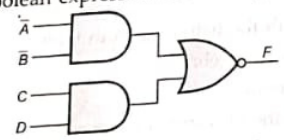
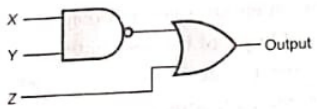
TYPE-B:BOOLEAN LOGIC:CH-3

QUESTIONS:

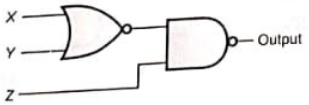
TYPE B : APPLICATION BASED QUESTIONS

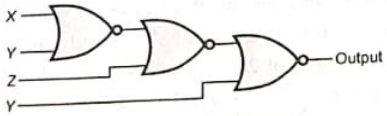
1. In the Boolean Algebra, verify using truth table that $X + XY = X$ for each X, Y in {0, 1}.
2. In the Boolean Algebra, verify using truth table that $(X + Y)' = X'Y'$ for each X, Y in {0, 1}.
3. Give truth table for the Boolean Expression $(X + Y')Y$.
4. Draw the truth table for the following equations : (*a*) $M = N(P + R)$ (*b*) $M = N + P + N\overline{P}$
5. Using truth table, prove that : $AB + BC + C\overline{A} = AB + C\overline{A}$.
6. State the principle of duality in boolean algebra and give the dual of the boolean expression : $(X + Y).(\overline{X} + \overline{Z}).(Y + Z)$
7. Prove the idempotence law of boolean algebra with the help of a truth table.
8. Use the duality theorem to derive another boolean relation from : $A + \overline{A}B = A + B$
9. What would be the complement of the following : (*a*) $\overline{A}(B\overline{C} + \overline{B}C)$ (*b*) $xy + \bar{y}z + \bar{z}z$?
10. Find the complement of the following Boolean function : $F_1 = AB' + C'D'$
11. Find the complement of Boolean expression $(A + \overline{B} + C)(A + \overline{B}C)$.
12. Find the complement of Boolean expression $\overline{A}D + \overline{C}D + \overline{A}B$.
13. Find the complement of Boolean expression $B + \overline{A}C + \overline{B}A$.
14. Find the complement of Boolean expression : $X\overline{Y}Z + \overline{X}\overline{Y}Z$.
15. Find the dual of Boolean expression $(A + \overline{B} + C)(A + \overline{B}C)$.
16. Find the dual of Boolean expression $\overline{A}D + \overline{C}D + \overline{A}B$.
17. Find the dual of Boolean expression $B + \overline{A}C + \overline{B}A$.
18. Find the dual of Boolean expression : $X\overline{Y}Z + \overline{X}\overline{Y}Z$.
19. Design a logic circuit to realize the Boolean function $f(x, y) = x \cdot y + x' \cdot y'$
20. Draw the logic circuit for this boolean equation : $y = \overline{A}\,\overline{B}\,\overline{C}D + A\overline{B}\overline{C}D + AB\overline{C}D + ABC\overline{D}$
21. Draw the AND-OR circuit for : $y = A\overline{B}\,\overline{C}\,\overline{D} + AB\overline{C}\,\overline{D} + ABCD$
22. Given the Boolean function $\overline{A}D + \overline{C}D + A\overline{B}$
    (*i*) Obtain the truth table of the function. (*ii*) Draw the logic circuit diagram.
23. Given the Boolean function $F = \overline{w}xy + w\bar{x}y + wxy$
    (*i*) Obtain the truth table of the function. (*ii*) Draw the logic circuit diagram.
24. Given the Boolean function $(ZX + \overline{Y})(XY + \overline{Z})$
    (*i*) Obtain the truth table of the function. (*ii*) Draw the logic circuit diagram.
25. Given the Boolean function $(A + \overline{B} + \overline{C})(\overline{A}\,\overline{B} + B\overline{C})$
    (*i*) Obtain the truth table of the function. (*ii*) Draw the logic circuit diagram.
26. Derive a boolean expression for the output *F* at the network shown in the below left figure.





27. What function is implemented by the circuit shown in the above right figure ?
28. What function is implemented by the circuit shown in the below left figure ?





