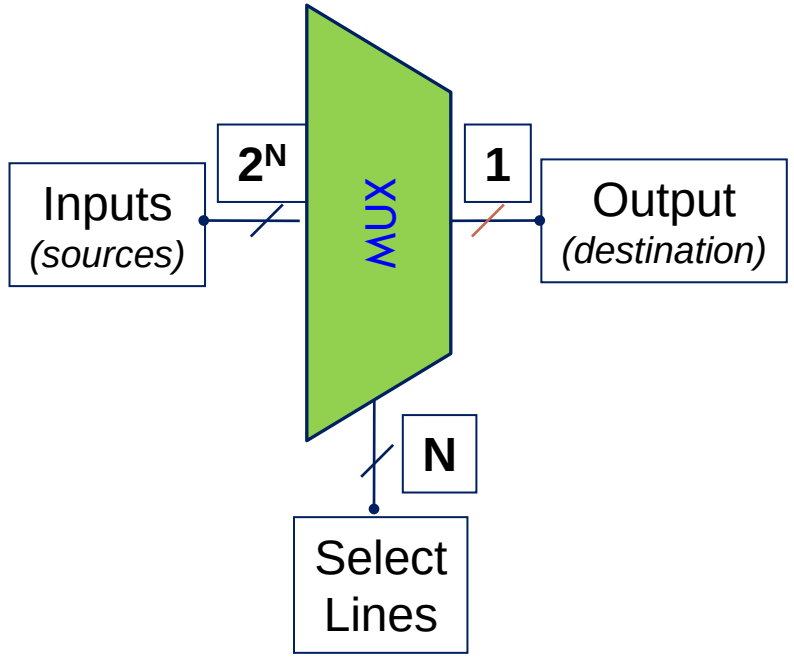
MULTIPLEXER

Presented by Nabanita Das

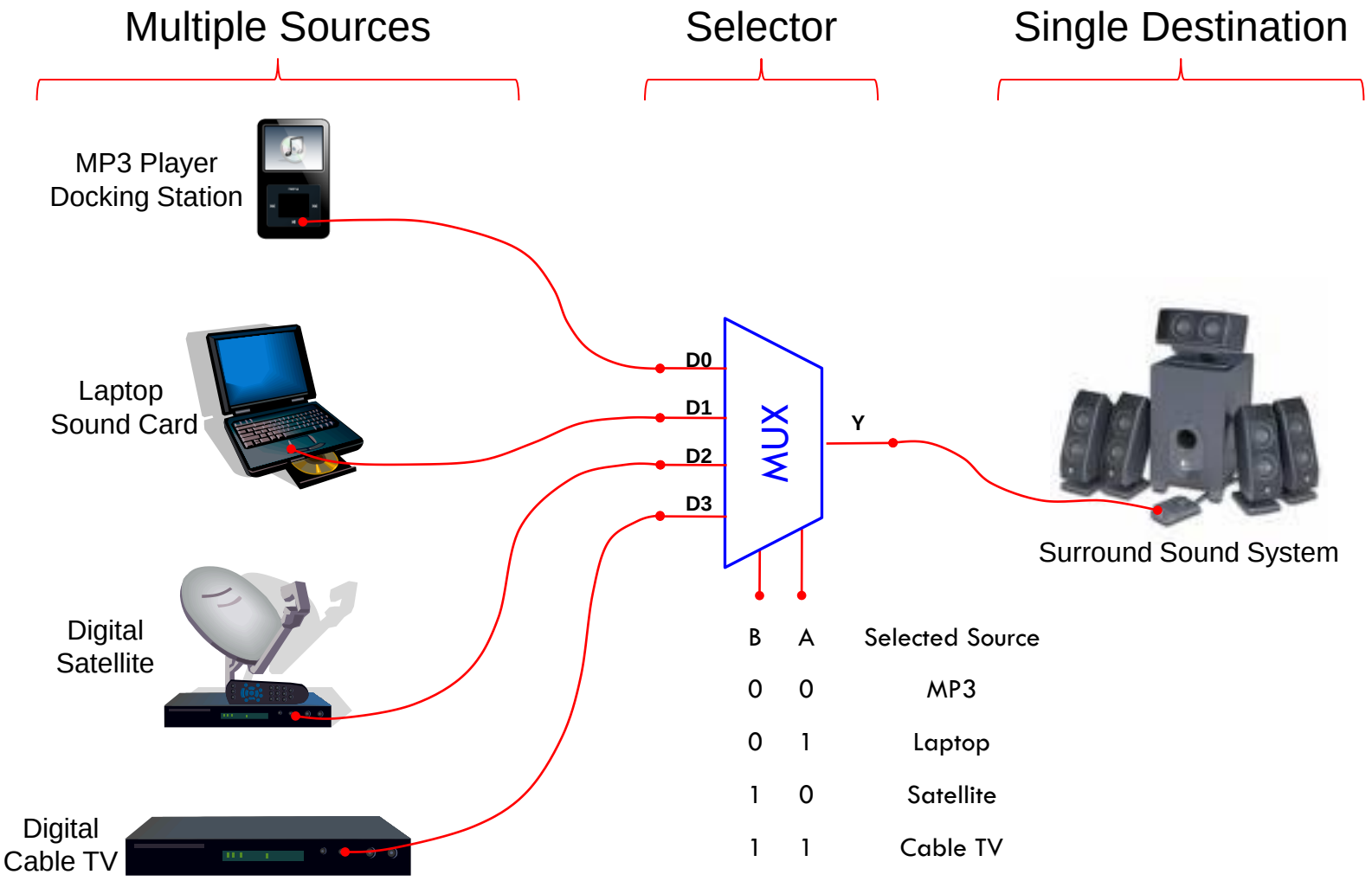
MULTIPLEXER

- Multiplexer is a device that has multiple inputs and a single line output.
- It is also called data selectors.
- Basic function: select one of its 2^n data input lines and place the corresponding information onto a single output line.
- n input bits needed to specify which input line is to be selected.
  - Place binary code for a desired data input line onto its n select input lines.

