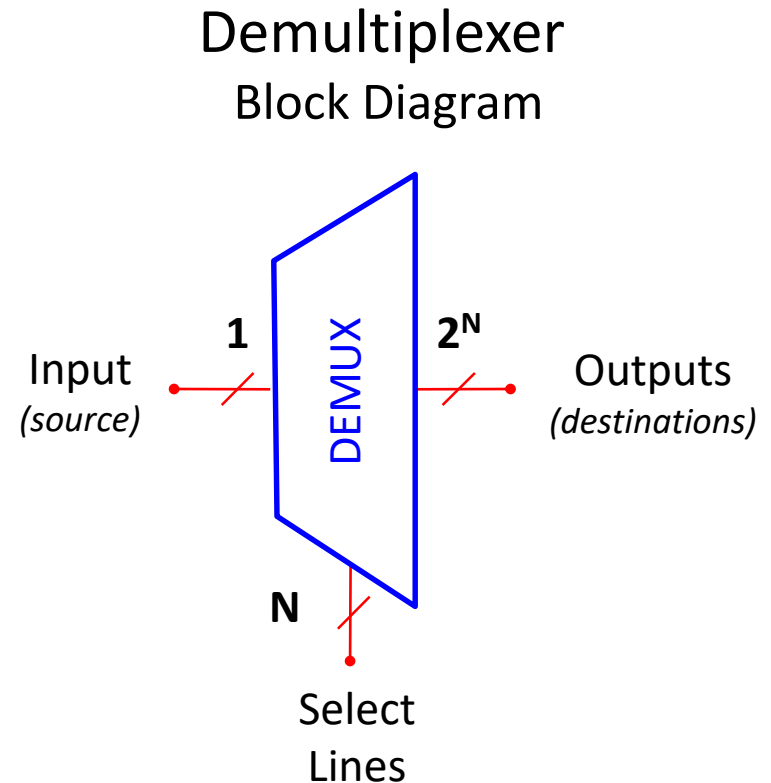
DE-MUX

Demultiplexers

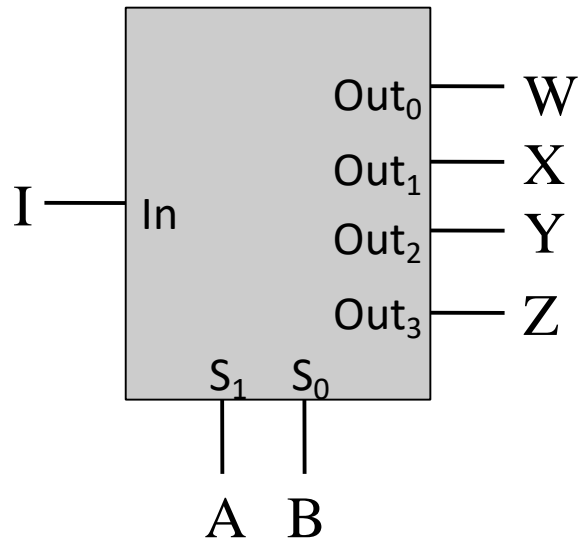
- A demultiplexer has
 - N control inputs
 - 1 data input
 - 2^N outputs
- A demultiplexer routes (or connects) the data input to the selected output.
 - The value of the control inputs determines the output that is selected.
- A demultiplexer performs the opposite function of a multiplexer.

What is a Demultiplexer (DEMUX)?

- A DEMUX is a digital switch with a single input (source) and a multiple outputs (destinations).
- The select lines determine which output the input is connected to.
- DEMUX Types
 - 1-to-2 (1 select line)
 - 1-to-4 (2 select lines)
 - 1-to-8 (3 select lines)
 - 1-to-16 (4 select lines)



Demultiplexers



$$W = A'.B'.I$$

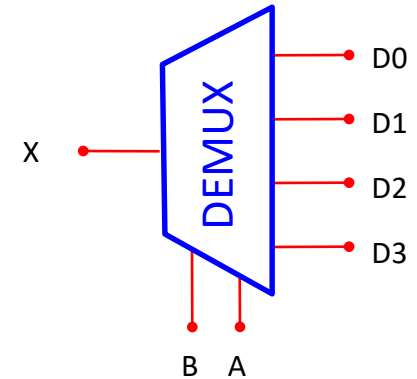
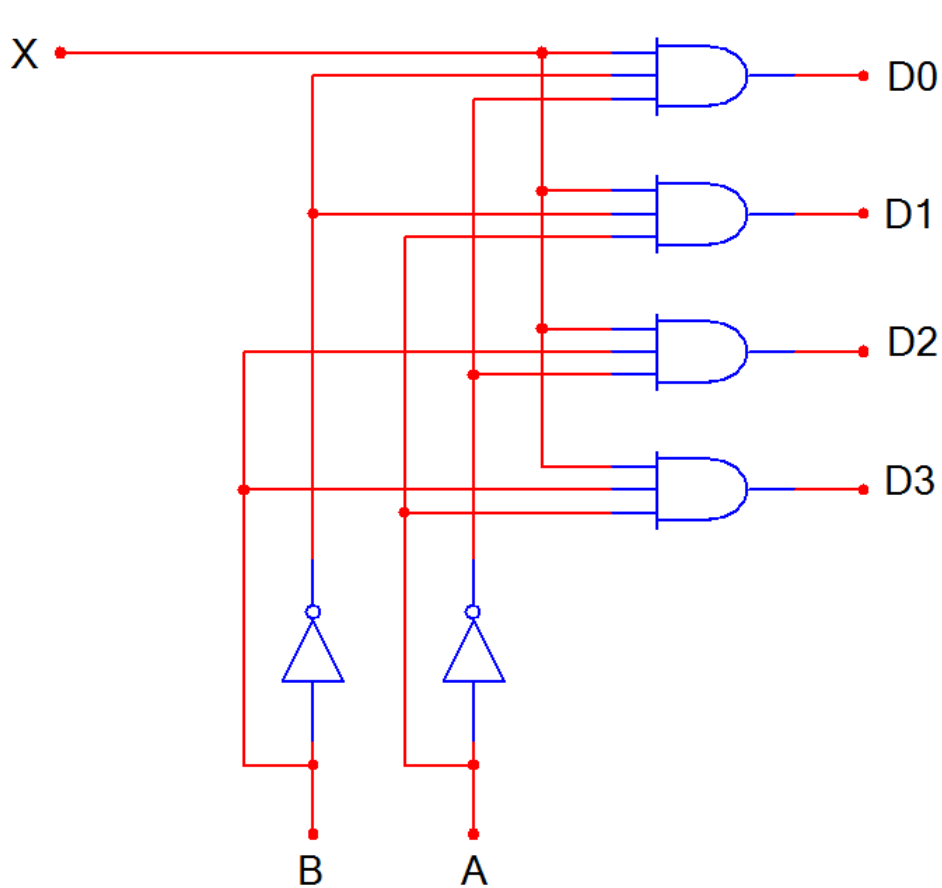
$$X = A.B'.I$$

$$Y = A'.B.I$$

$$Z = A.B.I$$

A	B	W	X	Y	Z
0	0	I	0	0	0
0	1	0	I	0	0
1	0	0	0	I	0
1	1	0	0	0	I

1-to-4 De-Multiplexer (DEMUX)



B	A	D0	D1	D2	D3
0	0	X	0	0	0
0	1	0	X	0	0
1	0	0	0	X	0
1	1	0	0	0	X

Typical Application of a DEMUX

