



# **SNS COLLEGE OF TECHNOLOGY**

Coimbatore-35  
An Autonomous Institution



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## **DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

### **19ECB202 – LINEAR AND DIGITAL CIRCUITS**

II YEAR/ III SEMESTER

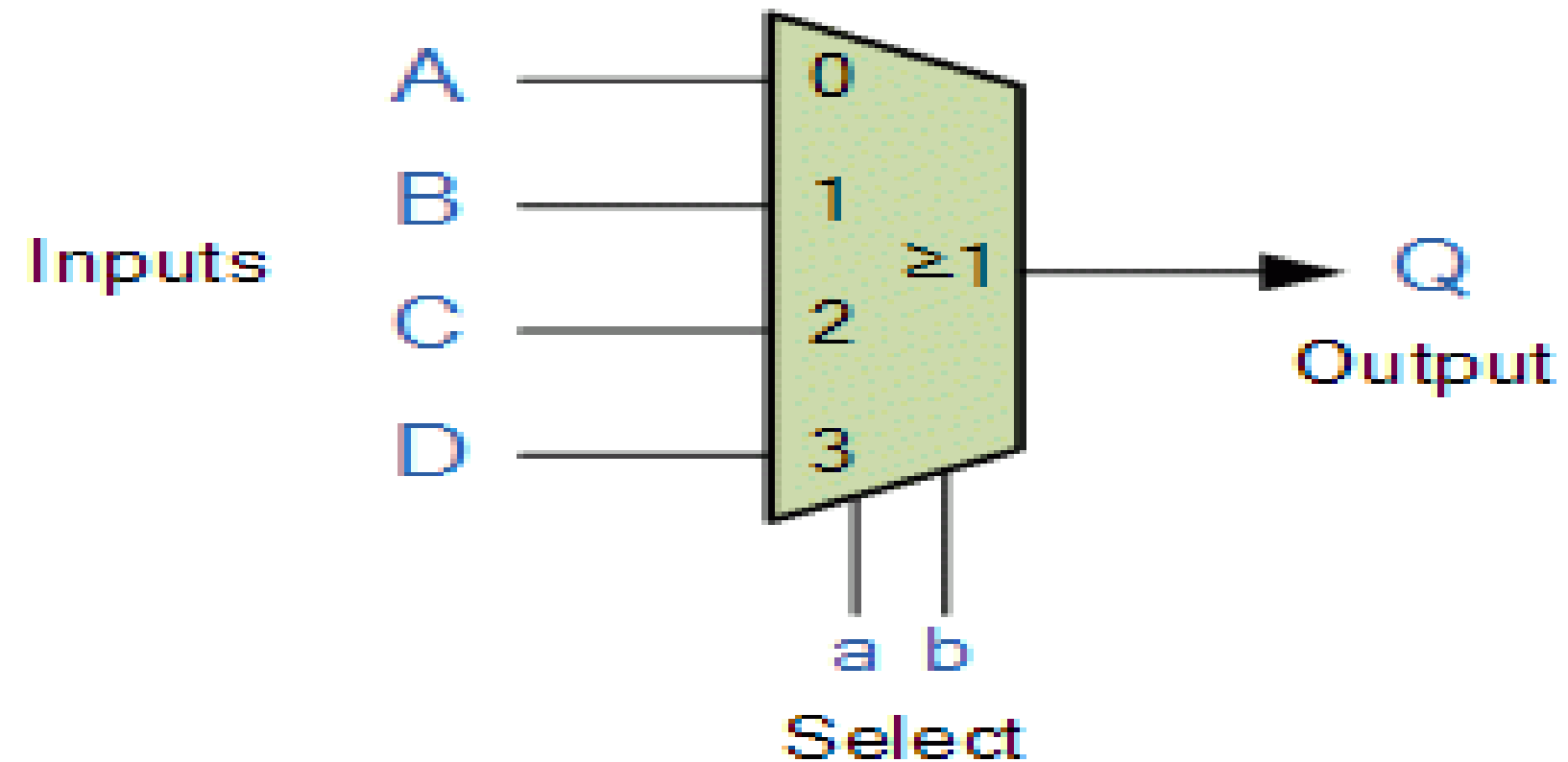
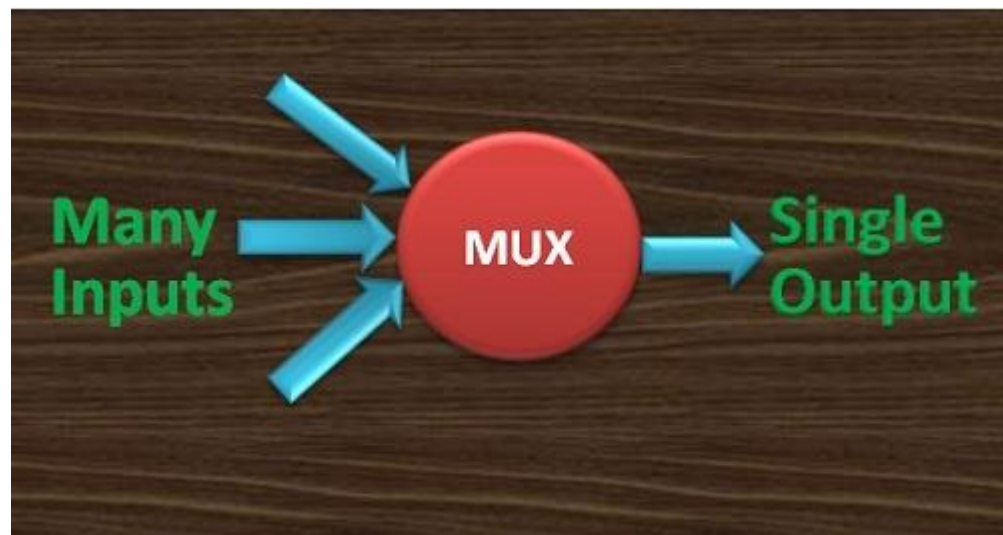
UNIT 4 – COMBINATIONAL and SEQUENTIAL CIRCUITS