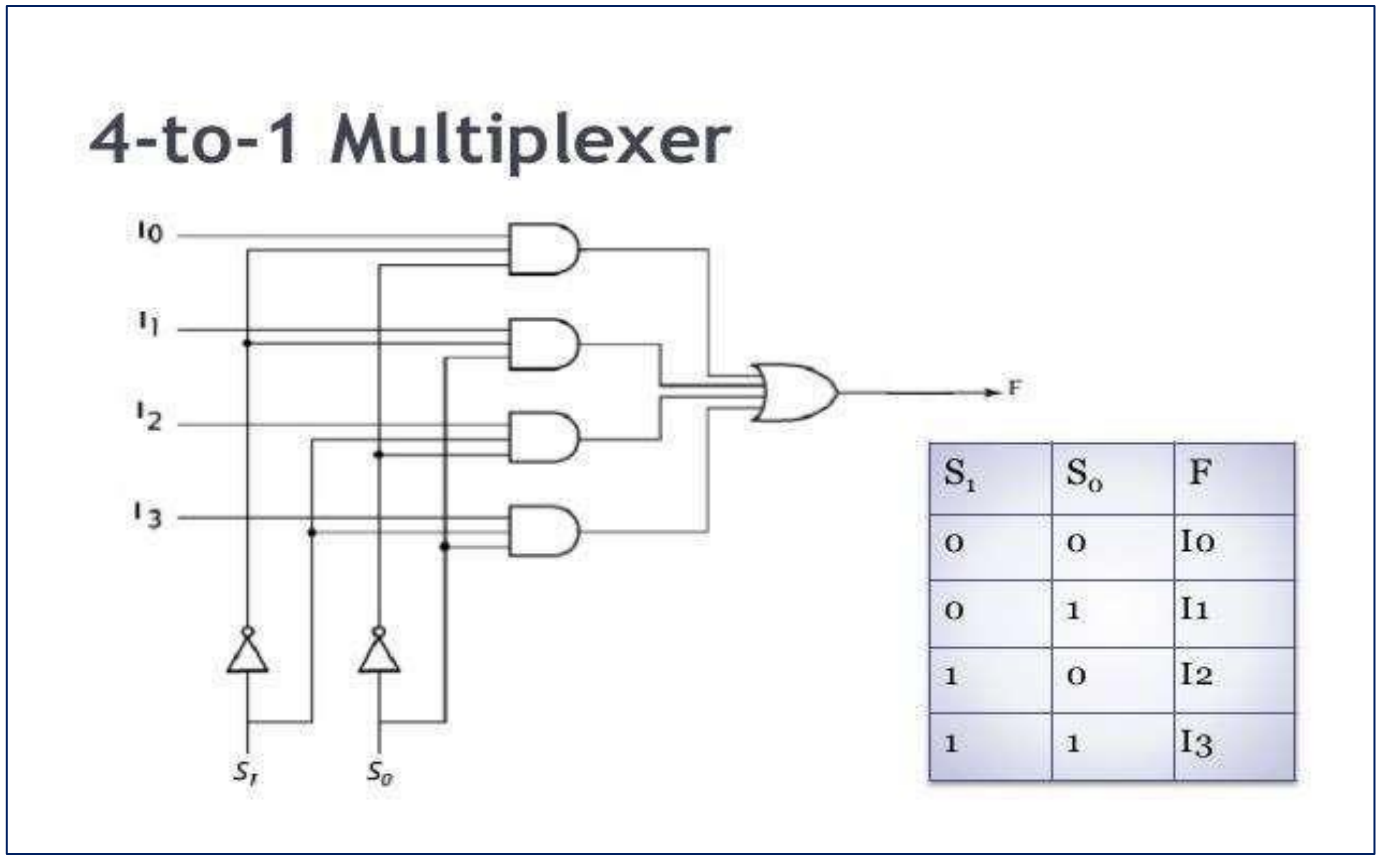


Multiplexer
Block Diagram

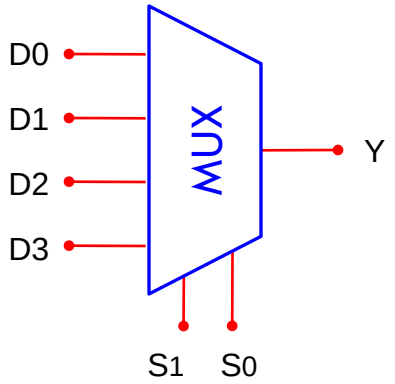
TYPICAL APPLICATION OF A MUX



4-TO-1 MULTIPLEXER (MUX)



S_1	S_0	F
0	0	I0
0	1	I1
1	0	I2
1	1	I3



APPLICATIONS OF MULTIPLEXER

- Telephone Network
- Transmission from the Computer of a Satellite.
- Communication System
- Computer Memory

Implementation of Boolean Function

- Like Logic Gates, the multiplexers can also be used to implement any Boolean expression.

Points to remember:

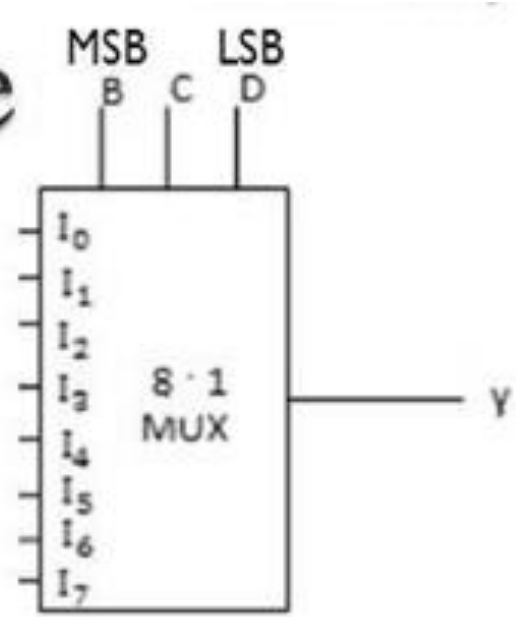
- Any n-variable Boolean Expression can be implemented using 2^{n-1} to 1 MUX and NOT Gates.
- If we have a 3-variable boolean function, it can be implemented using $2^{3-1} = 4$ to 1 MUX.
- If we have a 4-variable boolean function, it can be implemented using $2^{4-1} = 8$ to 1 MUX.

Steps to be followed for Implementation

- If you have a function of n variables, we convert it into SOP form.
- We leave out one variable and connect the remaining (n–1) variables to the select lines of Multiplexer.
- The remaining single variable of the function is used for the inputs of the multiplexer.
- Draw a implementation table.