29. What function is implemented by the circuit shown in the above right figure ?
30. Draw the logic circuit diagram for expressions : (*a*) $(A' + BC)(B' + C'A)$ (*b*) $AB' + B'C' + ABC$

SOLUTIONS;

1)

X	Y	XY	X+XY
0	0	0	0
0	1	0	0
1	0	0	1
1	1	1	1

X=X+XY
HENCE PROVED

2)

X	Y	X’	Y’	X+Y	(X+Y)’	X’Y’
0	0	1	1	0	1	1
0	1	1	0	1	0	0
1	0	0	1	1	0	0
1	1	0	0	1	0	0

(X+Y)’=X’Y’ HENCE PROVED

3) (X+Y’)’

X	Y	Y’	X+Y’	(X+Y’)’
0	0	1	1	0
0	1	0	0	1
1	0	1	1	0
1	1	0	1	0

4) (A) N(P+R)

N	P	R	P+R	N(P+R)
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	1	0
1	0	0	0	0
1	0	1	1	1
1	1	0	1	1
1	1	1	1	1

4) (B) N+P+NP’

N	P	P’	N+P	NP’	N+P+NP’
0	0	1	0	0	0
0	1	0	1	0	1
1	0	1	1	1	1
1	1	0	1	0	1

5) AB+BC+CA'= AB+CA'

A	B	C	A'	AB	BC	CA'	AB+BC+CA'	AB+CA'
0	0	0	1	0	0	0	0	0
0	0	1	1	0	0	1	1	1
0	1	0	1	0	0	0	0	0
0	1	1	1	0	1	1	1	1
1	0	0	0	0	0	0	0	0
1	0	1	0	0	0	0	0	0
1	1	0	0	1	0	0	1	1
1	1	1	0	1	1	0	1	1

6) PRINCIPLE OF DUALITY STATES THAT EVERY BOOLEAN EXPRESSION HAS A DUAL EXPRESSION :
CAN BE DERIVED BY:

- CHANGING EACH (OR) SIGN TO (AND) SIGN
- CHANGING EACH (AND) SIGN TO (OR) SIGN
- REPLACING 1 BY 0 AND 0 BY 1

DUALITY OF (X+Y).(X'+Z').(Y+Z) = (X.Y)+(X'.Z')+(Y.Z)

7) A) X+X=X

X	X	R
0	0	0
1	1	1

0+0=0
1+1=1

B) X.X=X

X	X	R
0	0	0
1	1	1

0.0=0
1.1=1

8) by principle of duality
(A+A'B=A+B)=A.(A'+B)=A.B

9) (A) the complement of the given question is:
A+((B'+C).(B+C'))

(B) the complement of the given question is:
(X'+Y').(Y+Z').(Z+Z')

10) the complement of the given question is:
(A'+B).(C+D)

11) the complement of the given question is:
(A'.B.C')+(A'.(B+C'))

12) the complement of the given question is:
(A+D').(C+D').(A+B')

13) the complement of the given question is:
B'.(A+C').(B+A')

14) the complement of the given question is:
(X'+Y+Z').(X+Y+Z')

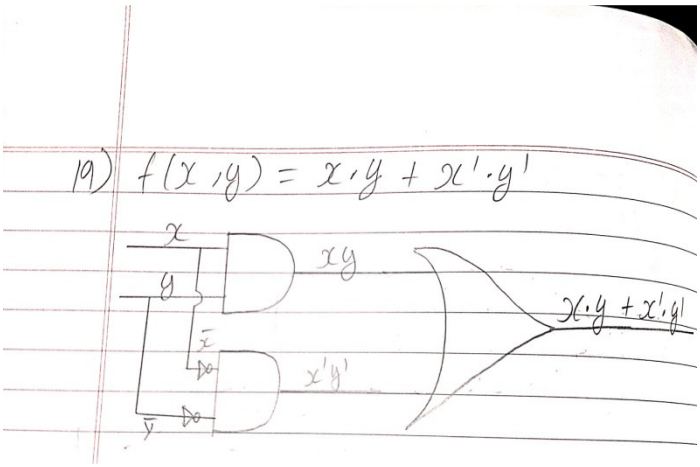
15) the dual of the given question is:
(A.B'.C)+(A.(B'+C))

