ASSIGNMENT-07

Name : Mosroor Mofiz Arman

ID : 1921079642

Course : CSE231

Section : 10.

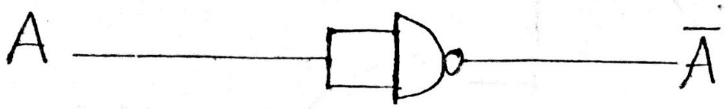
Submitted to : Dr. Mohammad Monirujjaman Khan

Date : 05-04-2021.

The universal property of NAND and NOR gates.

Truth table for 2 input NAND gate.

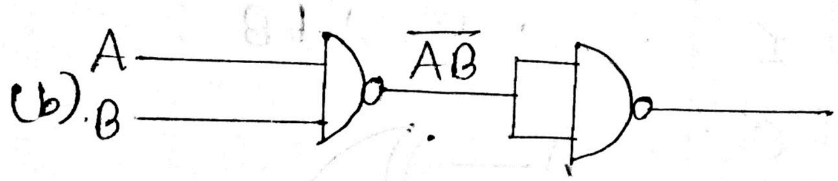
(a)



A	B	X
0	0	1
0	1	1
1	0	1
1	1	0

fig: A NAND gate used as an inverter.

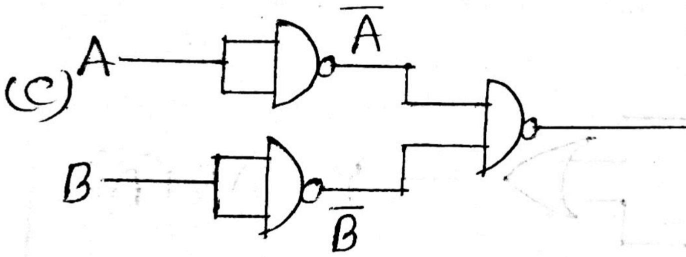
(b)



$\overline{\overline{AB}} = AB.$

fig: Two NAND gates used as an AND gate.

(c)



$\overline{\overline{A}\,\overline{B}} = \overline{\overline{A}} + \overline{\overline{B}} = A + B$

fig: Three NAND gates used as an OR gate.

(d)

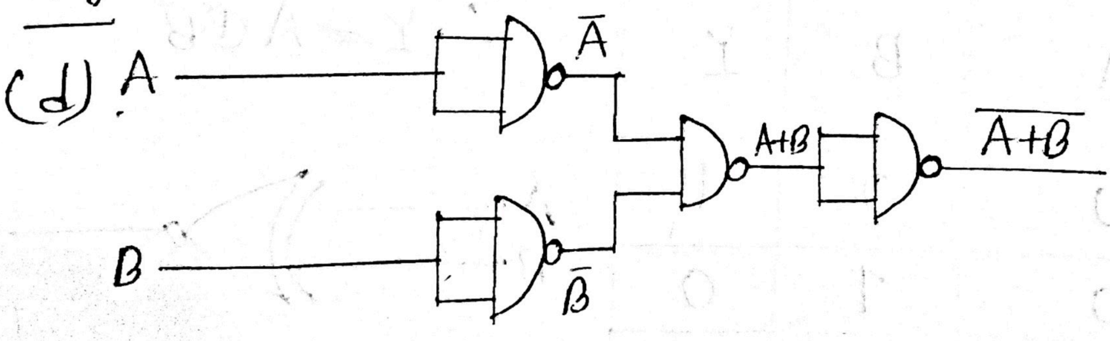


fig: Four NAND gates used as NOR gate.

The NOR Gate as a universal logic element.

Truth table for 2 input NOR Gate.

A	B	X
0	0	1
0	1	0
1	0	0
1	1	0

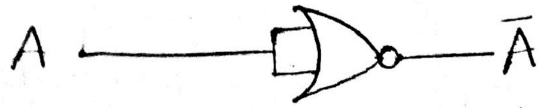


Fig: a NOR gate used as an inverter.

