Convert the following hexadecimal number into decimal number system

1. $(269)_{16}=2\times16^2+6\times16^1+9\times16^0$

$= 2\times256+96+9$

$= (617)_{10}$

2. $(2B8D.E2)16=2\times16^3+11\times16^2+8\times16^1+13\times16^0 +14\times16^{-1}+2\times16^{-2}$

$= 8192+2816+128+13+0.875+0.0078125$

$= (11149.88281)_{10}$

Manipal INSPIRED BY LIFE

Conversion from Octal number system into Binary number system:

When an octal number is to be converted to its equivalent binary number, each of its digits is replaced by equivalent group of three binary digits.

$(7423.245)_8$

7	4	2	3	.	2	4	5
111	100	010	011	.	010	100	101

$(7423.245)_8 = (111100010011.010100101)_2$

- **Conversion from Binary number system to Octal number system:**

To convert, Starting from the binary point, the binary digits are arranged in groups of three on both sides. Each in group of binary digit is replaced by its octal equivalent.

Note: 0's can be added on either side, if needed to complete a group of three.

$(11101101110.11111)_2$

011	101	101	110	.	111	110
3	5	5	6	.	7	6

$(11101101110.11111)_2 = (3556.76)_8$

Conversion from Hexadecimal number system to Binary number system

When a hexadecimal number is to be converted its equivalent binary number, each of its digits is replaced by equivalent group of 4 binary digits.

$(347.28)_{16}$

3	4	7	.	2	8
0011	0100	0111	.	0010	1000

$(347.28)_{16} = (001101000111.00101000)_2$

Property 2: $A + \bar{A}B = A + B$

A	B	$\bar{A}$	$\bar{A}B$	$A+\bar{A}B$		$A+B$
0	0	1	0	0		0
0	1	1	1	1	=	1
1	0	0	0	1		1
1	1	0	0	1		1

Duality: The important property to Boolean algebra is called Duality principle. The Dual of any expression can be obtained easily by the following rules.

1. Change all 0's to 1's
2. Change all 1's to 0's
3. .'s (dot's) are replaced by +'s (plus)
4. +'s (plus) are replaced by .'s (dot's)

Examples:

$\bar{0} = 1 \equiv \bar{1} = 0$

$X + 0 = X \equiv X \,.\, 1 = X$

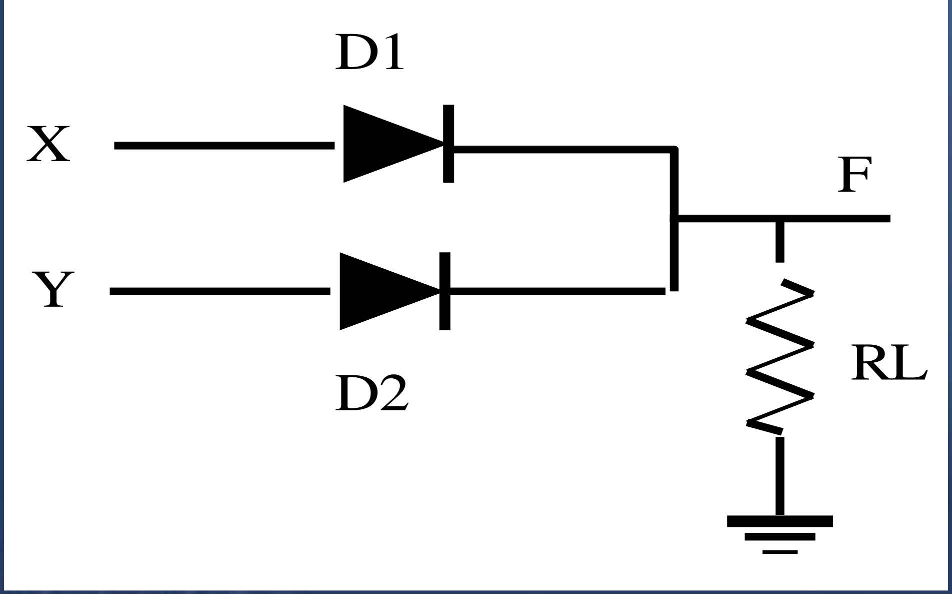
$X + Y = Y + X \equiv X.Y = Y.X$

$X + 1 = 0 \equiv X.0 = 1$

Logic Gates

- It is an electronic circuit which makes logic decisions. A logic gate is a digital circuit with one or more input signal and only one output signal. All input or output signals either low voltage or high voltage. A digital circuit is referred to as logic gate for simple reason i.e. it can be analyzed on the basis of Boolean algebra.
- To make logical decisions, three gates are used. They are OR, AND and NOT gate. These logic gates are building blocks which are available in the form of IC.
- The input and output of the binary variables for each gate can be represented in a tabular column or truth table.

- **Realization of OR gate using diodes:**
- Two input OR gate using "diode-resistor" logic is shown in figure below. Where X, Y are the inputs and F is the output.