Implementation Table

		I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7
$\bar{A}$	0	0	(1)	2	(3)	(4)	5	6	7
A	1	8	9	10	(11)	(12)	(13)	(14)	(15)
		0	$\bar{A}$	0	1	1	A	A	A



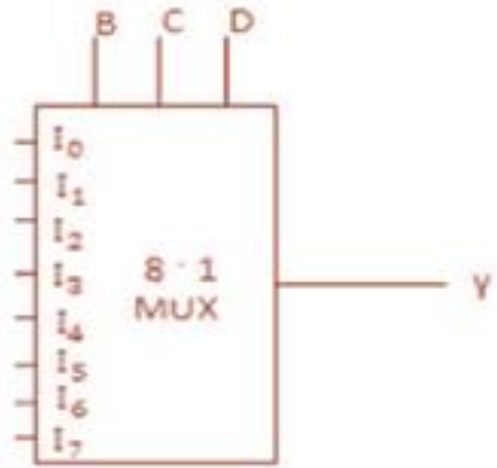
- Implementation is the list of inputs of the multiplexer and under them the list of all possible minterms in two rows.
- First Row list all those minterms where the variable connected to input of MUX is zero
- Second Row list all those minterms where the variable connected to input of MUX is one.

Implementation Table

		I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7
$\bar{A}$	0	0	(1)	2	(3)	(4)	5	6	7
A	1	8	9	10	(11)	(12)	(13)	(14)	(15)
		0	$\bar{A}$	0	1	1	A	A	A

$F(A,B,C,D) = \Sigma\,(1,3,4,11,12,13,14,15)$

A is MSB and D is LSB in the minterm



				Minterm	
B	C	D	Y	A=0	A=1
0	0	0	I_0	0	8
0	0	1	I_1	1	9
0	1	0	I_2	2	10
0	1	1	I_3	3	11
1	0	0	I_4	4	12
1	0	1	I_5	5	13
1	1	0	I_6	6	14
1	1	1	I_7	7	15

RULES

- If both the minterms in a column are not circled, apply 0 to the corresponding input.
- If both the minterms in a column are circled, apply 1 to the corresponding input.
- If the bottom minterms is circled and top is not circled, apply *A* to the input.
- If the top minterms is circled and bottom is not circled, apply *A'* to the input.

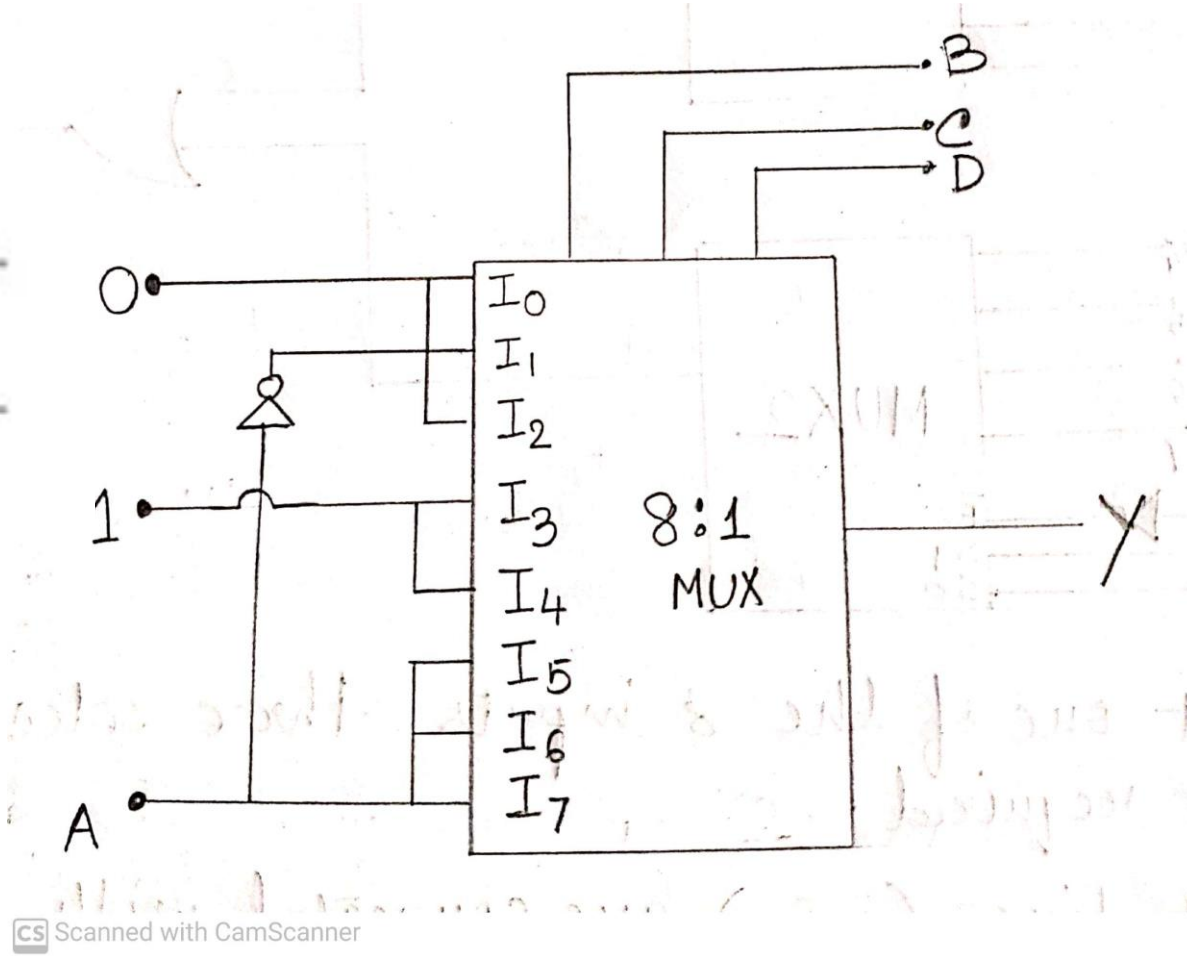
$$F(A,B,C,D) = \Sigma\,(1,3,4,11,12,13,14,15)$$