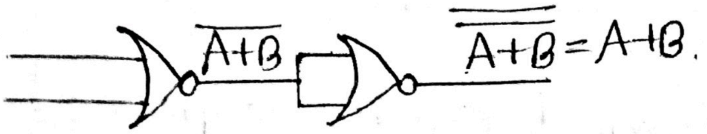
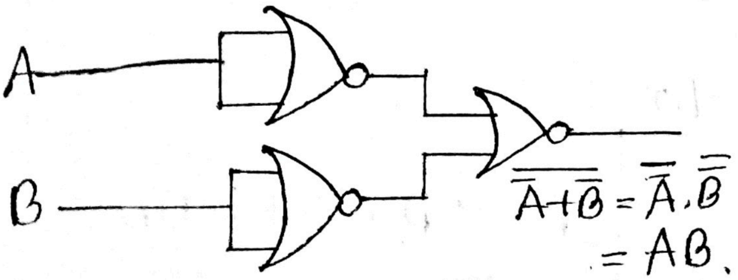


Fig: Two NOR gates used as an OR gate.



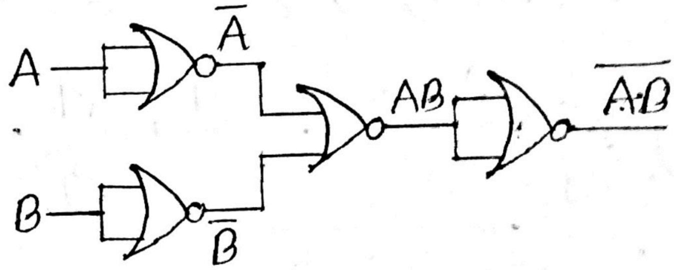


Fig: Three NOR gates used as an AND gate.

Fig: Four NOR gates used as a NAND gate

Simplify the Boolean Function in :

(a) Sum of products and

(b) Product of sum form.

$F(A,B,C,D) = \Sigma(0,1,2,5,8,9,10)$

(a)

AB \ CD	00	01	11	10
00	[0] 1	[1] 1	[3]	[2] 1
01	[4]	[5] 1	[7]	[6]
11	[12]	[13]	[15]	[14]
10	[8] 1	[9] 1	[11]	[10] 1

$F = \overline{B}\,\overline{C} + \overline{B}\,\overline{D} + \overline{A}\,\overline{C}\,\overline{D}$

In product of maxterms, F can be expressed as

$F(A, B, C, D) = \Pi(3, 4, 6, 7, 11, 12, 13, 14, 15)$

(b).

AB \ CD	00	01	11	10
00			0	
01	0		0	0
11	0	0	0	0
10			0	

$\overline{F} = CD + AB + B\overline{D}$

$F = \overline{CD + AB + B\overline{D}}$

$= (\overline{CD}).(\overline{AB}).(\overline{B\overline{D}})$

$= (\overline{C} + \overline{D})(\overline{A} + \overline{B})(\overline{B} + D)$

Combinational Logic using NAND and NOR gates:

NAND gate:

using De Morgan's rule :

$$\overline{AB} = \underbrace{\bar{A}+\bar{B}}_{\text{Negative OR}}$$

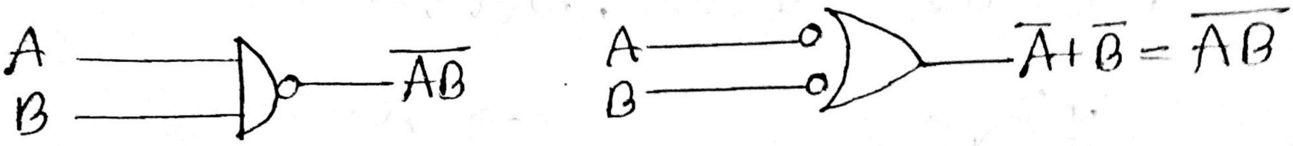
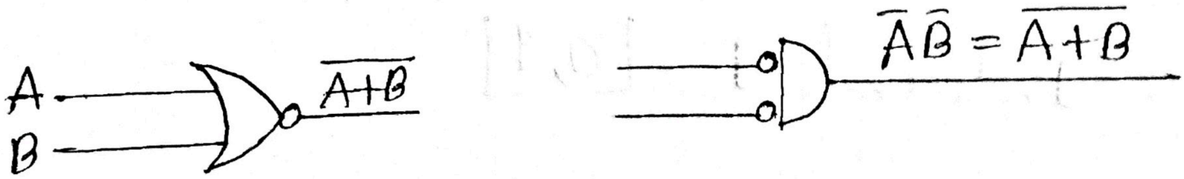


Fig : Two graphic symbols for NAND gate.

$$\overline{A+B} + \bar{A}\bar{B}$$

Negative AND.



