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Date: 1/10

Name

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Section

2+ BCS-2B

Roll no.

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Course

DLD

Assignment 2

Question 2.1(c)

$$\bar{X}Y + \bar{Y}Z + X\bar{Z} = X\bar{Y} + Y\bar{Z} + \bar{X}Z$$

X	Y	Z	$\bar{X}Y$	$\bar{Y}Z$	$X\bar{Z}$	$\bar{X}Y + \bar{Y}Z + X\bar{Z}$
0	0	0	0	0	0	0
0	0	1	0	1	0	1
0	1	0	1	0	0	1
0	1	1	1	0	0	1
1	0	0	0	0	1	1
1	0	1	0	1	0	1
1	1	0	0	0	1	1
1	1	1	0	0	0	0

$$XYZ \quad XY \quad YZ \quad XZ \quad XY + YZ + XZ$$

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

Question 2.a(d)

$$\begin{aligned}
 & \bar{X}\bar{Y} + \bar{Y}Z + XZ + XY + Y\bar{Z} = \bar{Y}\bar{Y} + XZ + YZ \\
 &= \bar{X}\bar{Y} + \bar{Y}Z(X + \bar{X}) + XZ + XY + Y\bar{Z} \\
 &= \bar{X}\bar{Y} + X\bar{Y}Z + \bar{X}YZ + XZ + XY + Y\bar{Z} \\
 &= \bar{X}\bar{Y}(1 + Z) + X\bar{Y}Z + XZ + XY + Y\bar{Z} \\
 &= \bar{X}\bar{Y} + XZ(1 + Y) + XY + Y\bar{Z} \\
 &= \bar{X}\bar{Y} + XZ + XY + Y\bar{Z} \\
 &= \bar{X}\bar{Y} + XZ + XY(Z + \bar{Z}) + Y\bar{Z} \\
 &= \bar{X}\bar{Y} + XZ + XY + Y\bar{Z}(1 + X) \\
 &= \bar{X}\bar{Y} + XZ(1 + Y) + Y\bar{Z} \\
 &= \bar{X}\bar{Y} + XZ + Y\bar{Z}
 \end{aligned}$$

Question 2.b(b)

$$\begin{aligned}
 & WY + \bar{W}Y\bar{Z} + WXZ + \bar{W}X\bar{Y} = WY + \bar{W}X\bar{Z} + X\bar{Y}\bar{Z} + \\
 & \quad \bar{W}XZ(Y + \bar{Y}) + \bar{X}\bar{Y}
 \end{aligned}$$

$$= WY + \bar{W}X\bar{Z}(Y+\bar{Y}) + \bar{X}\bar{Y}\bar{Z}(\bar{W}+W) + X\bar{Y}\bar{Z}(W+\bar{W})$$

$$= WY + \bar{W}X\bar{Z} + \bar{X}Y\bar{Z} + X\bar{Y}Z$$

Question 2.3(c)

$$\begin{aligned} & \overline{AD} + \overline{A}B + \overline{CD} + \overline{BC} = (\overline{A} + \overline{B} + \overline{C} + \overline{D})(A + B + C + D) \\ & \overline{AD} + \overline{A}B + \overline{CD} + \overline{BC} \\ & (\overline{A} + \overline{D}) \cdot (\overline{A} + \overline{B}) \cdot (\overline{C} + \overline{D}) \cdot (\overline{B} + \overline{C}) \\ & (\overline{AA} + \overline{AB} + \overline{AD} + \overline{DB})(\overline{CB} + \overline{CC} + \overline{DB} + \overline{CD}) \\ & (\overline{A}\overline{B} + \overline{AD} + \overline{DB})(\overline{CB} + \overline{DB} + \overline{CD}) \\ & \overline{ABC}\overline{B} + \overline{AB}\overline{D}\overline{B} + \overline{ABC}\overline{D} + \overline{ADC}\overline{B} + \overline{AD}\overline{B}\overline{B} + \overline{AB}\overline{C}\overline{D} + \\ & \overline{D}\overline{B}\overline{C}\overline{B} + \overline{D}\overline{B}\overline{D}\overline{B} + \overline{D}\overline{B}\overline{C}\overline{D} \\ & (\overline{ABC}\overline{D}) + ABCD \\ & = (A + B + C + D) \cdot (\overline{A} + \overline{B} + \overline{C} + \overline{D}) \end{aligned}$$

