Summary

Binary Digits and Logic Levels

Digital electronics uses circuits that have two states, which are represented by two different voltage levels called HIGH and LOW. The voltages represent numbers in the binary system.

In binary, a single number is called a *bit* (for *b*inary dig*it*). A bit can have the value of either a 0 or a 1, depending on if the voltage is HIGH or LOW.

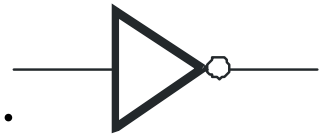
Summary

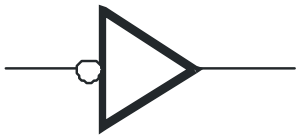
Basic Logic Functions

AND True only if ***all*** input conditions are true.

OR True only if ***one or more*** input conditions are true.

NOT Indicates the ***opposite*** condition.





Summary

Basic System Functions

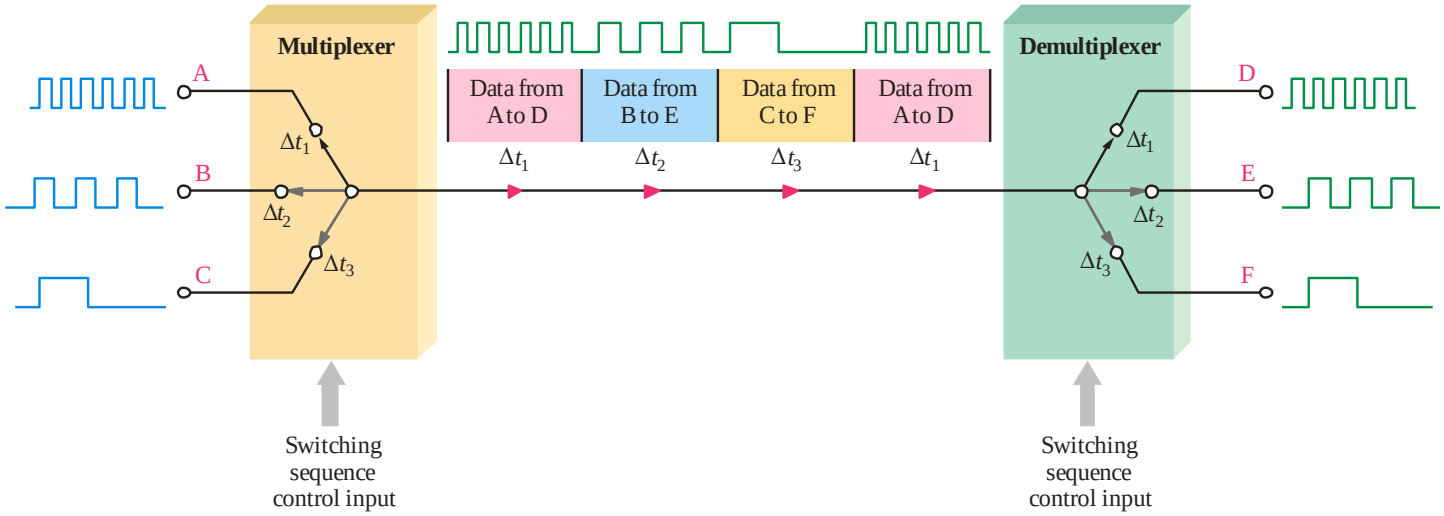
And, **or**, and **not** elements can be combined to form various logic functions.