OR- invert.

Fig : Two graphic symbols for NOR gate.

Assignment : 07 (Questions)

(1) $A + \overline{B}C$

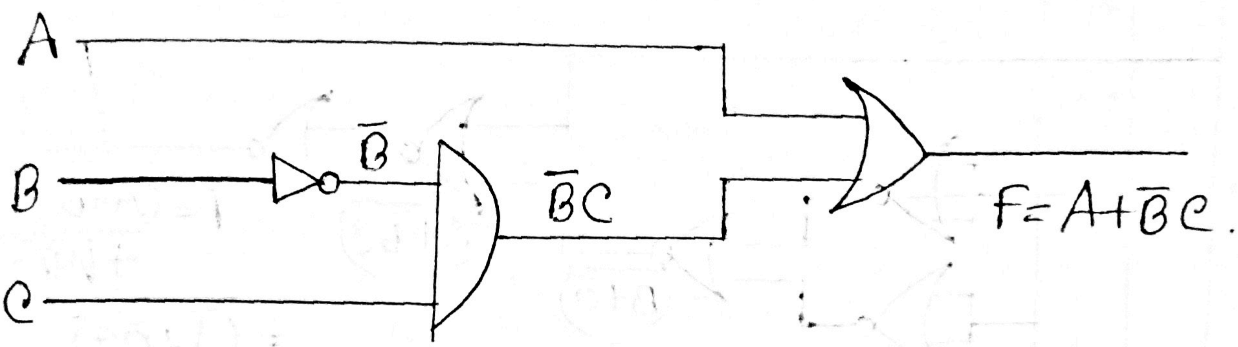
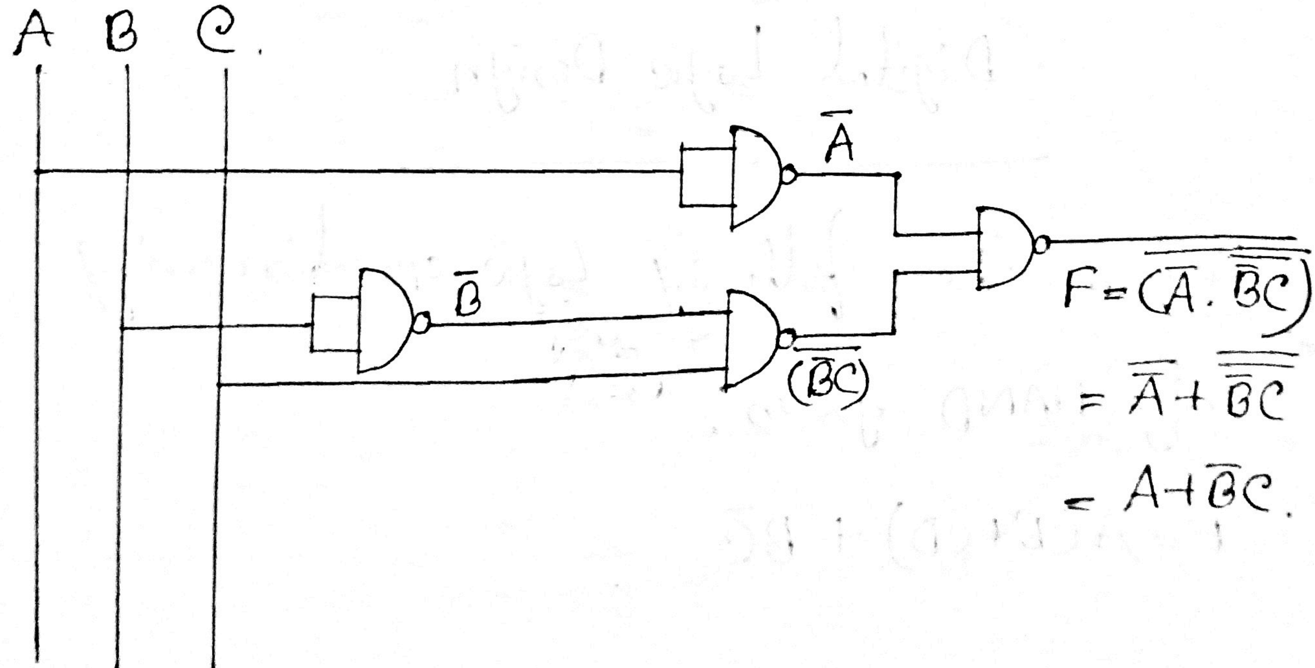


Fig : Normal Logic circuit.

