Experiment No. 3

Title: Design of digital system using Multiplexer.

Batch: B1 Roll No.: 16010420133 Experiment No.: 3

Aim: Design of digital system using Multiplexer..

Resources needed: Simulation Platform

Theory:

Multiplexer also called Data selector. A digital circuit which selects one of the 2^n data inputs and route it to the single output. Select lines are(n) and Input lines are (2^n)

.

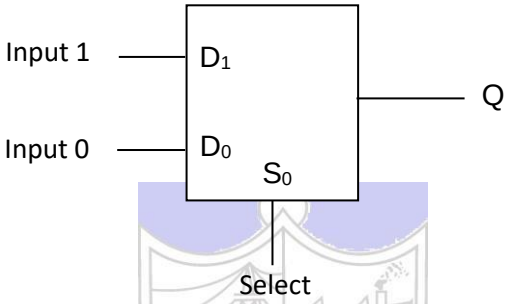


fig 1. A 2 : 1 multiplexer

In this case there are two input terminals D_0 and D_1, one select input S_0 and one output Q. When the select input is set to logic 0, D_0 is connected to the output. When the select input is set to logic 1, D_1 is connected to the output Q.

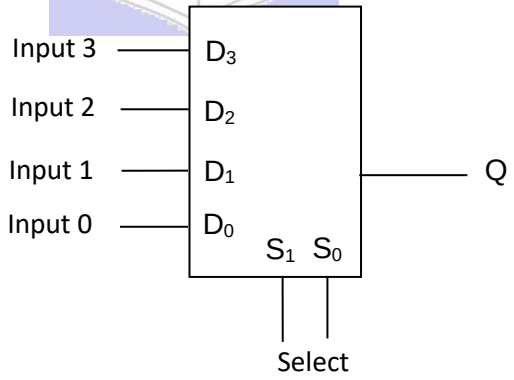


fig 2. A 4 : 1 multiplexer.

In this case there are four data input terminals $D_0 – D_3$, two select inputs S_0 and S_1 and just one output Q. The following truth table shows when each of the data inputs is connected to the output.

Table1. Truth table for 4:1 multiplexer

Select Inputs		Output
S_1	S_0	Q
0	0	D_0
0	1	D_1
1	0	D_2
1	1	D_3

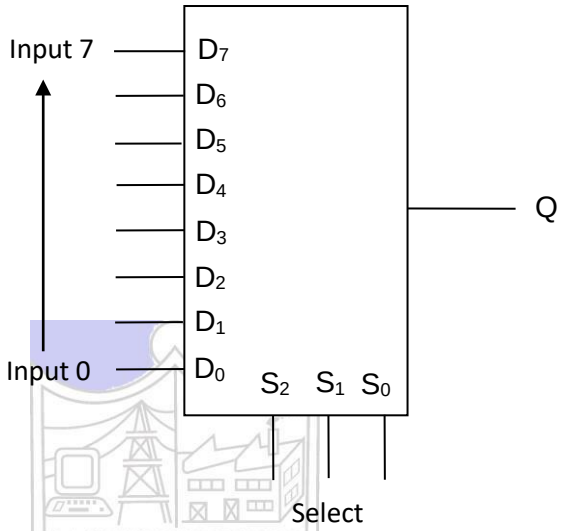


fig 3. An 8 : 1 multiplexer.

Table 2. Truth Table for 8:1 Multiplexer

Select Inputs			Output
S_2	S_1	S_0	Q
0	0	0	D_0
0	0	1	D_1
0	1	0	D_2
0	1	1	D_3
1	0	0	D_4
1	0	1	D_5
1	1	0	D_6
1	1	1	D_7

The above truth table shows when the data inputs are connected to the output.

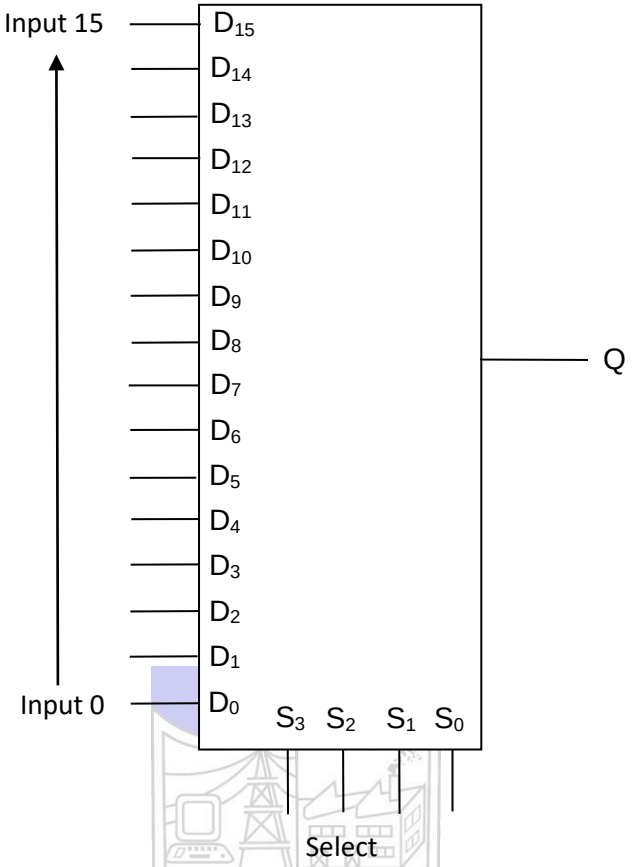


fig 3. A 16 : 1 multiplexer.

