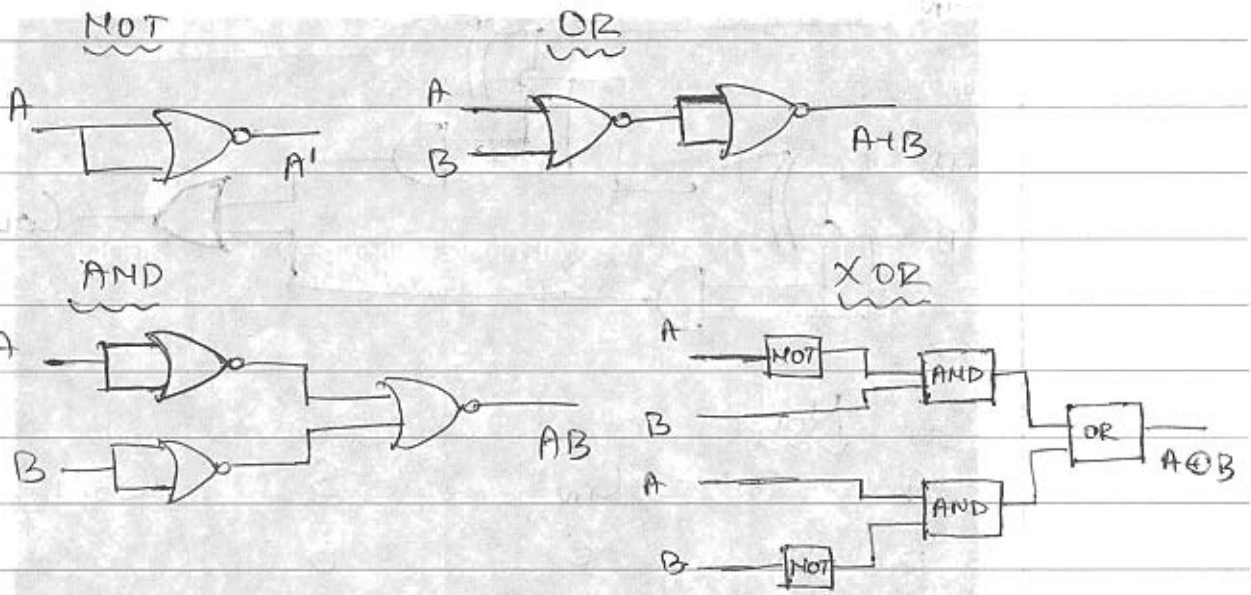
HOMEWORK 2 - DUE DATE OCT 10

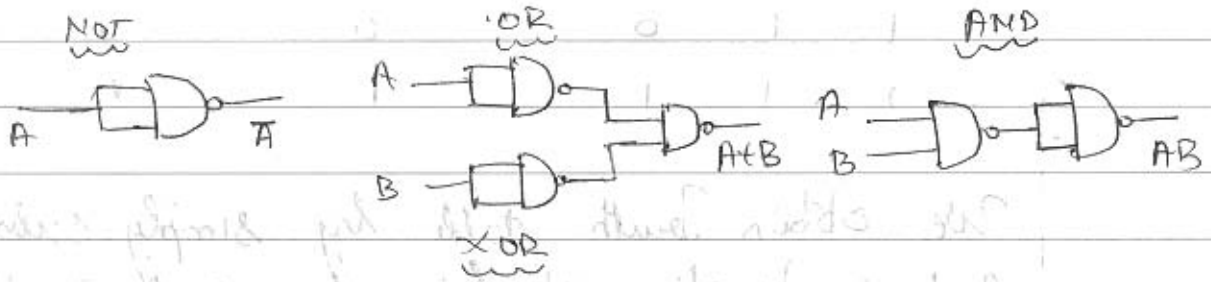
SOLUTIONS

2.13) (I) NOR Gate:



XOR Gate is not UNIVERSAL GATE since it cannot be used to implement all basic gates like NOT, AND, OR