(2) $A + \overline{B}C$



$F = \overline{(\overline{A} \cdot \overline{\overline{B}C})}$

$= \overline{\overline{A}} + \overline{\overline{\overline{B}C}}$

$= A + \overline{B}C$.

Fig : Logic circuit using NAND gate (universal gate).

(3) $A+\overline{B}C$.

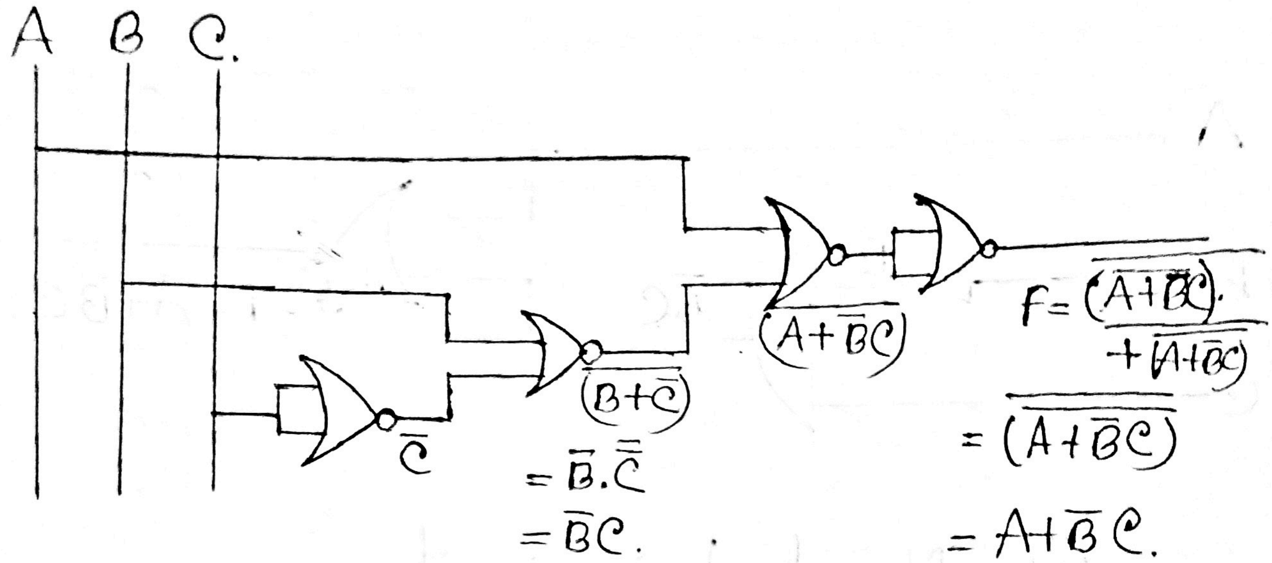


Fig: Logic circuit using NOR gate (universal gate)

Digital Logic Design

Perform the following Logic operation using only NAND gates:

$F=A(B+CD)+B\overline{C}$

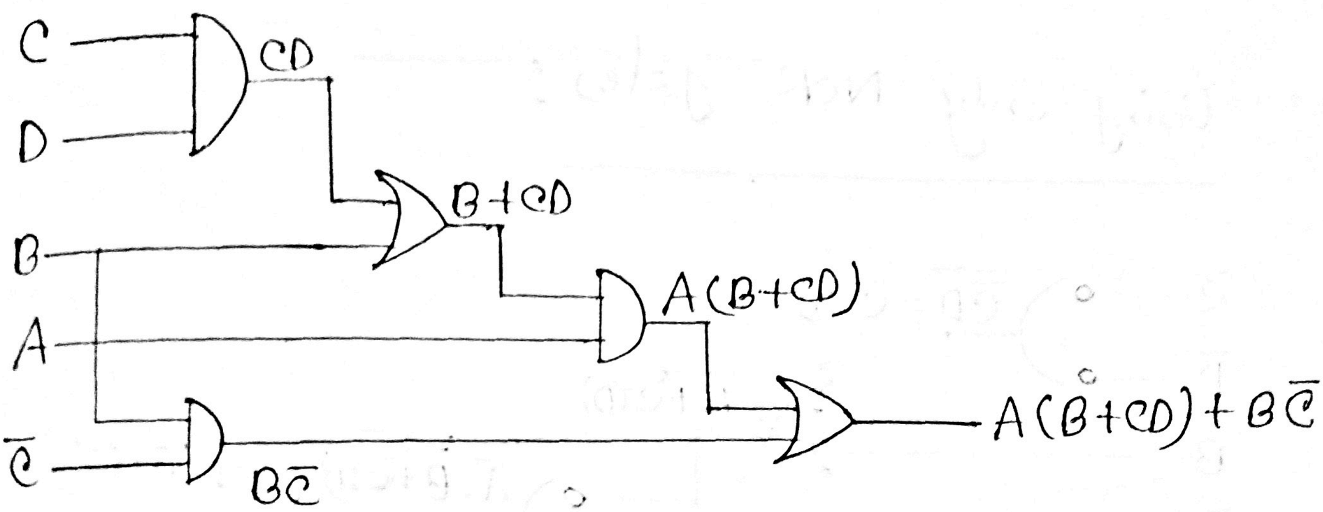
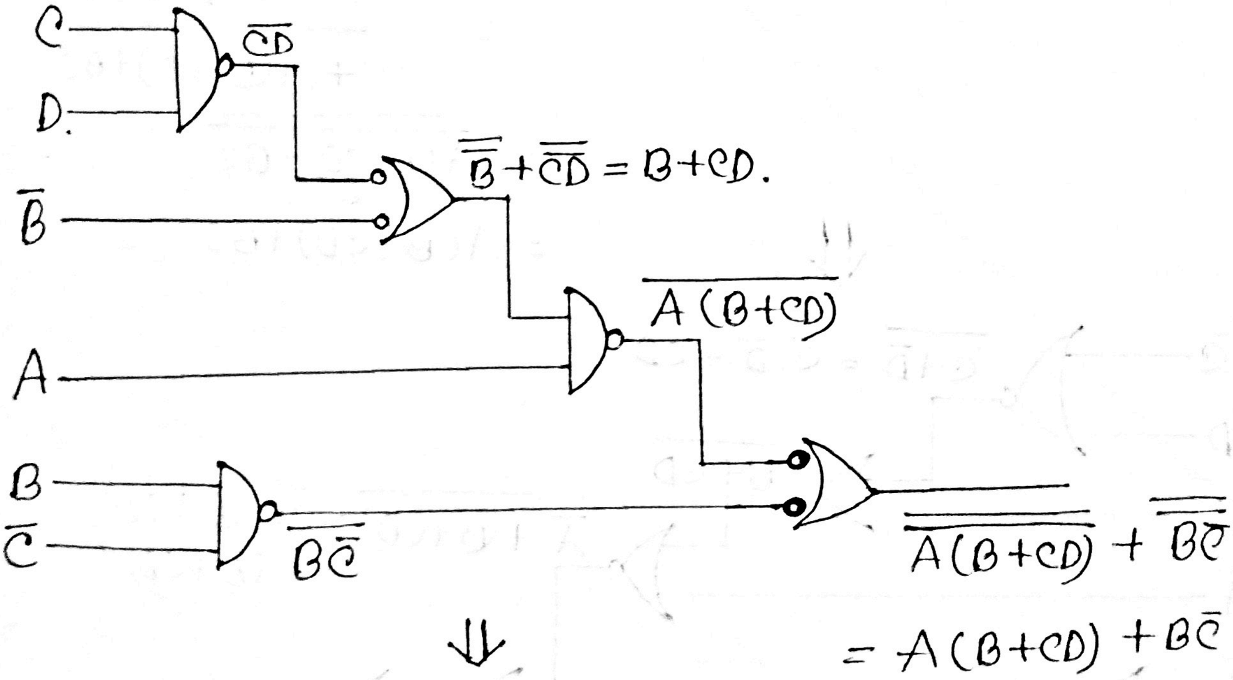


Fig: AND/OR implementation.