TOPIC 3 – MULTIPLEXER and DEMULTIPLEXER



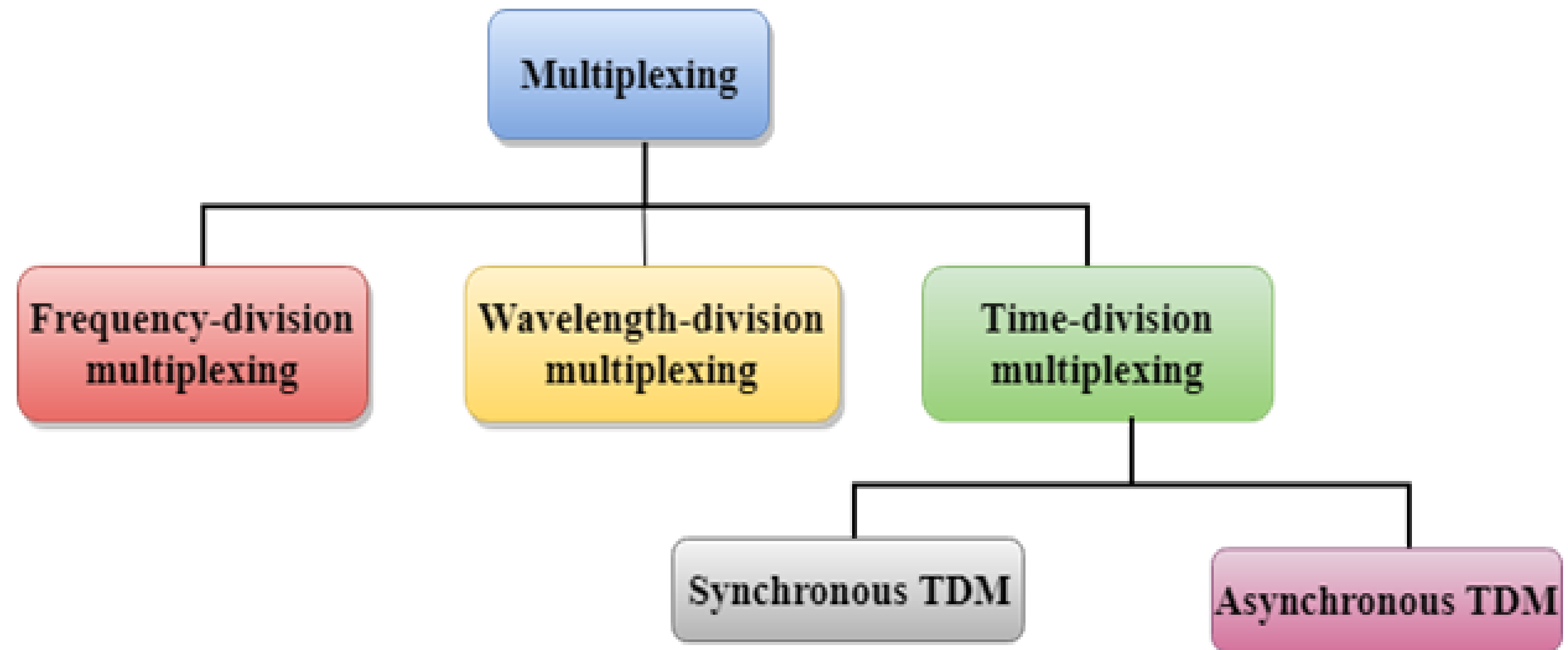
# What is a Multiplexer?

- Multiplexer is a combinational circuit that has maximum of  $2^n$  data inputs, 'n' selection lines and single output line.
- One of these data inputs will be connected to the output based on the values of selection lines..





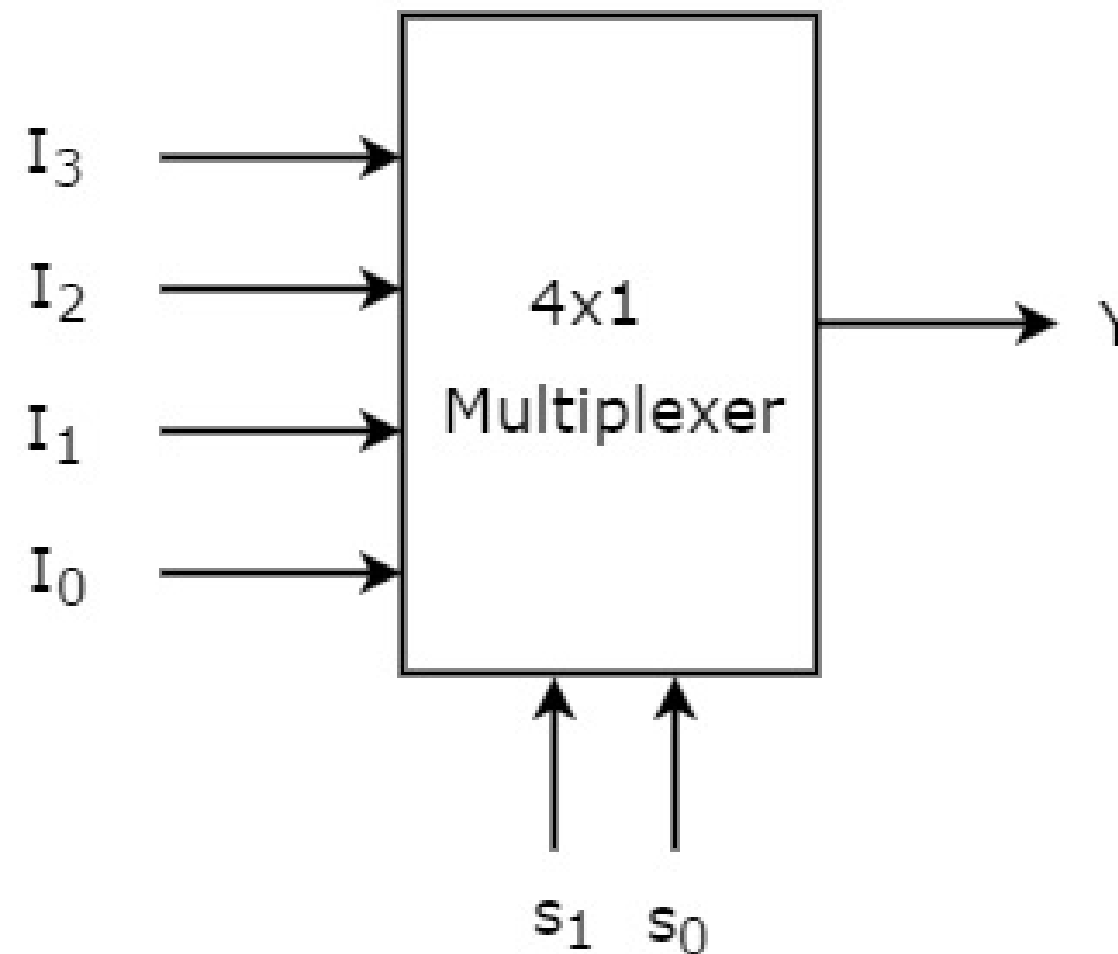
# Multiplexing Techniques





# 4x1 Multiplexer

- 4x1 Multiplexer has four data inputs  $I_3$ ,  $I_2$ ,  $I_1$  &  $I_0$ , two selection lines  $s_1$  &  $s_0$  and one output  $Y$ .





## 4x1 Multiplexer

- One of these 4 inputs will be connected to the output based on the combination of inputs present at these two selection lines.