Q. Question 2.6(b)

$$\begin{aligned} & (\overline{A} + \overline{B} + \overline{C})(\overline{ABC}) \\ & = \cancel{\overline{A}}(\overline{ABC})(\overline{A} + \overline{B} + \overline{C}) \\ & \cancel{A}\cancel{B}\cancel{C}\overline{A} + \\ & \overline{ABC}\overline{A} + \overline{ABC}\overline{B} + \overline{ABC}\overline{C} \\ & = \overline{ABC} + \overline{ABC} + \overline{ABC} \\ & = \cancel{ABC}. \end{aligned}$$

Question 2.6(d)

$$\bar{A}BD + \bar{A}\bar{C}D + BD$$

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

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

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

$$D(B + (\bar{A} + \bar{A})(\bar{A} + C - \bar{A}(C + \bar{C}))$$

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

Question 2.7

$$(a) \bar{X}\bar{Y} + XYZ + \bar{X}Y$$

$$\bar{X}(\bar{Y} + Y) + XYZ$$

$$\bar{X} + XYZ$$

$$(\bar{X} + X)(\bar{X} + YZ)$$

$$\bar{X} + YZ$$

$$b) X + Y(z + \bar{X} + \bar{Z})$$

$$X + Y(z + \bar{X} \cdot \bar{Z})$$

$$X + Y((z + \bar{Z})(z + \bar{X}))$$

$$X + Y(z + \bar{X})$$

$$X + Yz + Y\bar{X}$$

$$(X + \cancel{\bar{X}})(X + Y)$$

$$X + Y + Yz$$

$$= X + Y(1 + z)$$

$$= X + Y.$$

$$c) \bar{W}X(\bar{Z} + \bar{Y}Z) + X(W + \bar{W}YZ)$$

$$\bar{W}X((\bar{Z} + Z)(\bar{Z} + \bar{Y})) + X((W + \bar{W})(W + YZ))$$

$$\bar{W}X(\bar{Z}\bar{Y}) + X(WYZ)$$

$$\bar{W}X\bar{Y} + \bar{W}X\bar{Z} + XW + XYZ$$

$$X(W + \bar{W}\bar{Z}) + X(YZ + \bar{W}\bar{Y})$$

$$X((W + \bar{W})(W + \bar{Z})) + X((YZ + \bar{Y})(YZ + \bar{W}))$$

$$X(W + \bar{Z}) + X(Z + \bar{Y})$$

$$\bar{W}X\bar{Z} + \bar{W}X\bar{Y}Z + XW + X\bar{W}YZ$$

$$\bar{W}X\bar{Z} + XZ(\bar{W}\bar{Y} + \bar{W}Y) + XW$$

$$\bar{W}X\bar{Z} + \bar{W}XZ + WX$$

$$\bar{W}X + WX$$

$$= X$$

$$d) (AB + \bar{A}\bar{B})(\bar{C}\bar{D} + CD) + \bar{A}\bar{C}$$

$$\underset{\checkmark}{AB\bar{C}\bar{D}} + \underset{\checkmark}{ABC\bar{D}} + \underset{\checkmark}{\bar{A}\bar{B}\bar{C}\bar{D}} + \underset{\checkmark}{\bar{A}\bar{B}CD} + \underset{\checkmark}{\bar{A} + \bar{C}}$$

$$\bar{A}\bar{B}\bar{C}\bar{D}$$

$$\bar{C}(AB\bar{D} + \bar{A}\bar{B}\bar{D} + I) + \bar{A}(\bar{B}CD + I) + ABCD$$

$$\bar{C} + \bar{A} + ABCD$$

$$\bar{C} + ABD + \bar{A}$$

$$I + \bar{C} + \bar{A} + BD$$

Question Q.12

$$(AB + C)(B\bar{C}\bar{D})$$

$$AB + AB\bar{C}\bar{D} + BC$$

$$AB + BC \quad \text{sop}$$

$$= BC(A+C) \text{ P.O.S}$$

$$\text{b) } (\bar{X} + X)(\bar{Y} + \bar{Y})(\bar{Y} + \bar{Z}) \text{ P.O.S}$$

$$\bar{X} + (X + \bar{X}\bar{Y})(\bar{Y} + \bar{X}\bar{Z})$$

$$\bar{X} + (XY + X\bar{Z} + X\bar{Y}\bar{Z} + X\bar{Y}\bar{Z})$$

$$\bar{X} + XY + X\bar{Z}$$

$$\bar{X} + Y + X\bar{Z}$$

$$= \bar{X} + Y + \bar{Z} \text{ S.O.P}$$

$$\therefore (X \cdot \bar{Y} \cdot Z) \text{ P.O.S}$$

$$\text{c) } (A + B\bar{C} + CD)(\bar{B} + EF)$$

$$(A + G\bar{B})(A + \bar{C} + C)(A + D + B)(A + \bar{C}D)(\bar{B} + E)(\bar{B} + F)$$