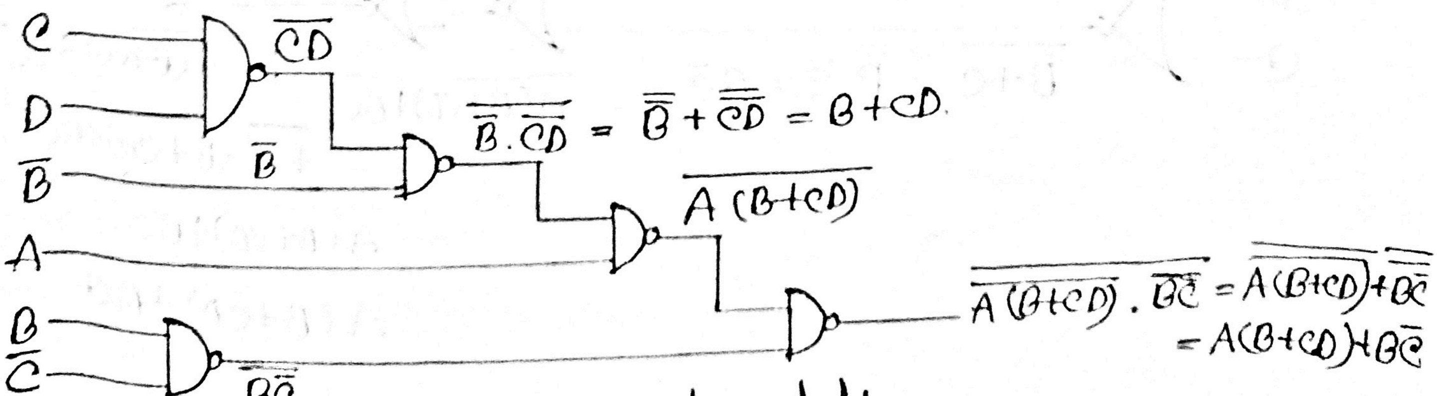
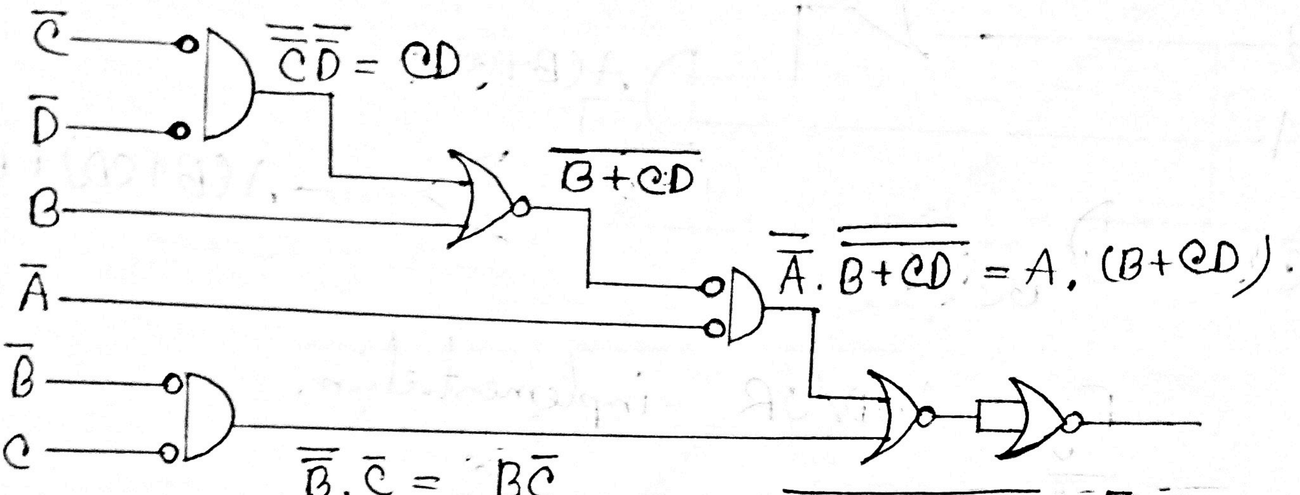


Fig: NAND implementation.