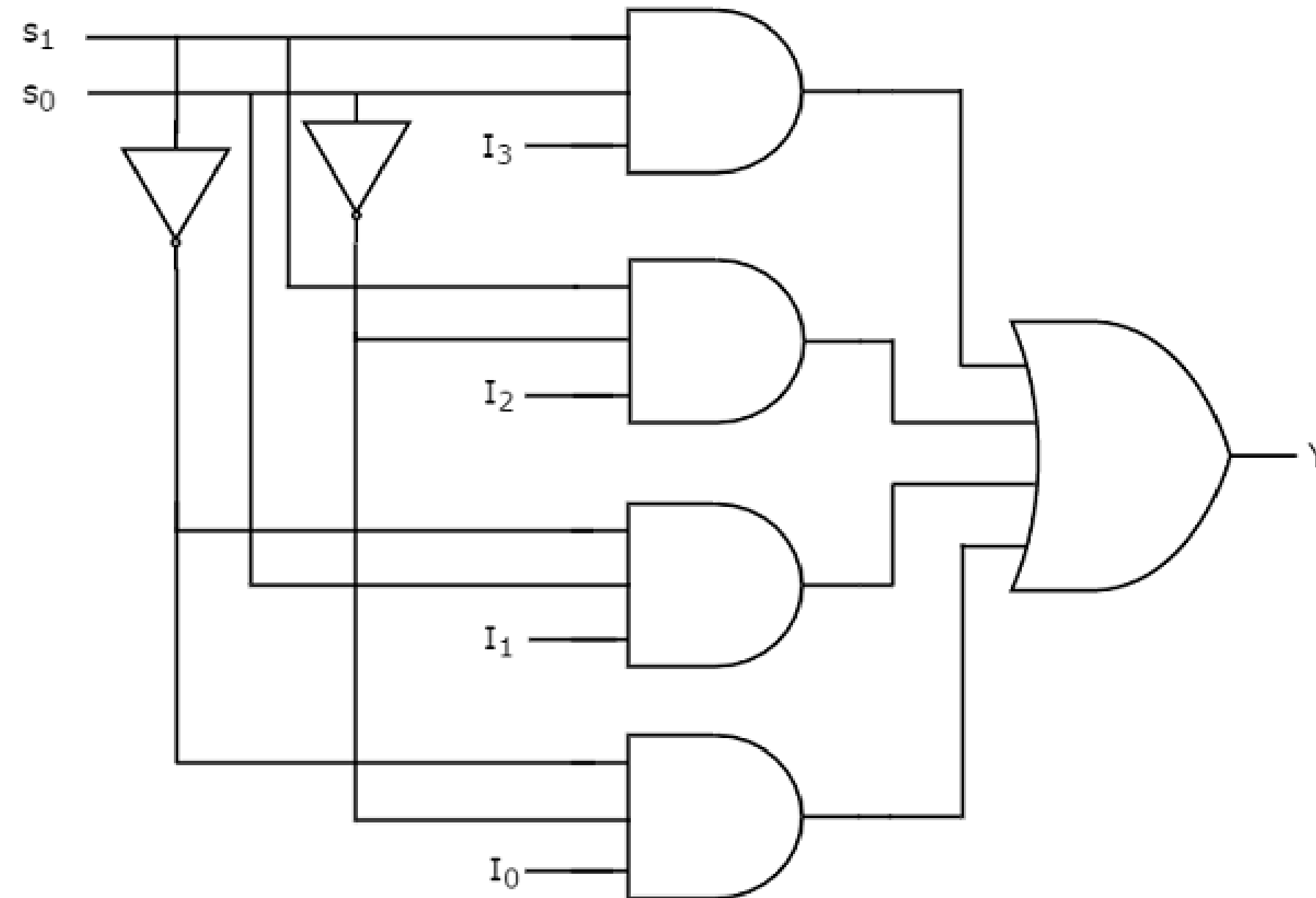
Selection Lines		Output
$S_1$	$S_0$	$Y$
0	0	$I_0$
0	1	$I_1$
1	0	$I_2$
1	1	$I_3$



# 4x1 Multiplexer



- We can implement this Boolean function using Inverters, AND gates & OR gate.

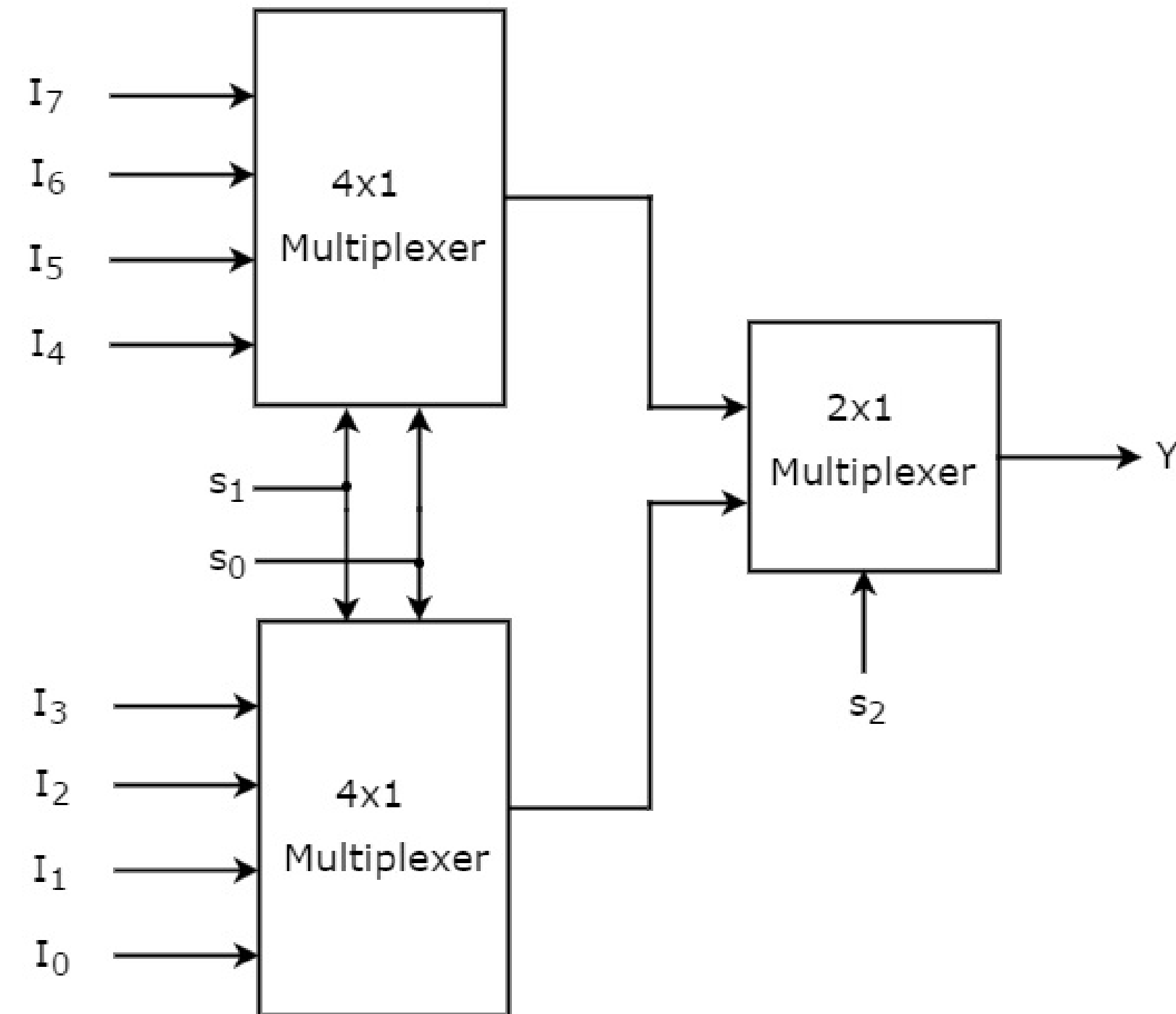




# 8x1 Multiplexer



- We require two 4x1 Multiplexers in first stage in order to get the 8 data inputs.