$$= \text{P.O.P}$$

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

$$AB + AEF + B\bar{C}EF + \bar{B}CD + CDEF \text{ S.O.P}$$

Question 2.14(d)

$$(d) f(A, B, C) = \Sigma_m(0, 2, 5, 4, 5, 7)$$

	BC	00	01	11	10
A	0	1		1	1
	1	1	1	1	1

$$\bar{B}\bar{C} + AC + \bar{A}B$$

$$AB + AC + BC + \bar{A}\bar{B}\bar{C}$$

	CD 00, 01	11	10	
A B	1	1	1	
C D	1	1	1	

$$\bar{B} + \bar{C}$$

Question 2.17

a) $F(W, X, Y, Z) = \Sigma m(0, 2, 5, 8, 9, 10, 11, 13)$

	CD 00	01	11	10
AB	1	.	.	1
00	1	.	1	0
01	.	1	1	0
11	1	1	1	0
10	1	1	1	1

$$F = \bar{X}\bar{Z} + WY + W\bar{X} + XY\bar{Z}$$

	CD 00	01	11	10
AB	.	1	1	1
00	.	1	1	1
01	.	1	1	1
11	1	1	1	1
10	1	1	1	1

$$F = \bar{B}D + \bar{A}\bar{B}\bar{C} + AD$$

• Question 2.18(c)

$$\bar{B}\bar{D} + A\bar{B}D + \bar{A}\bar{B}C$$

AB\CD	00	01	11	10	
00	1			1	
01			1	1	
11		1	1		
10	1			1	

$$\Sigma m(0, 2, 6, 7, 8, 10, 13, 15)$$

Question 2.19(c)

$$(c) F(A,B,C,D) = \Sigma m(1, 3, 4, 5, 9, 10, 11, 12, 13, 14, 15)$$

AB\CD	00	01	11	10	
00					
01	1	1	1	1	G
11	1	1	1	1	
10	1	1	1	1	H

$$\text{Prime} = AB, AC, AD, BC, BD, CD$$

$$\text{Essential} = AC, BC, BD$$

Question 2.20(c)

$$F(W,X,Y,Z) = \Sigma m(0, 2, 4, 6, 7, 8, 9, 12, 13, 14)$$

$\bar{A}B$	$\bar{C}D$	00	01	11	10
00	1	1	1	1	1
01	1	1	1	1	1
11	1	1	1	1	1
10	1	1	1	1	1

$\bar{B}B$	$\bar{C}Y^2$	00	01	11	10
WT	1	1	1	1	1
00	1	1	1	1	1
01	1	1	1	1	1
11	1	1	1	1	1
10	1	1	1	1	1

Prime = $\bar{Y}\bar{Z}$, $W\bar{Y}$, $\bar{W}\bar{Z}$, $W\bar{X}\bar{Z}$, $XY\bar{Z}$, $\bar{W}XY$

Essential = $W\bar{Y}$, $\bar{W}\bar{Z}$

$$F = W\bar{Y} + \bar{W}\bar{Z} + XYZ.$$

Question 2.22 (c)

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

$\bar{A}B$	$\bar{C}D$	00	01	11	10
00	1	1	1	1	1
01	1	1	1	1	1
11	1	1	1	1	1
10	1	1	1	1	1

Day:

$$\begin{aligned} & (\bar{A} + \bar{B} + D)(A + \bar{D})(A + B\bar{D}) (A + \bar{B}, + C, \bar{D}) \\ & (\bar{A} + \bar{A}\bar{D} + \bar{A}\bar{B} + \bar{B}\bar{D}, + \bar{A}\bar{D} + \bar{B}\bar{D})(A + A + \bar{A}\bar{B}, + A\bar{C} + \bar{A}\bar{D} + \bar{B}\bar{A} + \bar{B} \\ & + \bar{B}\bar{C} + \bar{B}\bar{D} + \bar{B}\bar{A} + \bar{D}\bar{B} + \bar{C}\bar{D} + \bar{D}\bar{D}) \end{aligned}$$

$$\begin{aligned} & (\bar{A} + \bar{A}\bar{D} + \bar{A}\bar{B} + \bar{B}\bar{D})(A + \bar{A}\bar{B} + \bar{A}\bar{C} + \bar{A}\bar{D} + \bar{A}\bar{B}\bar{C} + \bar{B}\bar{C} + \bar{B}\bar{D} + \bar{A}\bar{D}\bar{B} \\ & \bar{B}\bar{D} + \bar{A}\bar{B}\bar{D} + \bar{A}\bar{B}\bar{C}) \text{ SOP} \end{aligned}$$