Using only NOR gates:

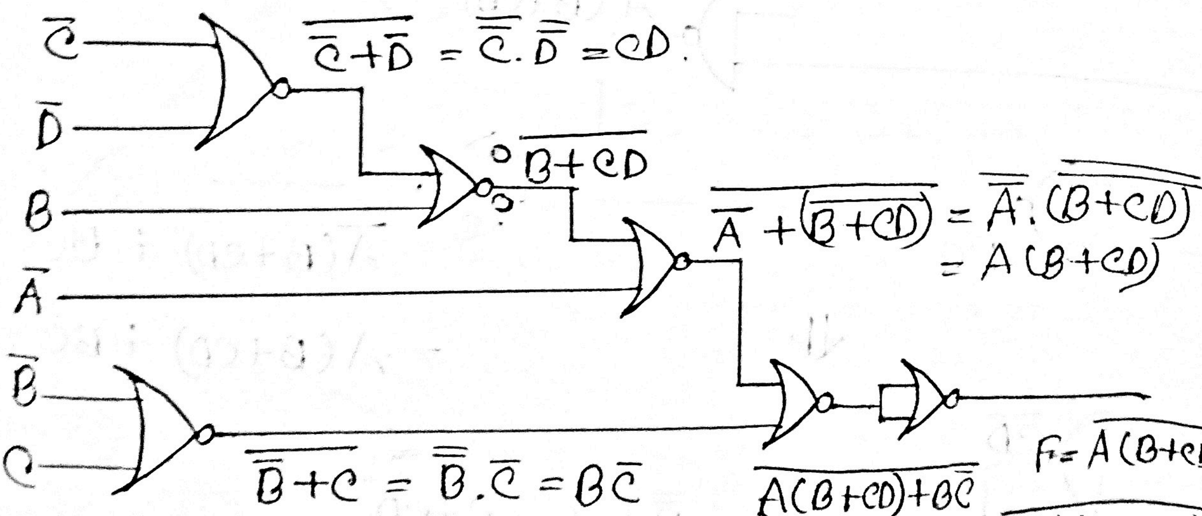


$F = \overline{\overline{A(B+CD)+B\bar{C}} + \overline{A(B+CD)+B\bar{C}}}$

$= \overline{\overline{A(B+CD)+B\bar{C}}}$

$= A(B+CD)+B\bar{C}$

$\Downarrow$

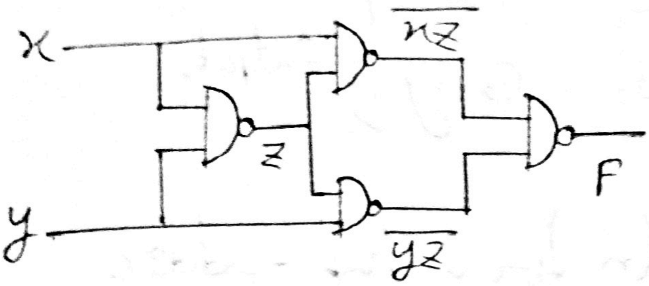


$F = \overline{\overline{A(B+CD)+B\bar{C}} + \overline{A(B+CD)+B\bar{C}}}$

$= \overline{\overline{A(B+CD)+B\bar{C}}}$

$= A(B+CD)+B\bar{C}$

Determine the truth table for the following :



x	y	$z=\overline{xy}$	$\overline{xz}$	$\overline{yz}$	F
0	0	1	1	1	0
0	1	1	1	0	1
1	0	1	0	1	1
1	1	0	1	1	0

$\therefore F = x \oplus y$

The Half Adder :

Basic rules for binary addition :

$0+0=0$

$0+1=1$

$1+0=1$

$1+1=10$.

These operations are performed by a logic circuit called a half-adder.

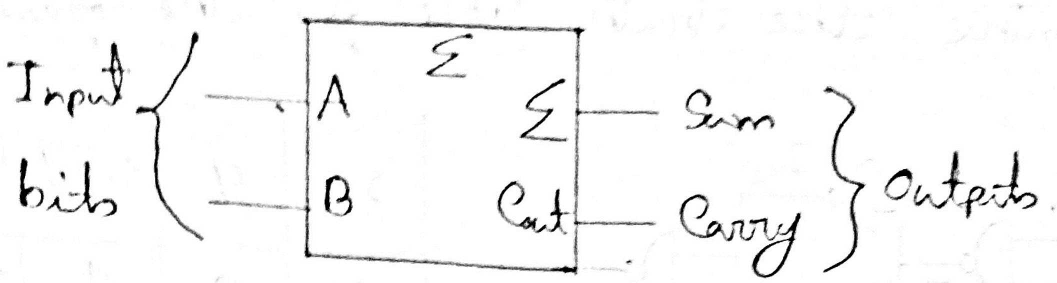


Fig: Block Diagram for a half-adder.