16) the dual of the given question is:
(A'+D).(C+D).(A'+B)

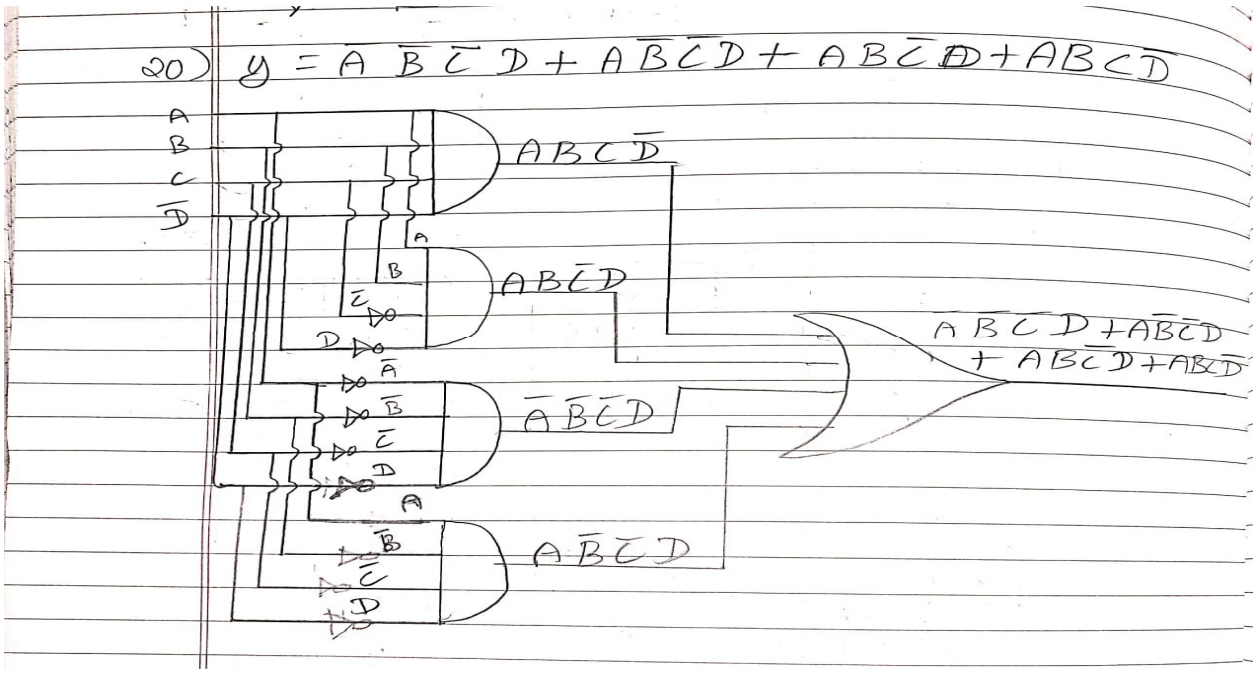
17) the dual of the given question is:
B.(A'+C).(B'+A)

18) the dual of the given question is:
(X+Y'+Z).(X'+Y'+Z)

19)



20)