# 8x1 Multiplexer



- Let the 8x1 Multiplexer has eight data inputs  $I_7$  to  $I_0$ , three selection lines  $s_2$ ,  $s_1$  &  $s_0$  and one output  $Y$

Selection Inputs			Output
$S_2$	$S_1$	$S_0$	$Y$
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	$I_7$





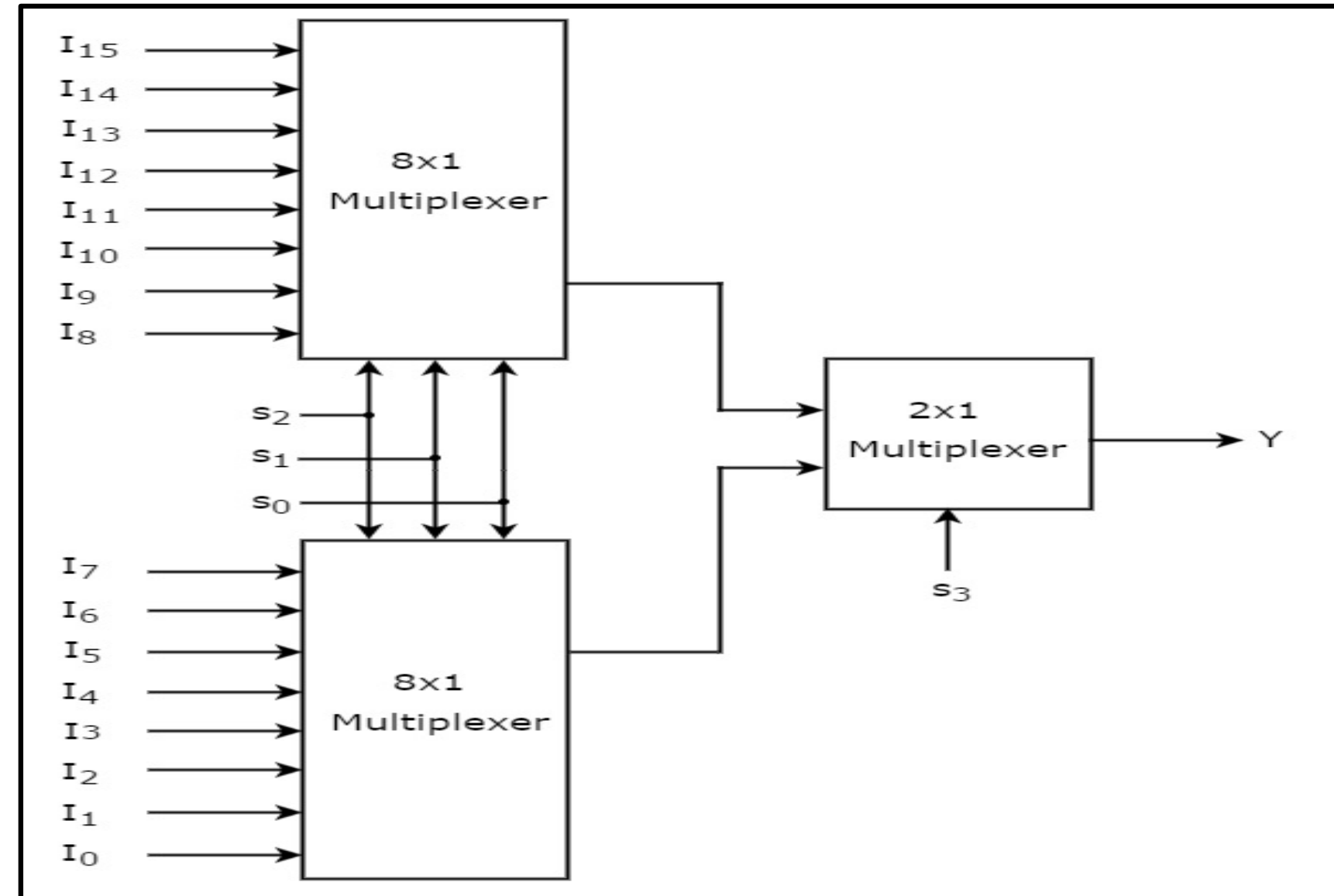
## Activity Time





## 16x1 Multiplexer

- We require two 8x1 Multiplexers in first stage in order to get the 16 data inputs.





## 16x1 Multiplexer

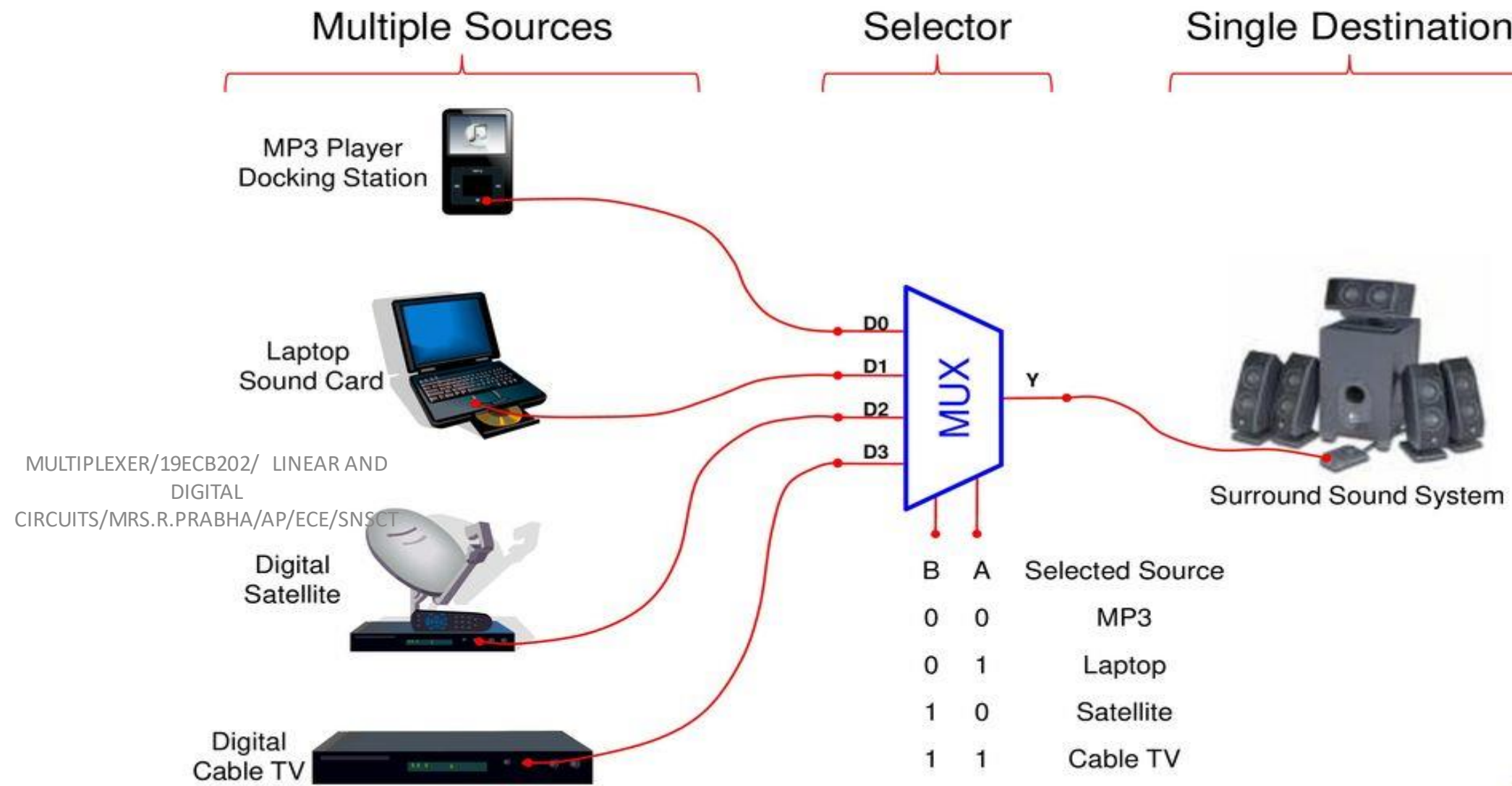
- 16x1 Multiplexer has sixteen data inputs  $I_{15}$  to  $I_0$ , four selection lines  $s_3$  to  $s_0$  and one output  $Y$ .