Examples is:

Summary

Basic System Functions

The data selection function



Summary

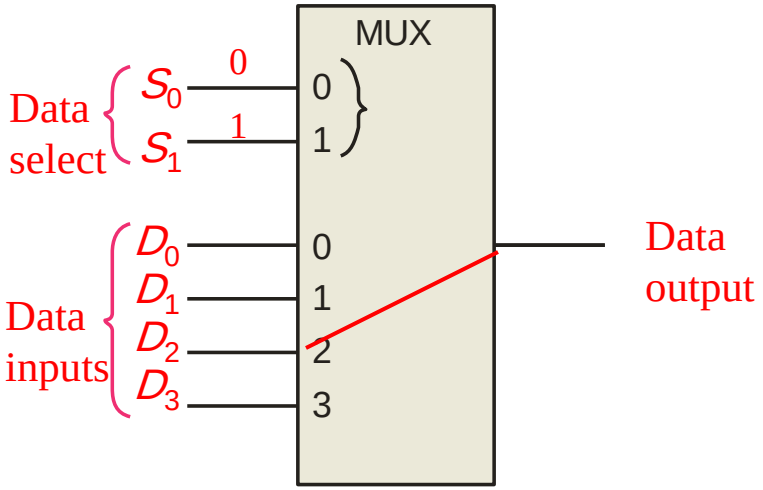
Multiplexers

A multiplexer (MUX) selects one data line from two or more input lines and routes data from the selected line to the output. The particular data line that is selected is determined by the select inputs.

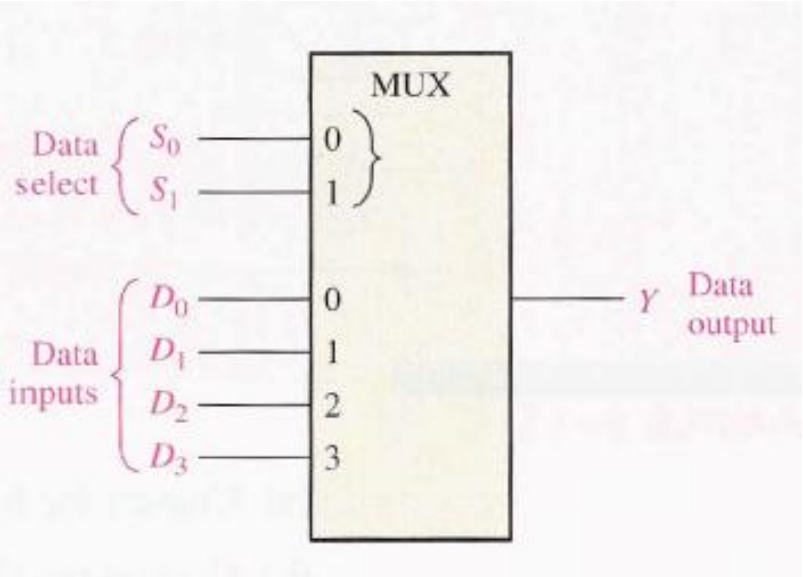
Two select lines are shown here to choose any of the four data inputs.

Question

Which data line is selected if $S_1S_0 = 10$? D_2



4 x 1 Multiplexer



DATA-SELECT INPUTS S_1	S_0	INPUT SELECTED
0	0	D_0
0	1	D_1
1	0	D_2
1	1	D_3

4 x 1 Multiplexer Equation

The data output is equal to D_0 only if $S_1 = 0$ and $S_0 = 0$: $Y = D_0\overline{S}_1\overline{S}_0$.

The data output is equal to D_1 only if $S_1 = 0$ and $S_0 = 1$: $Y = D_1\overline{S}_1 S_0$.