		I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7
$\bar{A}$	0	0	(1)	2	(3)	(4)	5	6	7
A	1	8	9	10	(11)	(12)	(13)	(14)	(15)
		0	$\bar{A}$	0	1	1	A	A	A

FINAL CIRCUIT

$F(A,B,C,D) = \Sigma\,(1,3,4,11,12,13,14,15)$

		I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7
$\bar{A}$	0	0	(1)	2	(3)	(4)	5	6	7
A	1	8	9	10	(11)	(12)	(13)	(14)	(15)
		0	$\bar{A}$	0	1	1	A	A	A



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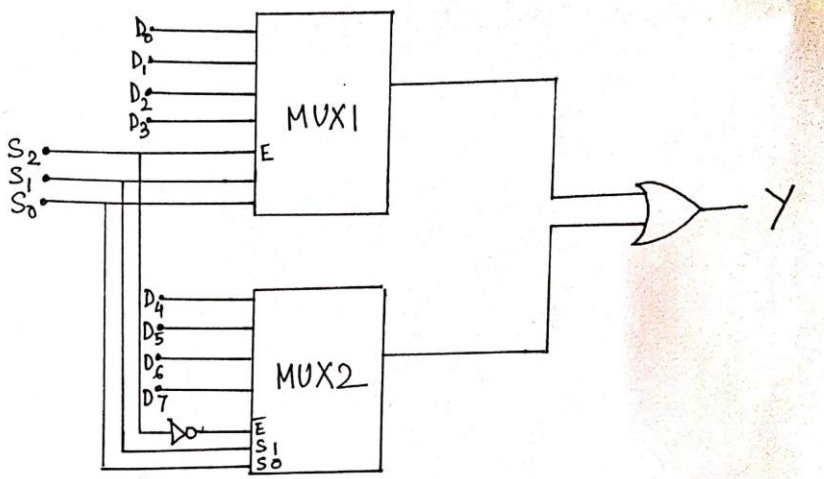
IMPLEMENTATION OF HIGHER-ORDER MULTIPLEXERS (8:1 MUX BY USING 4:1MUX)



To select one of the 8 inputs, three select lines ($S_2S_1S_0$) are required.

To select lines (S_1S_0) are connected with two inputs of both multiplexer.

The most significant line S_2 is connected directly to the E input of MUX1 while the same is connected an inverter $\overline{E}$ input of MUX2.

S_0, when $S_2=0$ is MUX1 is connected & MUX2 is disabled.

When $S_2=1$ MUX1 disabled MUX2 connected.

The output of MUX1 & MUX2 axed ORed using OR gate to generate the output.

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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.