Selection Inputs				Output
$s_3$	$s_2$	$s_1$	$s_0$	$Y$
0	0	0	0	$I_0$
0	0	0	1	$I_1$
0	0	1	0	$I_2$
0	0	1	1	$I_3$
0	1	0	0	$I_4$
0	1	0	1	$I_5$
0	1	1	0	$I_6$
0	1	1	1	$I_7$
1	0	0	0	$I_8$

1	0	0	1	$I_9$
1	0	1	0	$I_{10}$
1	0	1	1	$I_{11}$
1	1	0	0	$I_{12}$
1	1	0	1	$I_{13}$
1	1	1	0	$I_{14}$
1	1	1	1	$I_{15}$



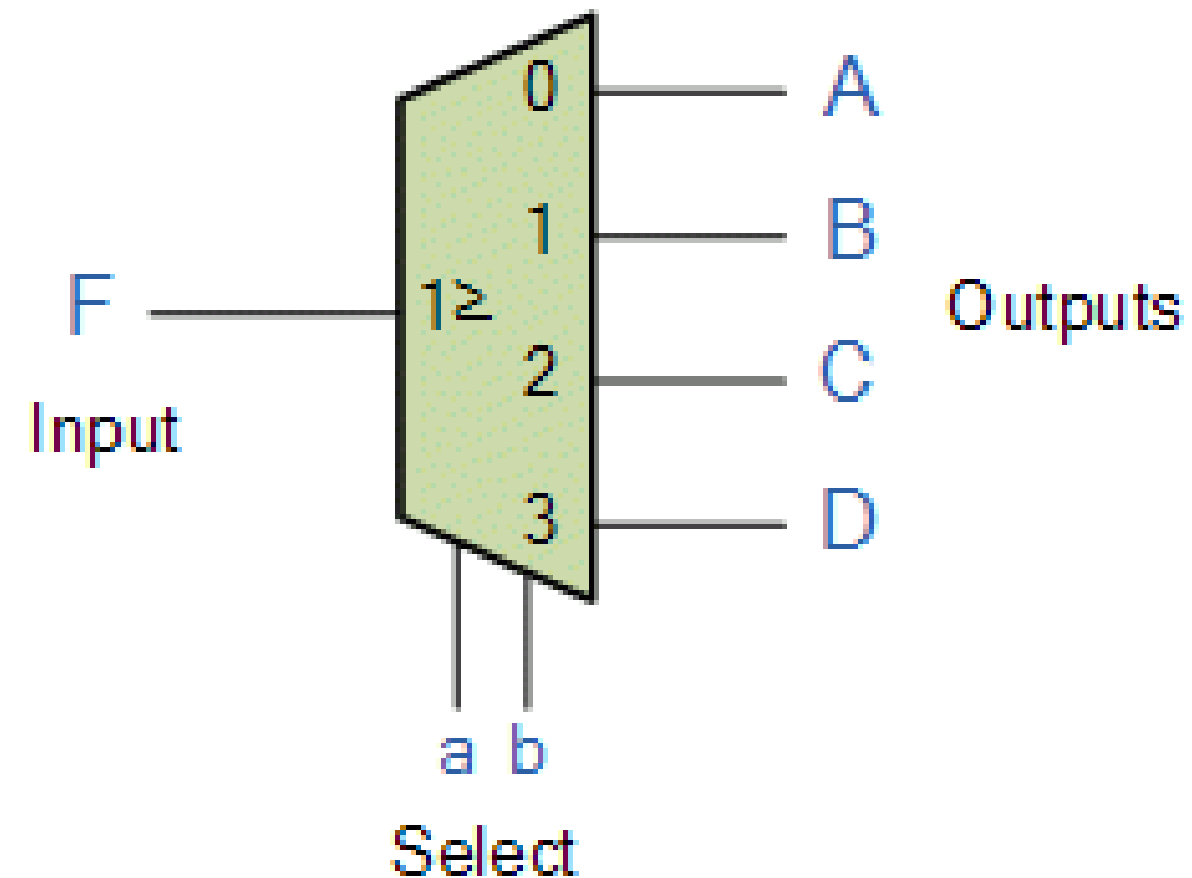
# Typical Application of a MUX





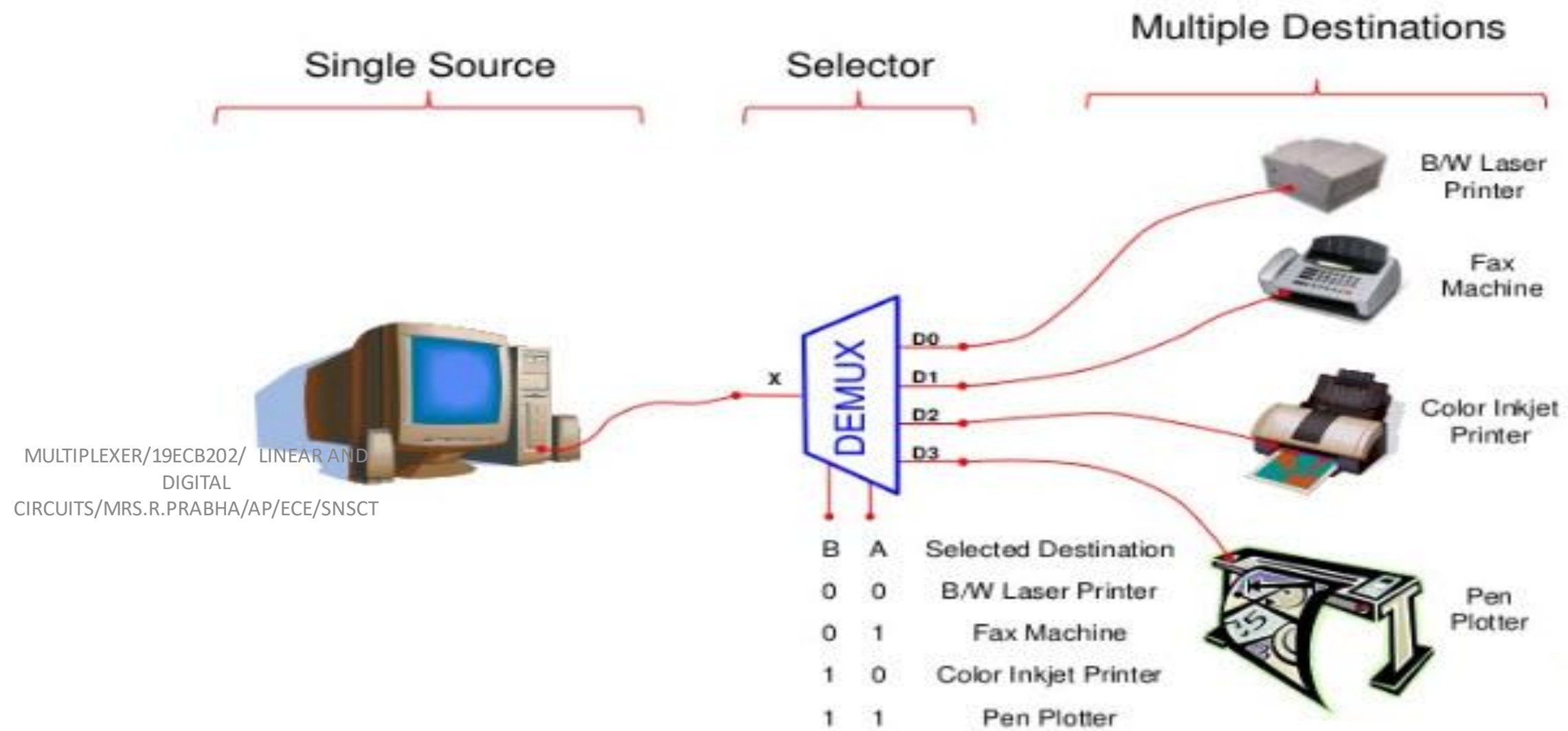
## What is De Multiplexer?