Half-adder truth table:

A	B	C_{out}	Σ
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

The sum bit can be expressed as

$$\Sigma = A \oplus B.$$

The carry bit can be expressed as

$$C_{out} = AB$$

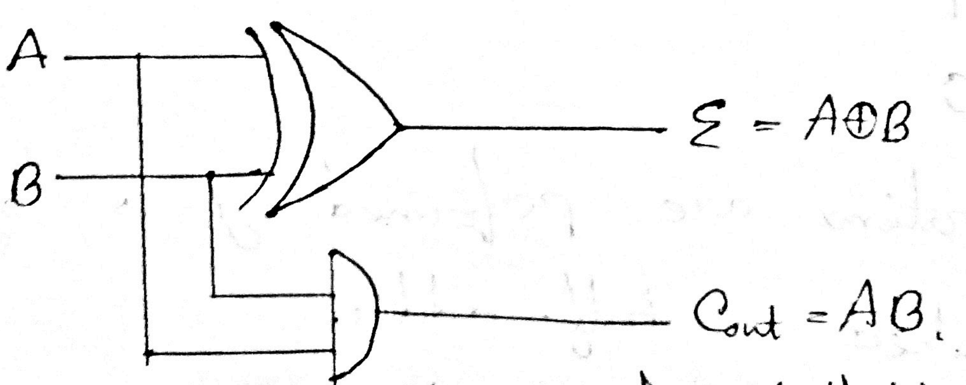


Fig: Logic Diagram for a halfadder.

The Full Adder :

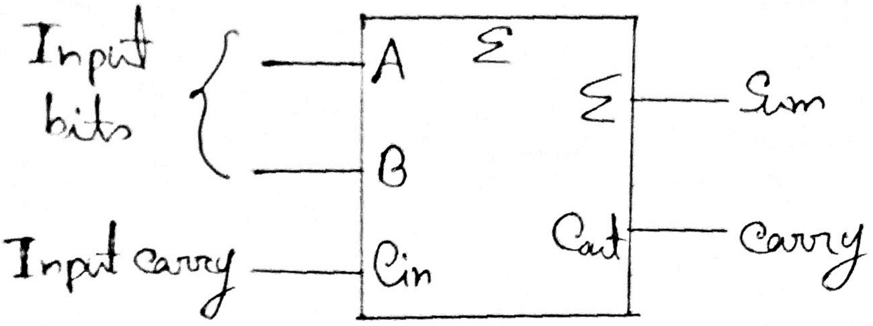


Fig : Block Diagram for a full-adder.

Full-adder truth table :

A	B	Cin	Cout	Σ
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

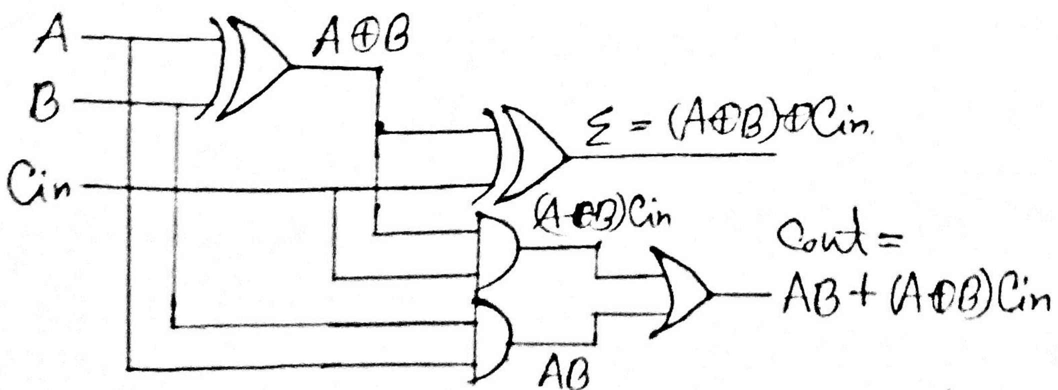


Fig : Complete logic circuit for a full adder.