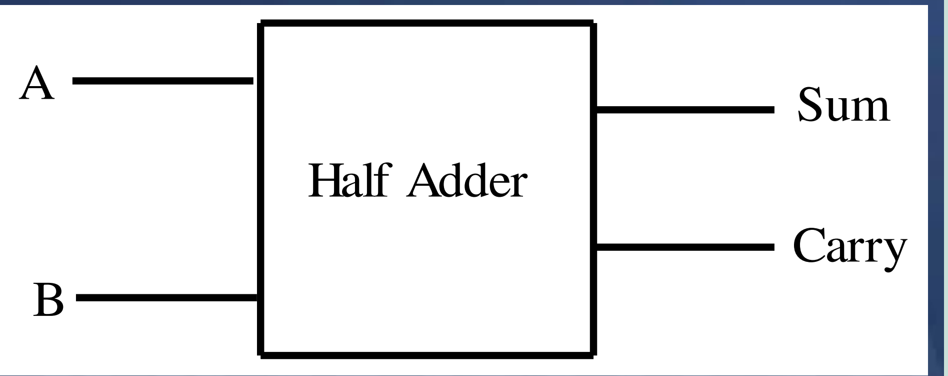


4.NAND Gate: The output of a NAND gate is LOW only when all inputs are HIGH and output of the NAND is HIGH if one or more inputs are LOW.

Truth Table:

Input		Output
A	B	$Y = \overline{AB}$
0	0	1
0	1	1
1	0	1
1	1	0

Half Adder: A combinational circuit which performs the arithmetic addition of two binary digits is called Half Adder. In the half adder circuit, there are two inputs, one is addend and augend and two outputs are Sum and Carry.

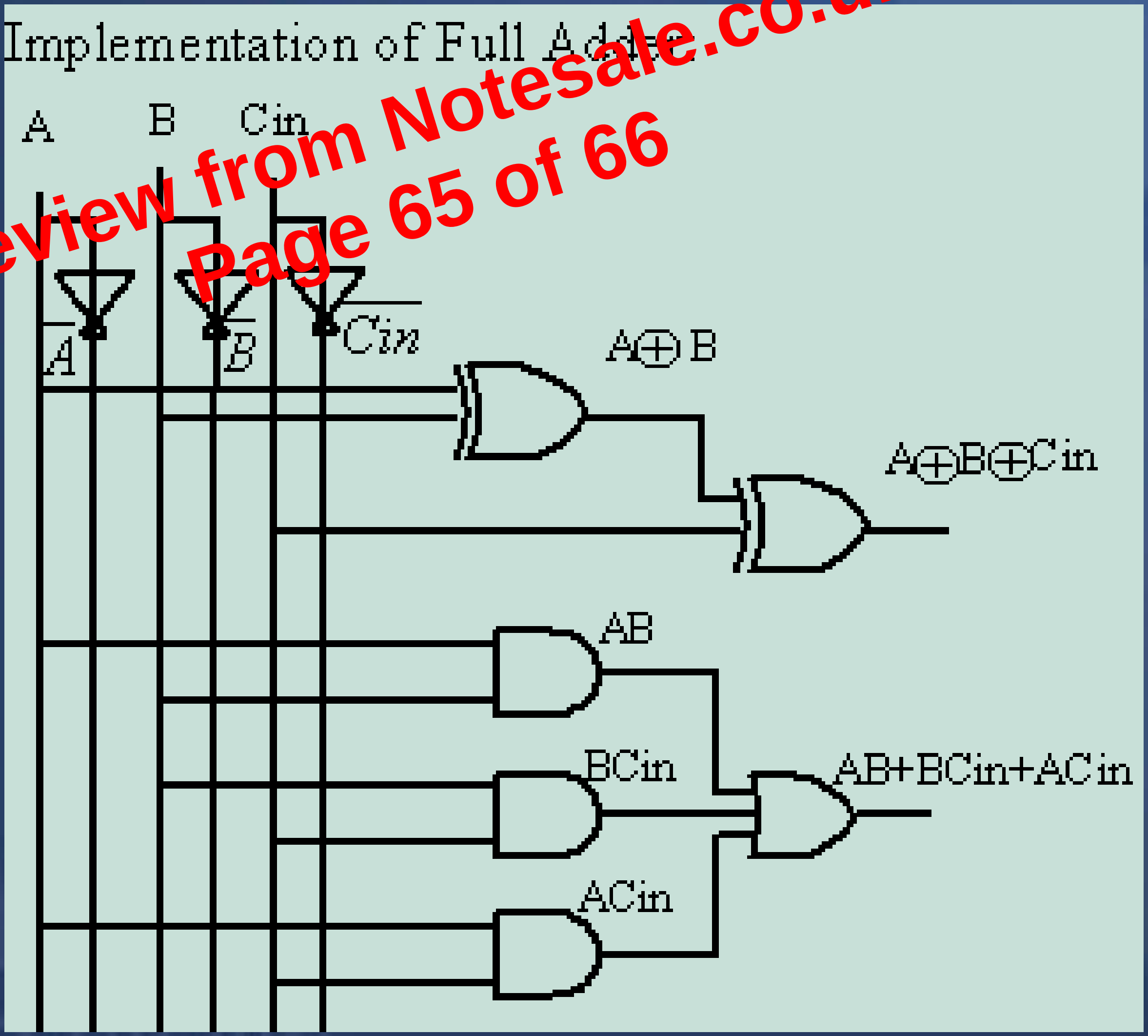


Truth Table for Half Adder

Input		Output	
A	B	Sum	Carry
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

$$Sum = \bar{A}B + A\bar{B} = A \oplus B$$

$$Carry = A.B$$


Implementation of Full Adder
A
B
Cin
A
B
Cin
A⊕B
A⊕B⊕Cin
AB
BCin
AB+BCin+ACin
ACin