- De-Multiplexer is a combinational circuit that performs the reverse operation of Multiplexer. It has single input, 'n' selection lines and maximum of  $2^n$  outputs.
- One of these data inputs will be connected to the output based on the values of selection lines..





# DeMultiplexer - Types

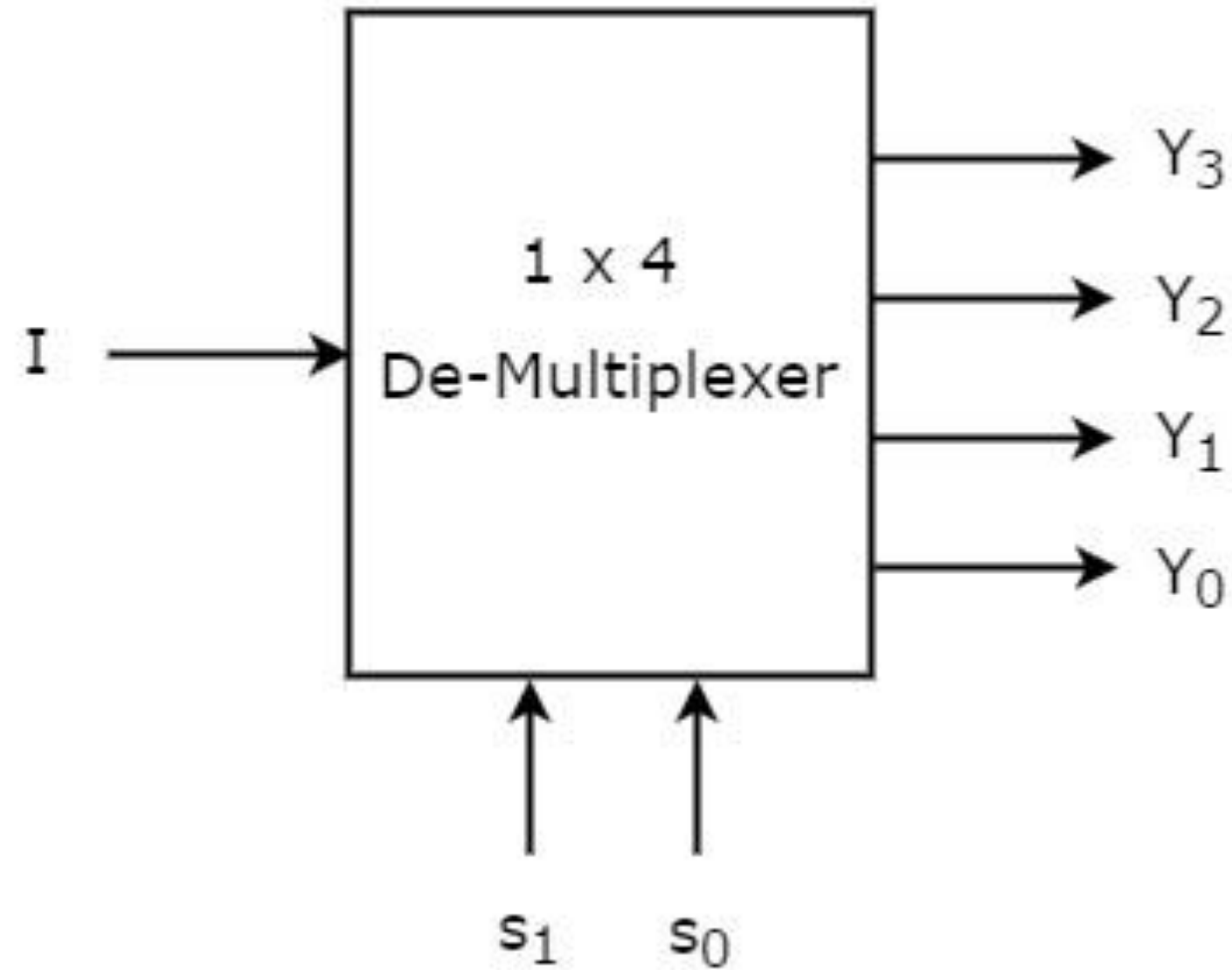




# 1x4 De-Multiplexer



- 1x4 De-Multiplexer has one input I, two selection lines, s1 & s0 and four outputs Y3, Y2, Y1 & Y0.





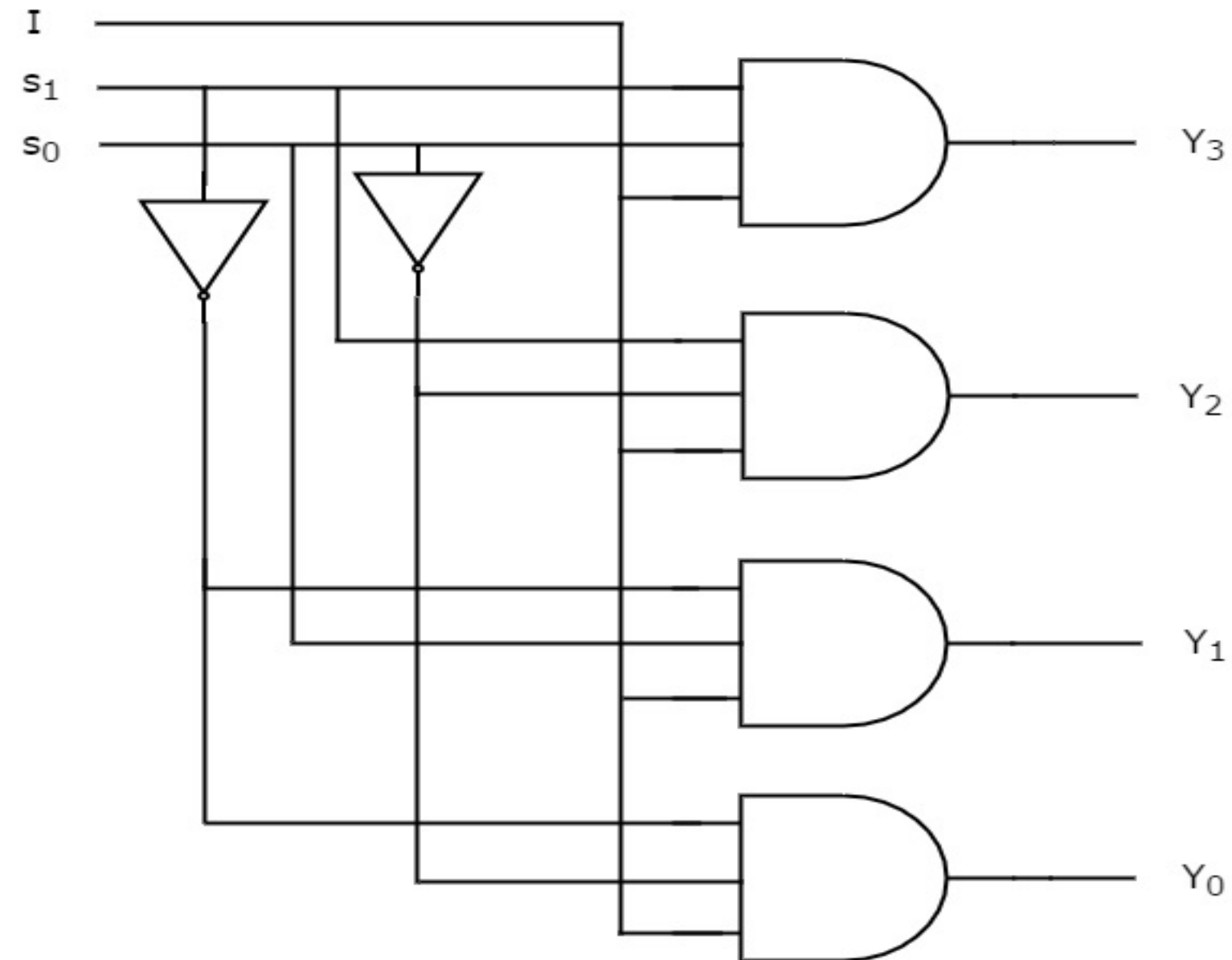
- The single input 'I' will be connected to one of the four outputs, Y3 to Y0 based on the values of selection lines s1 & s0. The Truth table of 1x4 De-Multiplexer is shown below.