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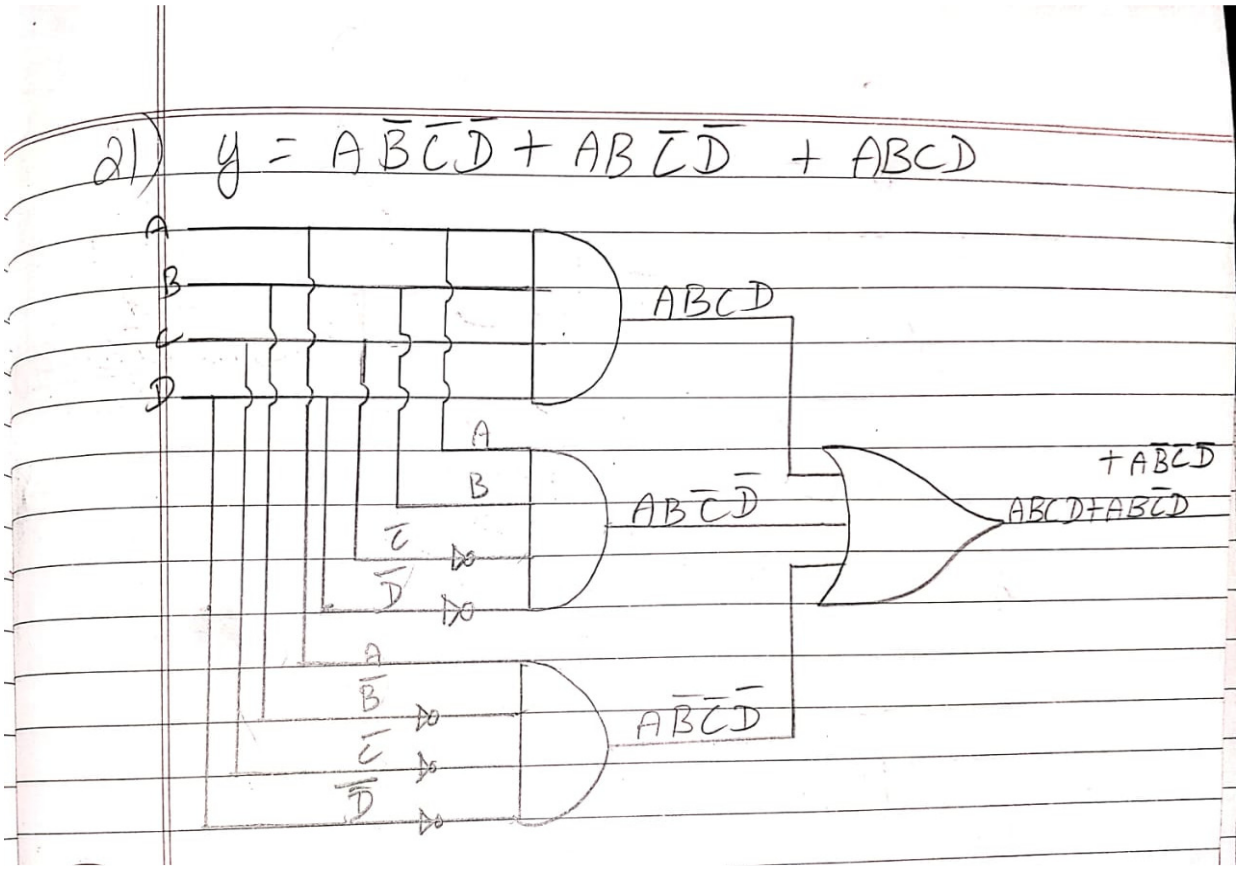
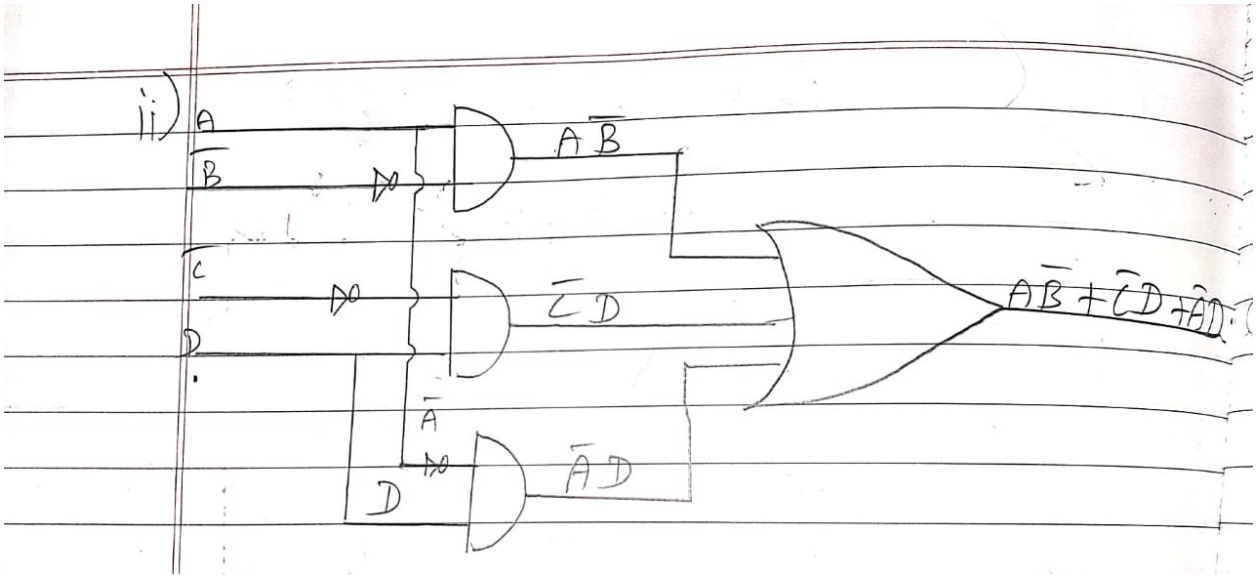