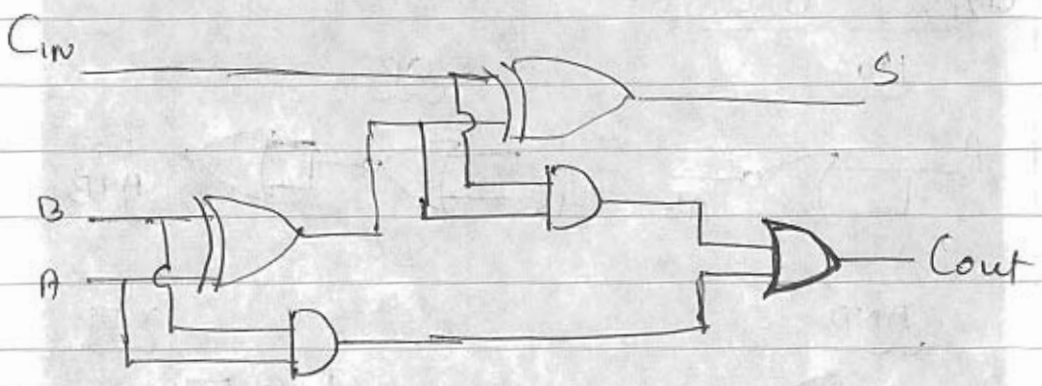
(II) NAND Gate:



Can be constructed with above blocks as done for NOR Gate

2.14)

Convert the block diagram in book interms of gate. Let the 3rd i/p be named as C_{IN}.



Now

A	B	Cin	S	Cout
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

We obtain Truth table by simply substituting each combination of bit value and walking through circuit to find o/p.

Thus it is same as a FULL ADDER

2.15) No.

In two level implementation we get a Max. delay of 3 units to get SUM o/p.

whereas in cascaded HALF adder implementation we get

2 unit delay to get SUM o/p

[NOTE: Assuming 1 unit delay for each gate]

2.17) (c) $f = Y'Z + X'YZ + XYZ$

$= Y'Z + YZ(X+X')$

$= Y'Z + YZ \quad [\because X+X'=1]$

$= Z(Y+Y')$

$= Z \quad [Y+Y'=1]$

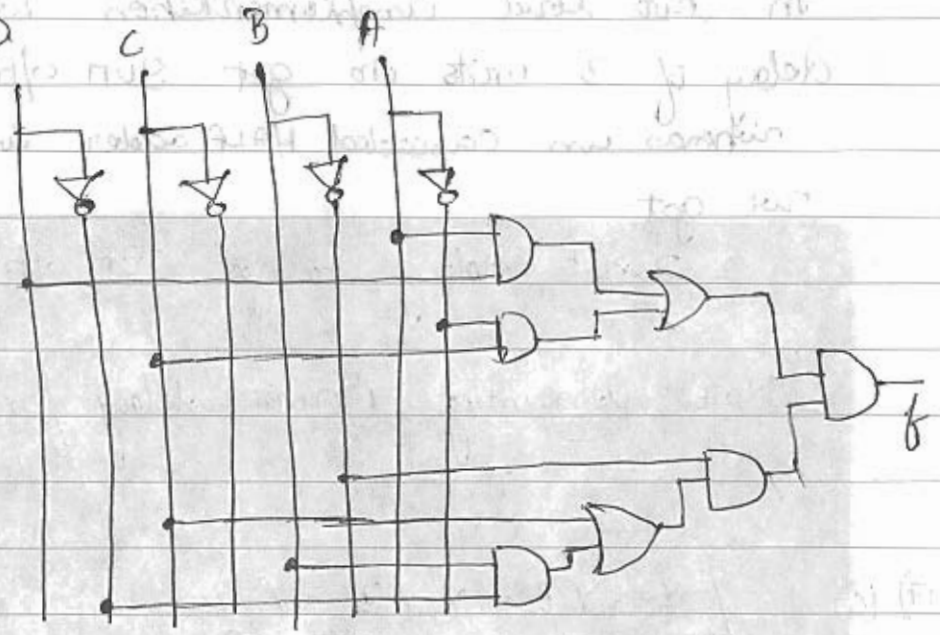
(e) $f = X + XYZ + X'YZ + X'Y + WX + WX'$

$= X + YZ(X+X') + X'Y + W(X+X') \quad [X+X'=1]$

$f = X + YZ + X'Y + W.$

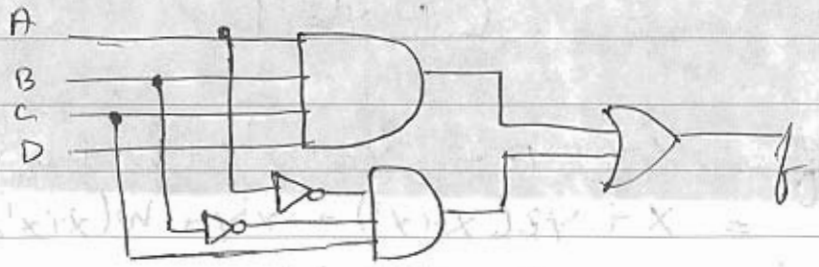
2.18) $f = (AD + A'C)[B'(C + BD')]$

(a)