The following truth table shows when the data inputs are connected to the output.

Select Inputs				Output
S_3	S_2	S_1	S_0	Q
0	0	0	0	D_0
0	0	0	1	D_1
0	0	1	0	D_2
0	0	1	1	D_3
0	1	0	0	D_4
0	1	0	1	D_5
0	1	1	0	D_6
0	1	1	1	D_7
1	0	0	0	D_8
1	0	0	1	D_9
1	0	1	0	D_{10}
1	0	1	1	D_{11}
1	1	0	0	D_{12}
1	1	0	1	D_{13}
1	1	1	0	D_{14}
1	1	1	1	D_{15}

Multiplexers are commonly used in communication systems; however they can be used in Logic System design and simplification as well.

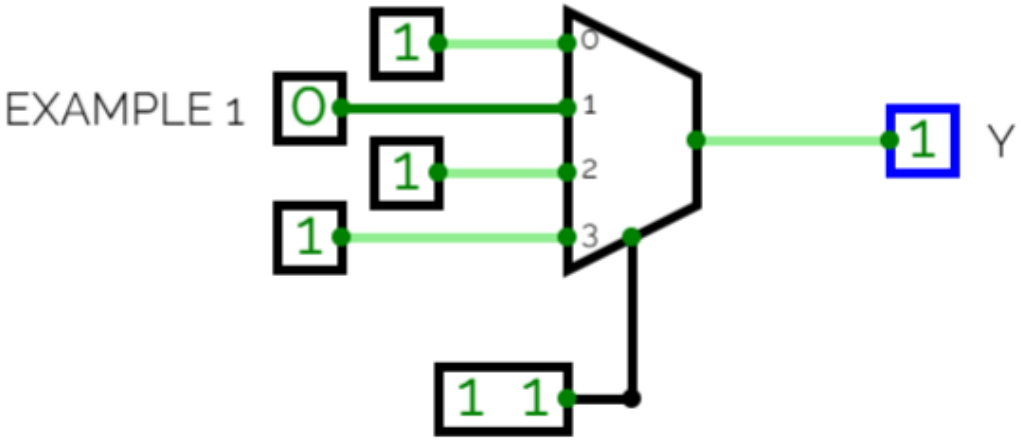
Example 1: Show how a 4 : 1 multiplexer can be used to perform the logic function.

$$\mathbf{f(A,B) = \sum m\ (0,2,3)}$$

Inputs		Output
A	B	Q
0	0	1
0	1	0
1	0	1
1	1	1

Solution:

CircuitVerse Simulation:

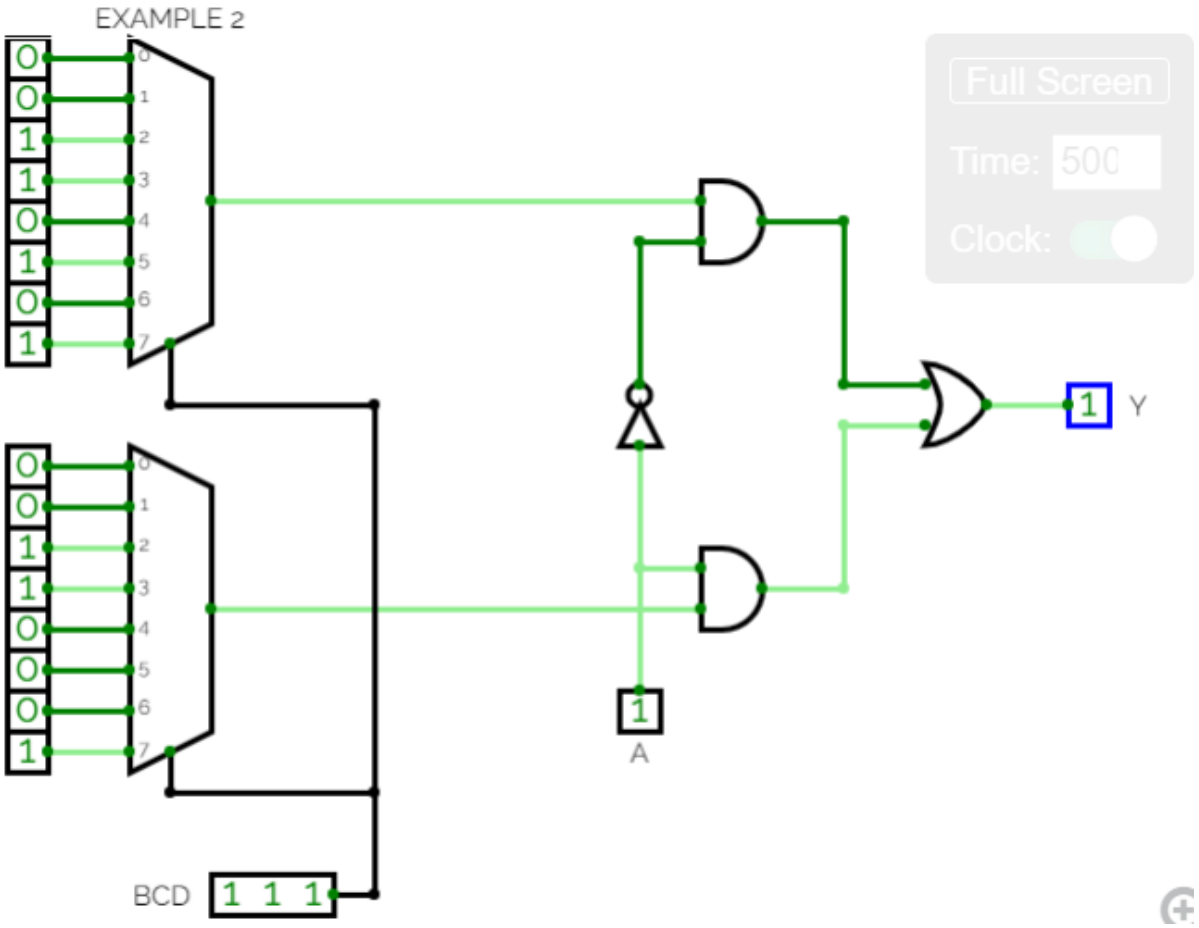


Example 2 : Show how 8 : 1 multiplexer can be used to perform the logic function.(Simulate on circuitverse)

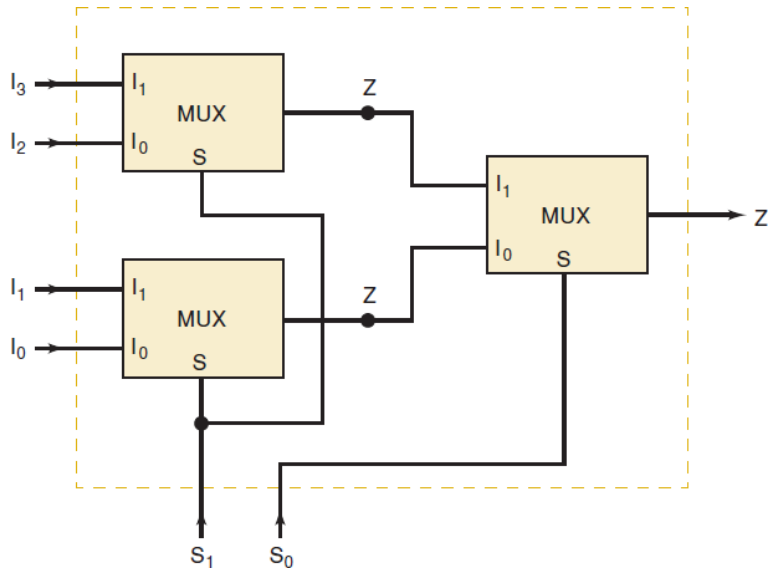
F (A,B,C,D) = ∑m (2,3,5,7,10,11,15)

Inputs				Output
A	**B**	**C**	**D**	**Q**
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

CircuitVerse Simulation:


EXAMPLE 2
Full Screen
Time: 500
Clock:
0
0
1
1
0
1
0
1
0 1 2 3 4 5 6 7
0
0
1
1
0
0
0
1
0 1 2 3 4 5 6 7
1
A
1
Y
BCD
1 1 1

Post lab Question :
a) The circuit in following Figure uses three two-input multiplexers . Determine the function performed by this circuit.



Ans: : $S_1'S_0'I_0 + S_1'S_0I_2 + S_1'S_0'I_1 + S_1S_0I_3$

- The function that the above figure demonstrates is that we can use a three 2-to-1 multiplexers to construct a 4-input multiplexer. It serves as a substitute to the 4-input multiplexer.

- A 4x1multiplexer has four data inputs I_3, I_2, I_1 & I_0, two selection lines s_1 & s_0 and one output.

Procedure:

a) Design logic circuits for given examples.
b) Simulate the circuit for example 2 and verify the outputs.
c) Upload the write-up with the solved design problems given in write-up.

Observations and Results: Solve the examples as given in write-up/given during Lab session and simulate as per instructions in Lab session

---

Outcomes: Design the combinational and sequential circuits using basic building blocks

---

Conclusion:
From the above experiment we can conclude that we successfully designed and verified the implementation of the circuit by using a multiplexer.

Grade: AA / AB / BB / BC / CC / CD /DD

Signature of faculty in-charge with date

References:
Books/ Journals/ Websites:

1. R. P. Jain, “Modern Digital Electronics”, Tata McGraw Hill.
2. http://www.scribd.com/doc/78927750/16-1-Mux-Using-8-1-Mux-4-1mux-And-2-1-Mux#scribd
3. http://he-coep.virtual-labs.ac.in