22) (A) (A'D+C'D+AB')

A	B	C	D	A'	B'	A'D	C'	C'D	AB'	A'D+C'D+AB'
0	0	0	0	1	1	0	1	0	0	0

0	0	0	1	1	1	1	1	1	0	1
0	0	1	0	1	1	0	0	0	0	0
0	0	1	1	1	1	1	0	0	0	1
0	1	0	0	1	0	0	1	0	0	0
0	1	0	1	1	0	1	1	1	0	1
0	1	1	0	1	0	0	0	0	0	0
0	1	1	1	1	0	1	0	0	0	1
1	0	0	0	0	1	0	1	0	1	1
1	0	0	1	0	1	0	1	1	1	1
1	0	1	0	0	1	0	0	0	1	1
1	0	1	1	0	1	0	0	0	1	1
1	1	0	0	0	0	0	1	0	0	0
1	1	0	1	0	0	0	1	1	0	1
1	1	1	0	0	0	0	0	0	0	0
1	1	1	1	0	0	0	0	0	0	0

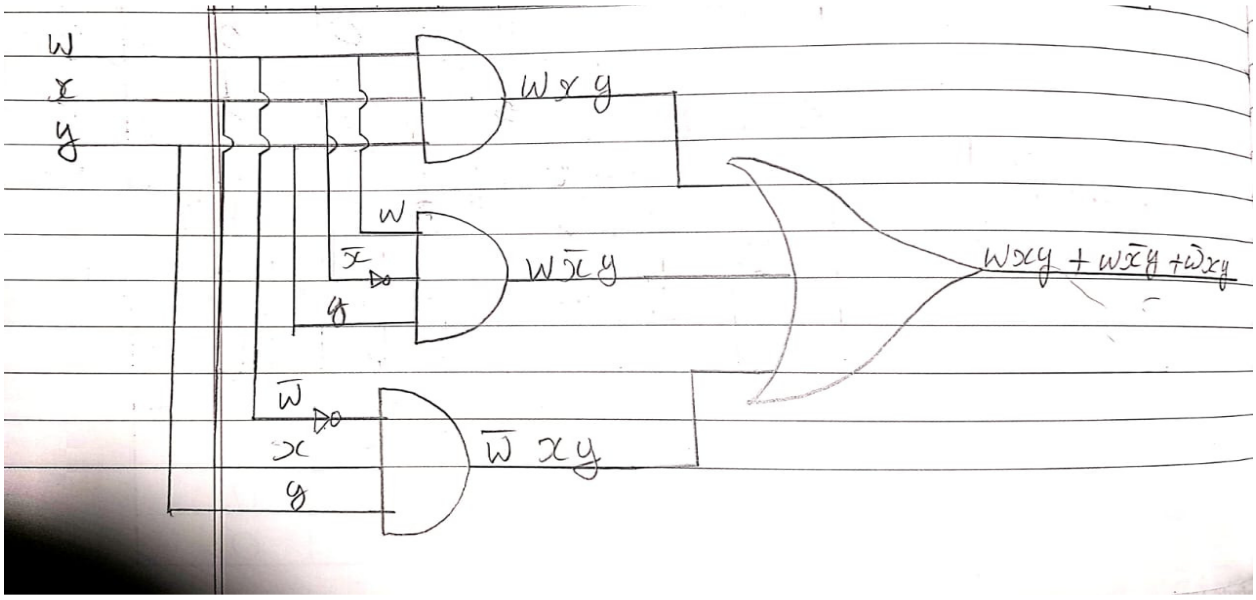
22) (B)