(b) $f = (AD + A'C)B'C$

$f = AB'CD + A'B'C$



2.19) (a) $F = A'B'C'D' + A'B'C'D + A'B'CD' + A'BCD + AB'C'D' + AB'C'D + AB'CD' + ABCD$

(b) $F = \Sigma m(0, 1, 2, 7, 8, 9, 10, 15)$

$= \Pi M(3, 4, 5, 6, 11, 12, 13, 14)$

$= (A+B+C'+D')(A+B'+C+D)(A+B'+C+D')(A+B'+C'+D)$
$(A'+B+C'+D')(A'+B'+C+D)(A'+B'+C+D')$

(c) $\bar{F}$ = Take complement of F in MAX Terms to get $\bar{F}$ as MIN terms and apply DeMORGAN's LAW

$\bar{F} = A'B'CD + A'BC'D' + A'BC'D + A'BCD' + AB'CD + ABC'D' + ABC'D + ABCD'$

$\bar{F} = \Sigma m(3,4,5,6,11,12,13,14)$

(d) $\bar{F}$ = Take complement of F in MIN term to get $\bar{F}$ as MAX Term and use DEMORGAN's LAW.

$\bar{F} = (A+B+C+D)(A+B+C+D')(A+B+C'+D)(A+B'+C'+D')$
$(A'+B+C+D)(A'+B+C+D')(A'+B+C'+D)(A'+B'+C'+D')$

2.21)

$f = AB + B'C' + AC'$

(a) $= AB(C+C') + B'C'(A+A') + AC'(B+B')$

$\therefore f = ABC + ABC' + AB'C' + A'B'C'$

$f = \Sigma m(0,4,6,7)$

(b) $\bar{F} = (A'+B'+C')(A'+B'+C)(A'+B+C)(A+B+C)$

$= \Pi M(0,4,6,7)$

2.22) $F = A'BC + AD + AC$

(a) $F = A'BC(D+D') + AD(B+B') + AC(B+B')$

$= A'BCD + A'BCD' + ADB + ADB' + ACB + ACB'$

$= A'BCD + A'BCD' + ADB(C+C') + ADB'(C+C') + ACB(D+D') + AB'C(D+D')$

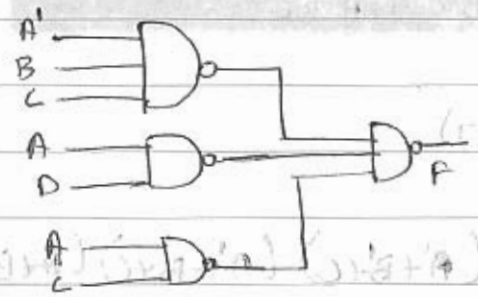
$F = ABCD + A'BCD' + ABC'D + AB'CD + AB'C'D + ABCD' + AB'CD'$

$F = \Sigma m(6, 9, 10, 11, 13, 14, 15)$

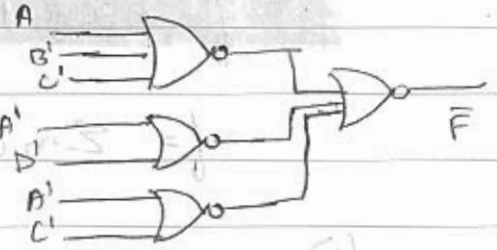
(b) $F' = [A'BC + AD + AC]'$

$F' = (A+B'+C')(A'+D')(A'+C')$

F as NAND

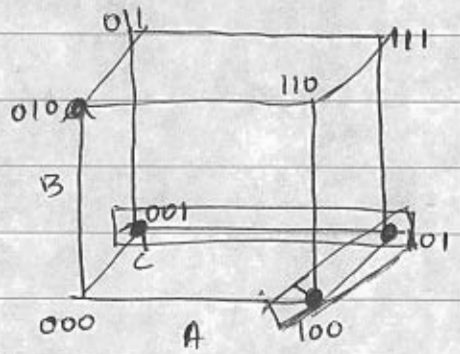


$\bar{F}$ as NOR



Boolean Cube

$f = \Sigma m\,(1,2,4,5)$



$f = AB' + B'C + A'BC'$