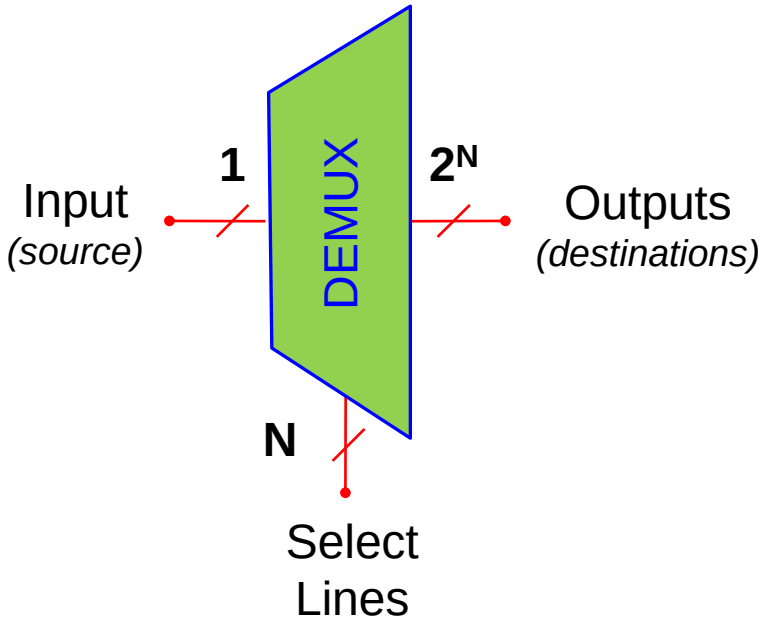
DEMUX Types

→ 1-to-2 (1 select line)

→ 1-to-4 (2 select lines)

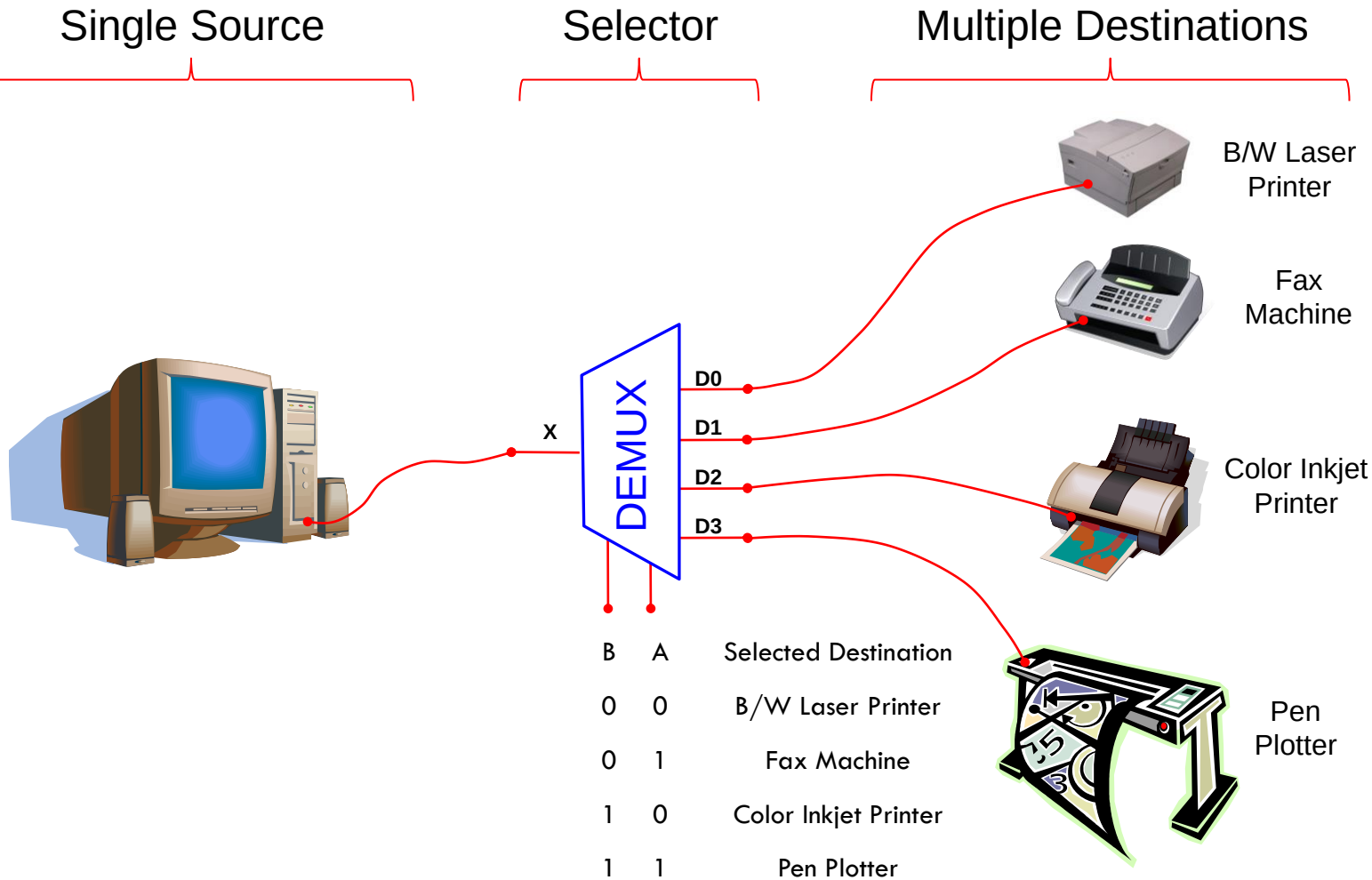
→ 1-to-8 (3 select lines)