23) (A) (W'XY+WX'Y+WXY)

W	X	Y	W'	X'	W'XY	WX'Y	WXY	W'XY+WX'Y+WXY
0	0	0	1	1	0	0	0	0
0	0	1	1	1	0	0	0	0
0	1	0	1	0	0	0	0	0
0	1	1	1	0	1	0	0	1
1	0	0	0	1	0	0	0	0
1	0	1	0	1	0	1	0	1
1	1	0	0	0	0	0	0	0
1	1	1	0	0	0	0	1	1

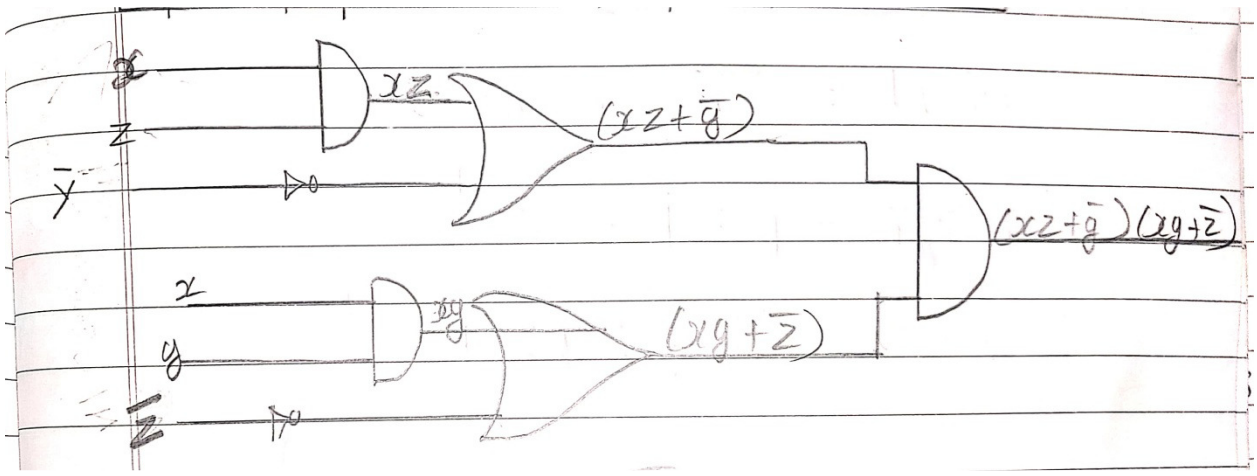
B)



24) (A) (ZX+Y')(XY+Z')

X	Y	Z	Y'	Z'	ZX	ZX+Y'	XY	XY+Z'	(ZX+Y')(XY+Z')
0	0	0	1	1	0	1	0	1	1
0	0	1	1	0	0	1	0	0	0
0	1	0	0	1	0	0	0	1	0
0	1	1	0	0	0	0	0	0	0
1	0	0	1	1	0	1	0	1	1
1	0	1	1	0	1	1	0	0	0
1	1	0	0	1	0	0	1	1	0
1	1	1	0	0	1	1	1	1	1