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

AB	CD	00	01	11	10	00	01	11	10
00		(0)	0			0	1		
01		0				1	0	1	1
11		(0)	0	0	0				
10		0	0			1		1	1

$$(\bar{B} + \bar{C} + D)(\bar{A} + \bar{B})(B + \bar{D}) \text{ POS}$$

$$\bar{B}\bar{D} + D\bar{A}B + C\bar{A}B \text{ SOP}$$

Question 2 BCB)

b) $F(W, X, Y, Z) = \Sigma m(3, 11, 13, 15)$

$W\bar{X}$	$\bar{Y}Z$	00	01	10	11	$W\bar{X}$	$\bar{Y}Z$	00	01	11	10
00	0	1	0	1	0	00	0	1	0	1	0
01	1	0	1	0	1	01	1	0	1	0	1
11	0	1	1	0	1	11	0	1	0	1	0
10	1	0	0	1	0	10	1	0	0	1	0

$$\cancel{W + X + \bar{Y} + \bar{Z}} \quad (\bar{X} + \bar{Z} \bar{Y})(\bar{W} + \bar{Z} + \bar{X})$$

$W\bar{X}$	$\bar{Y}Z$	00	01	11	10	POS.		
00	0	1	1	1	1			
01	1	0	1	1	1			
01	0	1	0	0	1			
10	1	1	1	1	0			

$$\bar{Z} + \bar{W}X + \bar{Y}\bar{X} \text{ SOP.}$$

Question 2.24(c)

$$F(A, B, C) = \Sigma m(1, 2, 4) \quad d = (0, 3, 6, 7)$$

$A \cap BC$					
X	1	1	X	1	1
1	1	X	X	1	0

$$F = \bar{A} + \bar{C}$$

Question 2.26 (b)

$$F(WXYZ) \text{ m}(3,4,9,15)$$

$$\text{d}(0,1,2,5,10,12,14)$$

W	X	Y	Z	W	X	Y	Z
00	X	X	1	X	00	X	X
01	1	X	1	1	01	X	0
11	X	1	X	11	1	0	X
10	1	1	X	10	0	0	X

$$F = \bar{W}X + \bar{X}\bar{Y}Z + WXY + \bar{W}\bar{Y}$$
 Sop.

$$F = \bar{W}(X+Z)(\bar{X}+\bar{Y}+\bar{W})(\bar{W}+X+\bar{Y}) \\ (\bar{W}+\bar{X}+Y)$$

Question 1(a)

$$a) A\bar{B}C(CBD + CDE) + A\bar{C}$$

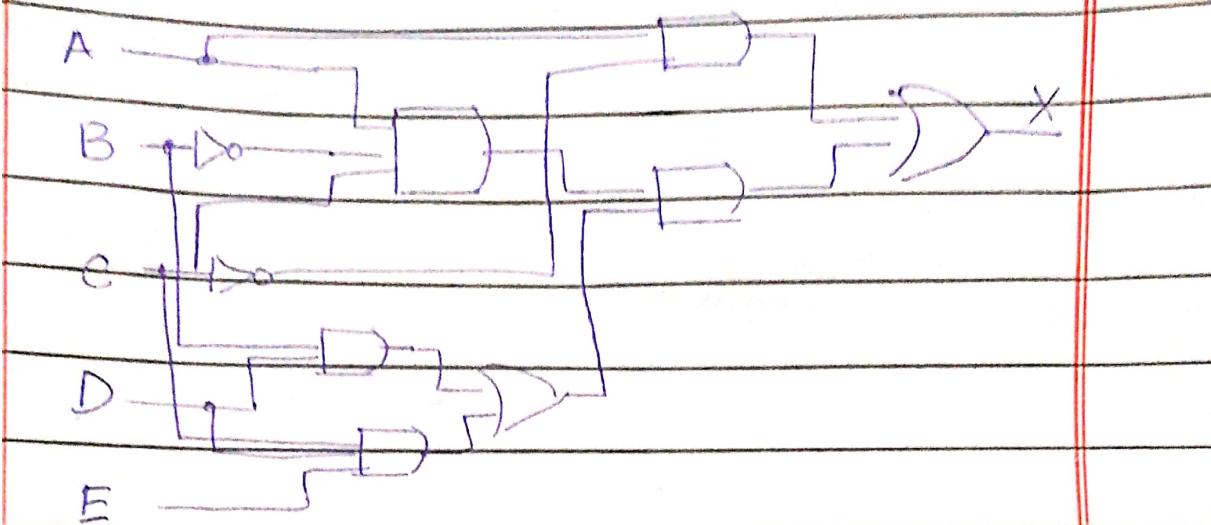
$$A\bar{B}BCD + A\bar{B}CCDE + A\bar{C} \quad : B\cdot\bar{B} =$$