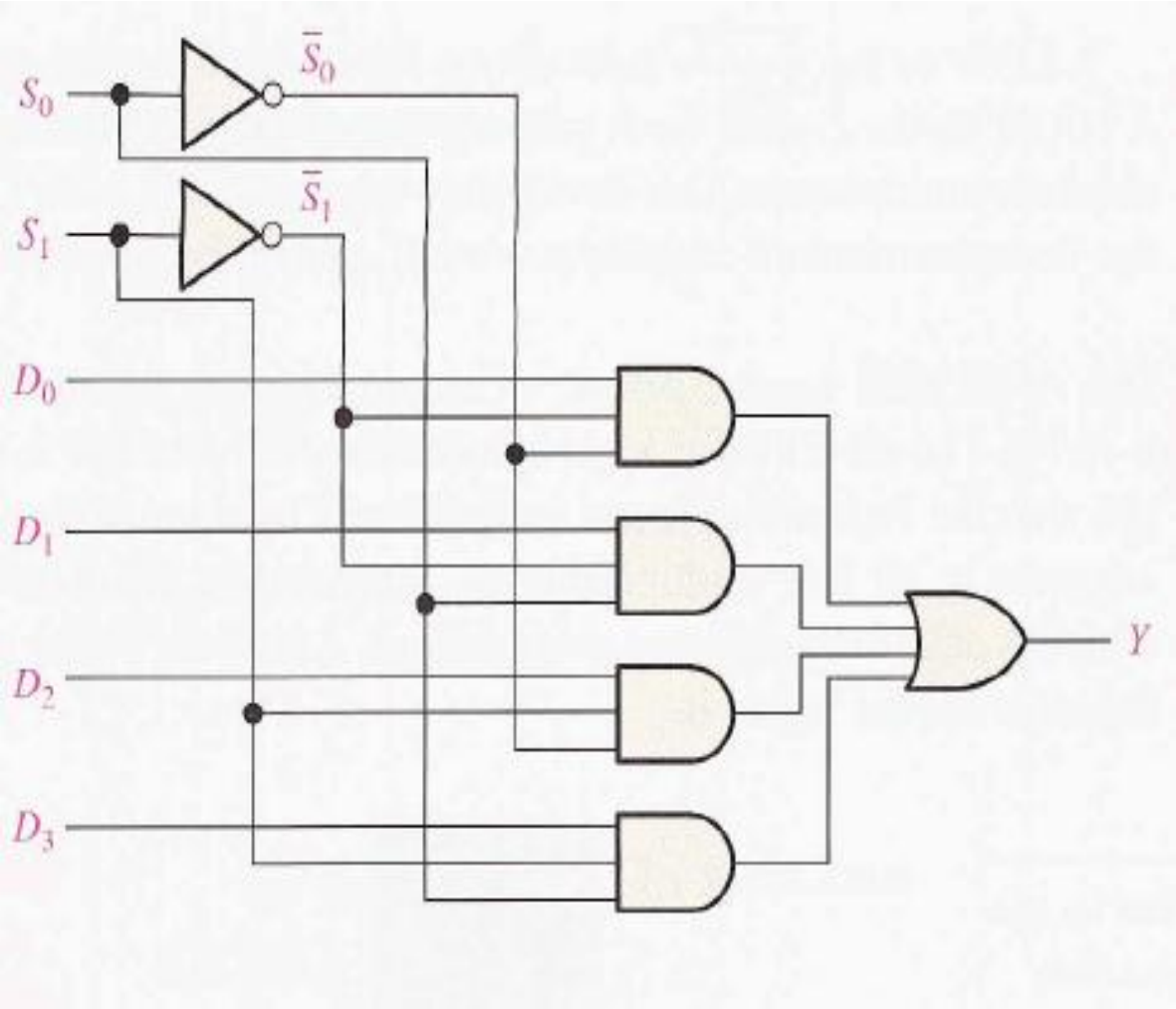
The data output is equal to D_2 only if $S_1 = 1$ and $S_0 = 0$: $Y = D_2 S_1\overline{S}_0$.

The data output is equal to D_3 only if $S_1 = 1$ and $S_0 = 1$: $Y = D_3 S_1 S_0$.

When these terms are ORed, the total expression for the data output is

$$Y = D_0\overline{S}_1\overline{S}_0 + D_1\overline{S}_1 S_0 + D_2 S_1\overline{S}_0 + D_3 S_1 S_0$$

4 x 1 Multiplexer Circuit Diagram



4 x 1 Multiplexer Timing Diagram