Selection Inputs		Outputs			
S <sub>1</sub>	S <sub>0</sub>	Y <sub>3</sub>	Y <sub>2</sub>	Y <sub>1</sub>	Y <sub>0</sub>
0	0	0	0	0	I
0	1	0	0	I	0
1	0	0	I	0	0
1	1	I	0	0	0





We can implement these Boolean functions using Inverters & 3-input AND gates. The circuit diagram of 1x4 De-Multiplexer is shown in the following figure.

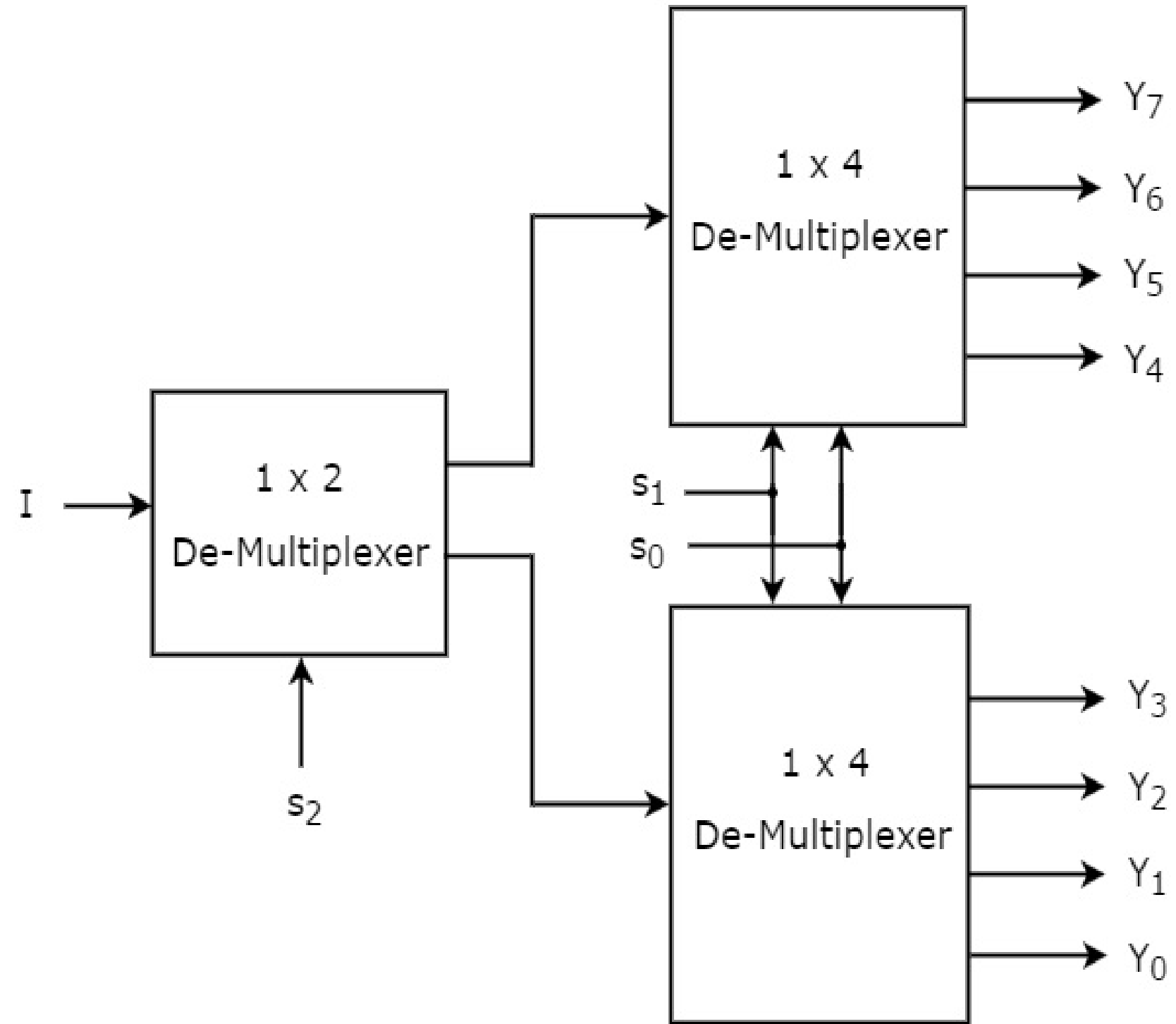




# 1x8 De-Multiplexer



1x8 De-Multiplexer has single input, three selection lines and eight outputs.