$$A\bar{B}CDE + A\bar{C} \quad : C\cdot C =$$

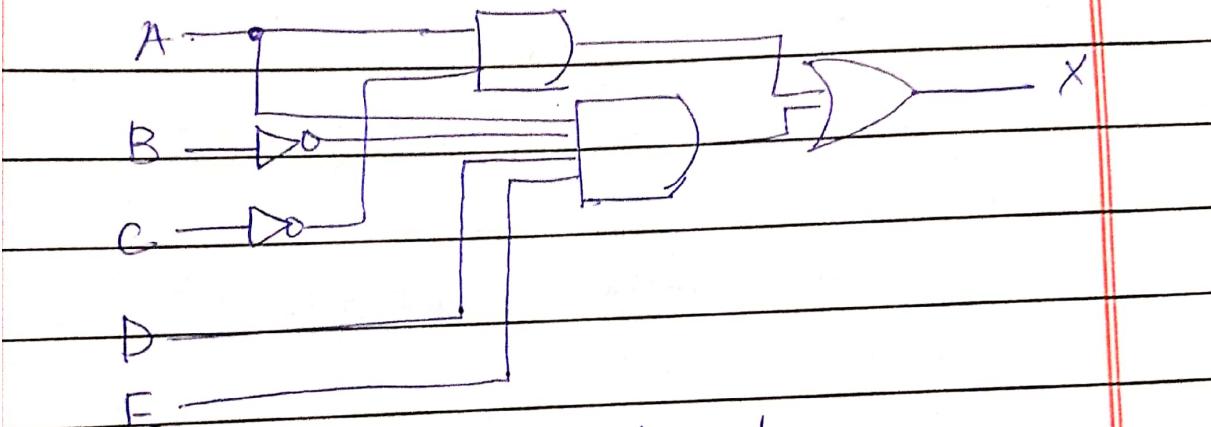
$$AC(\bar{B}CDE + A\bar{C})$$

$$AC(\bar{C} + C)(\bar{C} + \bar{B}DE) \quad \text{Distribution law}$$

$$AC + ABDE$$



$$\text{Gate input cost} = 10 + 3 + 2 = 15$$



Gate input cost

$$6 + 2 + 1 = 9$$

Question 1(b)

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

$$C(AB' + A'B + A'B')$$

$$C(AB' + A'(B+B'))$$

$$C(AB' + A')$$

$$C((A+A') \cdot B + A)$$

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

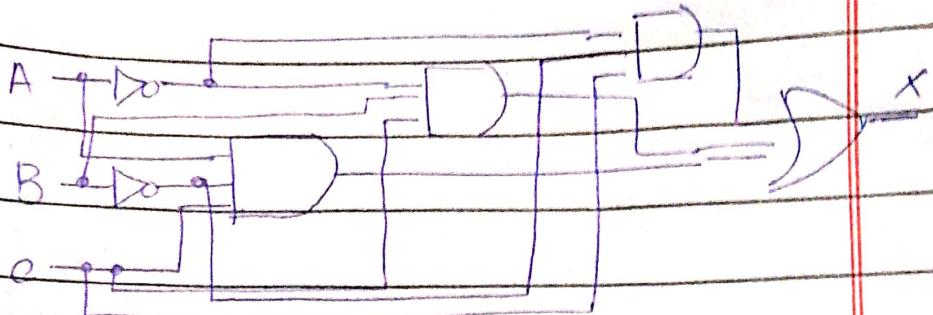
$$A'C + B'C$$

$$B+B' = 1$$

Distributive

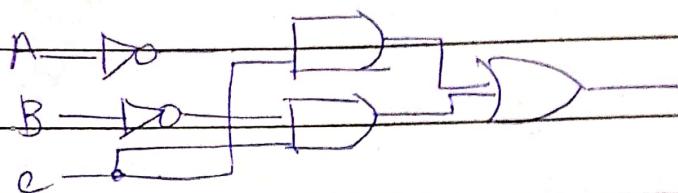
$$x + \bar{x}y = xy$$

$$A\bar{B}C + \bar{A}BC + \bar{A}\bar{B}C$$



Gate input = 9 + 2 + 2 = 13
cost

$$A'C + BC$$



Gate input : 4 + 2 + 1 = 7
cost

Q1 e) Question 1(c)