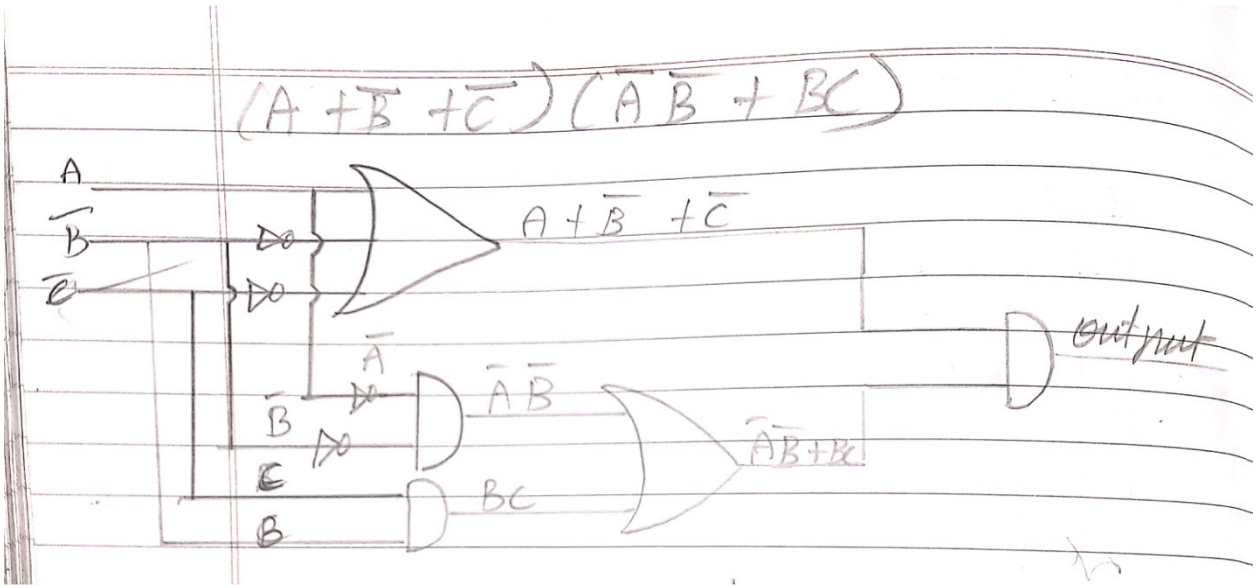
(B)



25) (A)

A	B	C	A’	B’	C’	A’B’	BC’	A’B’+BC’	A+B’+C’	(A’B’+BC’)*(A+B’+C’)
0	0	0	1	1	1	1	1	1	1	1
0	0	1	1	1	0	1	0	1	1	1
0	1	0	1	0	1	0	0	0	1	0
0	1	1	1	0	0	0	0	0	0	0
1	0	0	0	1	1	0	1	1	1	1
1	0	1	0	1	0	0	0	0	1	0
1	1	0	0	0	1	0	0	0	1	0
1	1	1	0	0	0	0	0	0	1	0

(B)



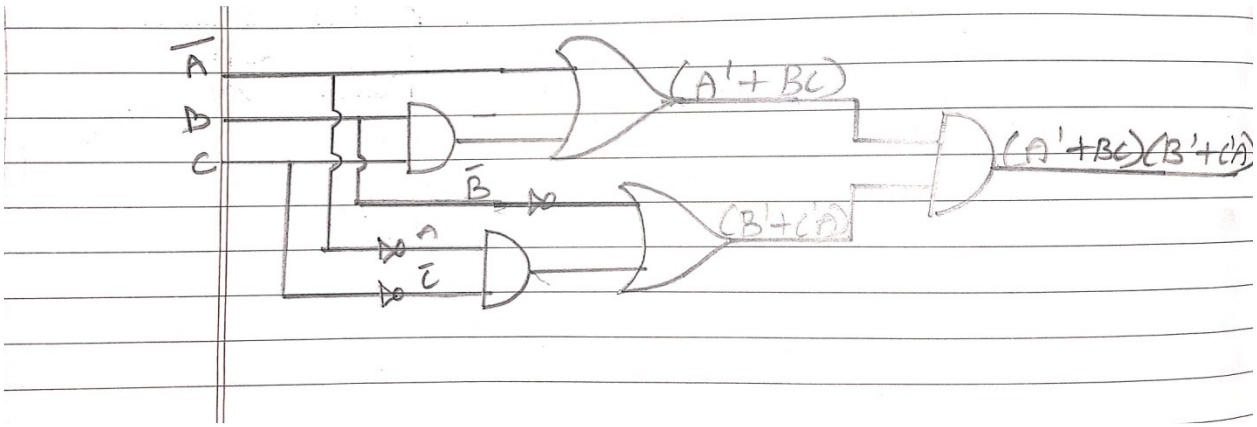
26) ANS: F=(A’B’+CD)’

27)ANS: (XY)’+Z

28)ANS: ((XY)’+Z)’

29)(((X+Y)’+Z)’+Y)’

30)
(A)



(B)