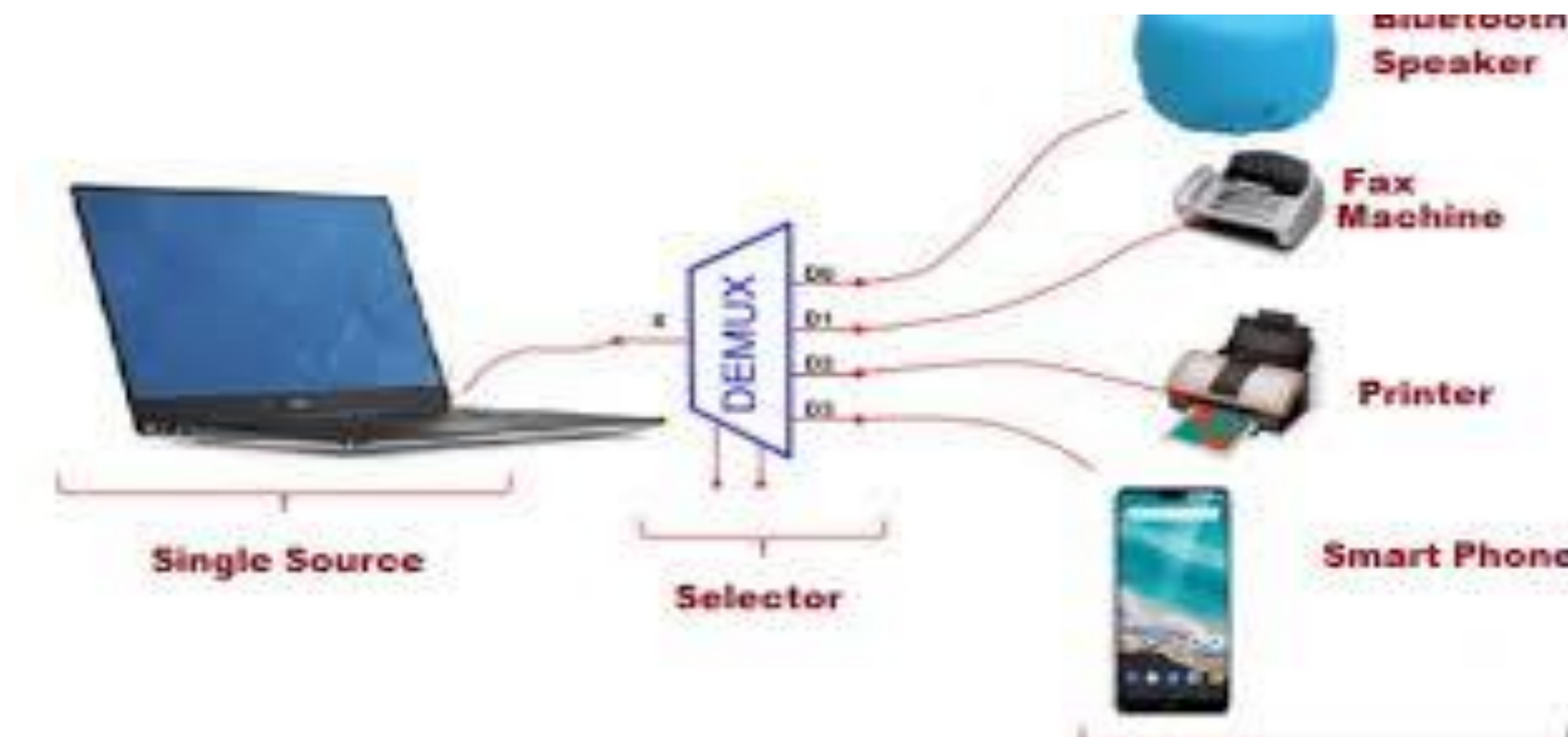
**1x8 De-Multiplexer has one input I, three selection lines s<sub>2</sub>, s<sub>1</sub> & s<sub>0</sub> and outputs Y<sub>7</sub> to Y<sub>0</sub>. The Truth table of 1x8 De-Multiplexer is shown below.**

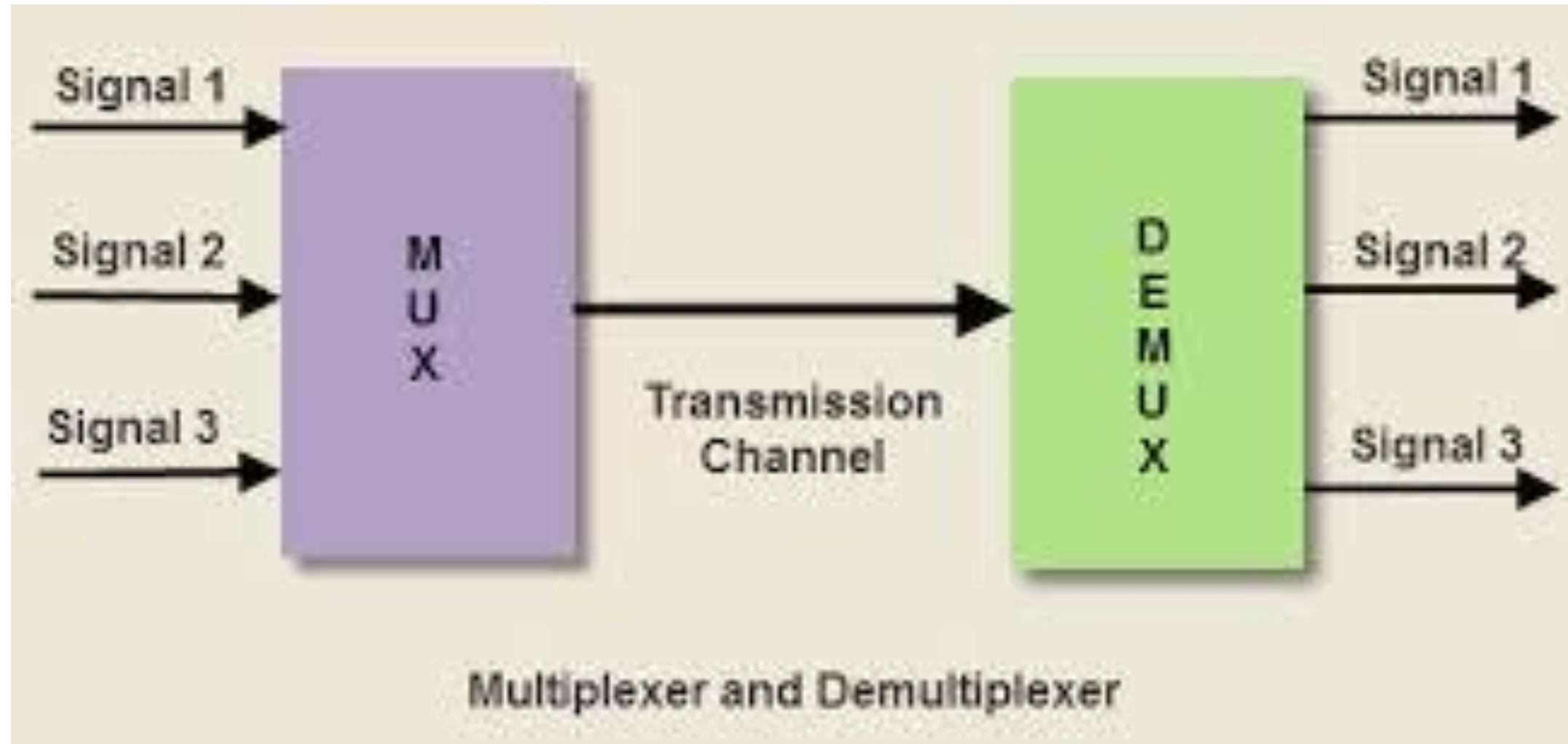
Selection Inputs			Outputs							
s <sub>2</sub>	s <sub>1</sub>	s <sub>0</sub>	Y <sub>7</sub>	Y <sub>6</sub>	Y <sub>5</sub>	Y <sub>4</sub>	Y <sub>3</sub>	Y <sub>2</sub>	Y <sub>1</sub>	Y <sub>0</sub>
0	0	0	0	0	0	0	0	0	0	I
0	0	1	0	0	0	0	0	0	I	0
0	1	0	0	0	0	0	0	I	0	0
0	1	1	0	0	0	0	I	0	0	0
1	0	0	0	0	0	I	0	0	0	0
1	0	1	0	0	I	0	0	0	0	0
1	1	0	0	I	0	0	0	0	0	0
1	1	1	I	0	0	0	0	0	0	0



# Applications

Demultiplexer is used to connect a single source to multiple destinations. The main application area of demultiplexer is communication system where multiplexer are used.







## ASSESSMENTS



**THINK**  
(Yourself)



**PAIR**  
(With a partner)



**SHARE**  
(Whole class)



**THANK YOU**