~~$$BCDE + Bc(DE)' + BC'DE$$~~

~~$$BCDE + BC\overline{DE} + \overline{BC} DE$$~~

~~$$BCDE + Bc(\bar{D} + \bar{E}) + (\bar{B} + \bar{C}) DE$$~~

~~$$BC(CDE + \bar{D} + \bar{E}) + (\bar{B} + \bar{C}) DE$$~~

~~$$BC(C(\bar{D} + \bar{B})(\bar{E} + \bar{D}) + \bar{D}) + (\bar{B} + \bar{C}) DE$$~~

~~$$BC(B + \bar{D} + \bar{B})(\bar{B} + \bar{C}) DE$$~~

~~$$BC\bar{D} + \bar{B} DE + \bar{C} DE$$~~

Question 1 (c)

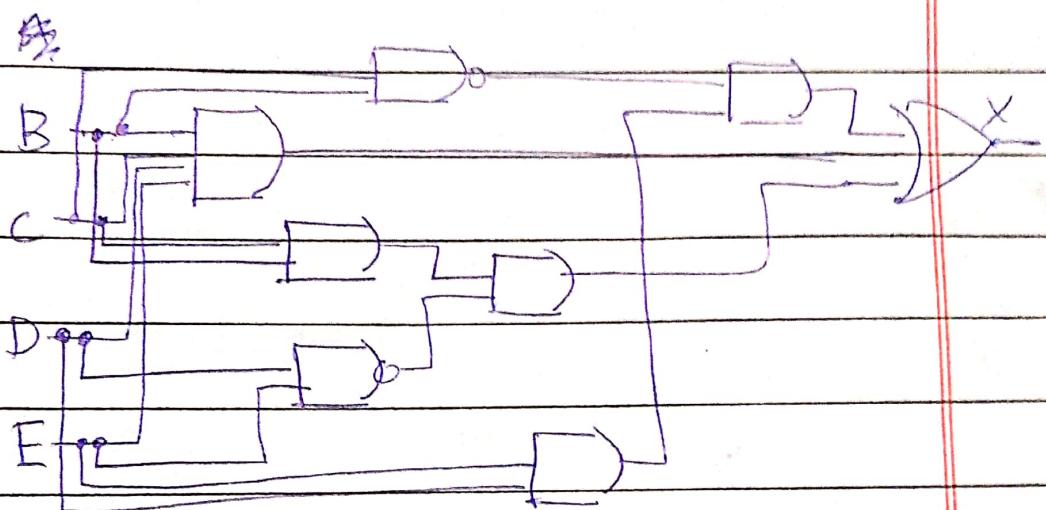
$$BCDE + BC\bar{D}\bar{E} + \bar{B}CDB$$

$$BC(CDE + \bar{D}\bar{E}) + \bar{B}CDE \quad DE|D\bar{E}=1$$

$$BC + DE \quad \bar{B}C \quad \text{distributive}$$

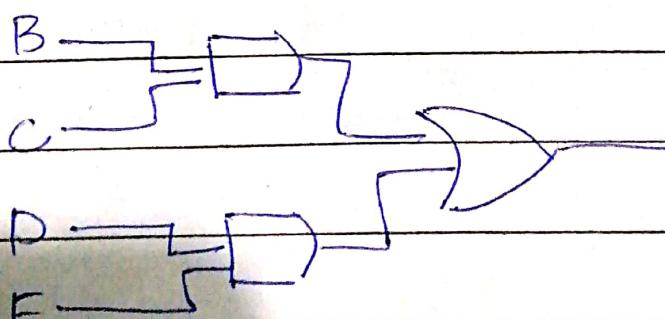
$$(BC + \bar{B}C)(BC + DE) \quad BC + \bar{B}C = 1$$

$$BC + DE$$



$$\text{Gate input cost: } 12 + 2 + 2$$

$$16.$$



$$\text{Gate cost: } 4 + 1 = 5$$

input cost.