→ 1-to-16 (4 select lines)

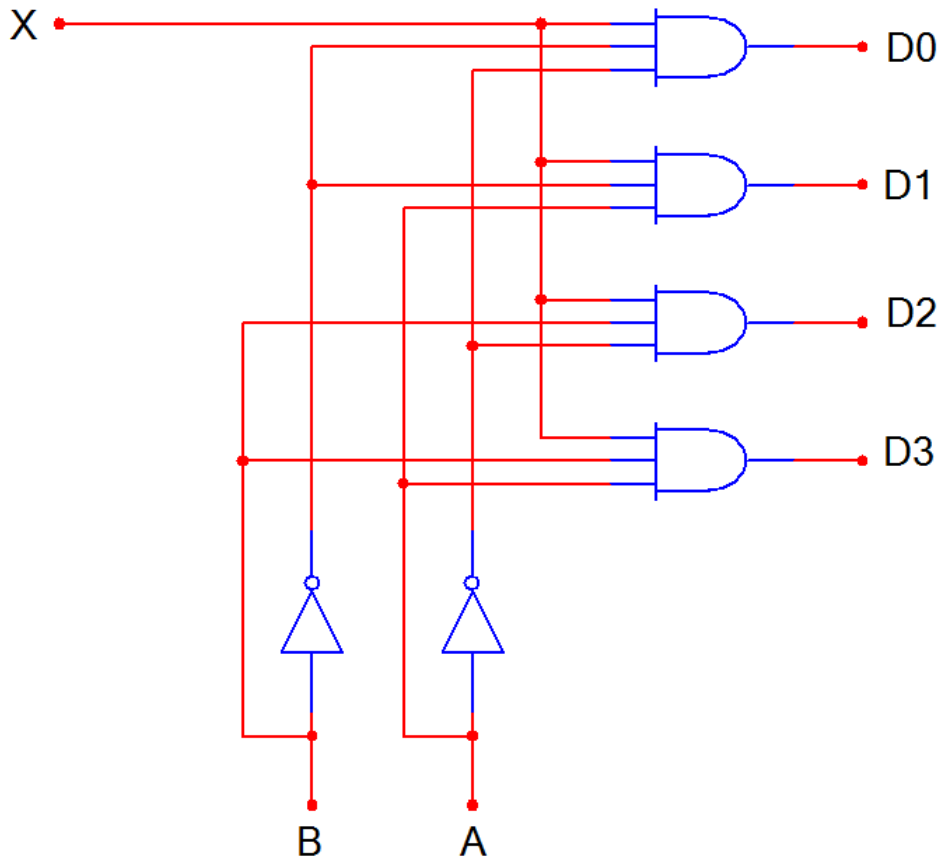


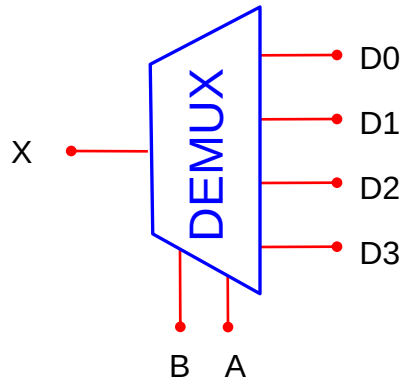
Demultiplexer
Block Diagram

TYPICAL APPLICATION OF A DEMUX



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