Digital Logic Design :

Lecture 1

Text Books

1) Digital Fundamentals by Thomas L. Floyd
2) Digital Logic and Computer Design by M. Morris Mano

- There are two digits in binary system, 1 and 0. are called bits.
- In digital circuits, two different voltage levels are used to represent the two bits.

A '1' is represented by the higher voltage level, referred to as a HIGH.

A '0' is represented by the lower voltage level, referred to as a LOW.

Basic Logic Operation :

NOT operation : The NOT operation changes one logic level to the opposite logic level.

- The NOT operation is implemented by a logic circuit known as an inverter.

Fig. : NOT operation

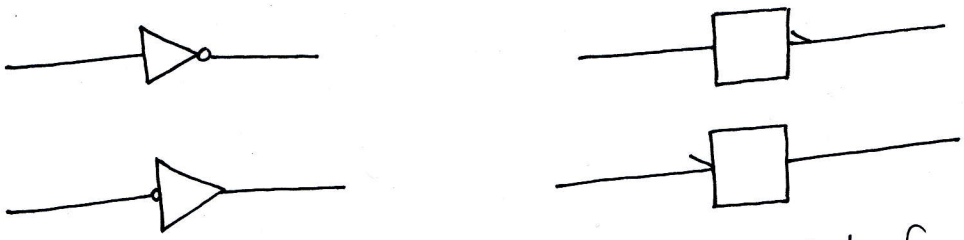


Fig. : Standard logic symbol for inverter

Inverter Truth Table :

Input	Output
LOW (0)	HIGH (1)
HIGH (1)	LOW (0)

- If input is A and output is X then,

$X = \overline{A}$ or A'

AND operation :

The AND operation produces a HIGH if and only if all the inputs are HIGH.

An AND gate can have two or more inputs and performs AND operation or logical multiplication.

Fig. : Logic symbol for AND gate (two input)

Truth table for a two-input AND gate :

Inputs		Outputs
A	B	X
0	0	0
0	1	0
1	0	0
1	1	1

Logic expression for the AND Gate : If one input variable is A, the other input variable is B, and the output variable is X, then the Boolean expression is,

$$X = AB$$

OR operation : The OR operation produces a HIGH output when any of the inputs is HIGH.

- An OR gate has two or more inputs and one output and performs OR operation or Logical addition.

Fig. : Logic symbol for OR gate (two-input)

Truth table for a two-input OR gate :

Inputs		Outputs
A	B	X
0	0	0
0	1	1
1	0	1
1	1	1

- Logic Expression for the OR Gate :

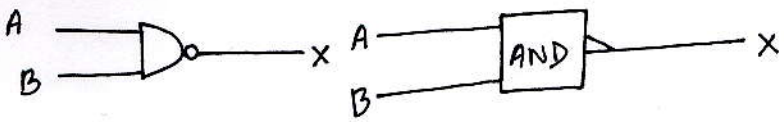
$X = A + B$ for two-input OR gate

$X = A + B + C$ for three-input OR gate

NAND gate :

The NAND gate performs AND function with inverted output.

Logic symbol for NAND Gate



Truth table for a two-input NAND gate :

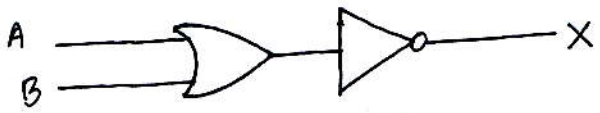
Inputs		Outputs
A	B	X
0	0	1
0	1	1
1	0	1
1	1	0

Logic Expressions for the NAND gate :

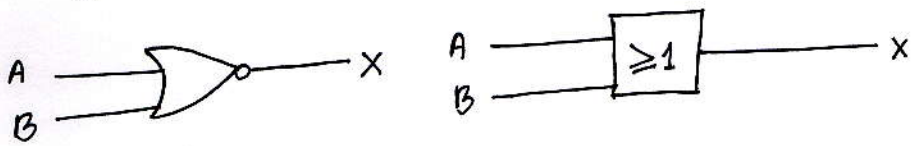
The Boolean expression for the output of a two-input NAND gate is,

$$X = \overline{AB}$$

NOR gate : The NOR gate performs OR operation with an inverted output.



Logic symbol for NOR gate



Truth table for two-input NOR gate :

Inputs		Outputs
A	B	X
0	0	1
0	1	0
1	0	0
1	1	0

Logic Expression for NOR gate :

The Boolen expression for the output of a two-input NOR gate is,

$$X = \overline{A+B} \quad \text{or} \quad (A+B)'$$