

23i-2623
Muneeb Lone
DS-B

Date: _____

ASSIGNMENT #2

o 1 2 3

NUMBER: 7650

C C₁ C₂ C₃ C₄ C₅ C₆

NAME: L B A E N U M

2 Y W X Z W

$$Q1(i) \overline{(W + \overline{X}(Y + \overline{Z}))} \cdot (\overline{W}\overline{X} + Y\overline{Z}) + (W + \overline{X})(X + Z)$$

$$E + \overline{A}(B + \overline{L}) \cdot (\overline{EA} + BL) + (E + \overline{A})(A + L)$$

$$\overline{E} \cdot \overline{A}(B + \overline{L}) \cdot (\overline{EA} \cdot \overline{BL}) + EA + \overline{AA} + \overline{AA} + \overline{AL}$$

$$\overline{E} \cdot (\overline{A} + (B + \overline{L})) \cdot ((\overline{E} + \overline{A}) \cdot (\overline{B} + \overline{L})) + EA + O + O + \overline{AL}$$

$$\overline{E} \cdot (A + (\overline{B} \cdot \overline{L})) \cdot (\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L}) + EA + \overline{AL}$$

$$\overline{E} \cdot (A + (B \cdot L)) \cdot (\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \cancel{EA} + \overline{A} \cdot \overline{L}) + EA + \overline{AL}$$

$$\overline{EA} + \overline{E}(\overline{B} \cdot L) \dots \dots \dots$$

$$(\overline{E} \cdot A + \overline{E} \cdot \overline{B} \cdot L)(\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L}) + EA + \overline{A} \cdot L$$

$$\overline{E} \cdot A (\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L}) + \overline{E} \cdot \overline{B} \cdot L (\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L}) + EA + \overline{A} \cdot L$$

$$A((\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L}) \overline{E} + E) + (\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L}) \overline{E} \cdot \overline{B} \cdot L + \overline{AL}$$

$$A(\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L} + E) + (\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L}) \overline{E} \cdot \overline{B} \cdot L + \overline{AL}$$

$$A(\overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L} + E) + (\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L}) \overline{E} \cdot \overline{B} \cdot L + \overline{AL}$$

$$A(\overline{B} + \overline{L} + \overline{A} + E) + (\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L}) \overline{E} \cdot \overline{B} \cdot L + \overline{AL}$$

$$\overline{AB} + \overline{AL} + \overline{AA} + AE + (\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L}) \overline{E} \cdot \overline{B} \cdot L + \overline{AL}$$

$$AB + AL + O + AE + (\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L}) \overline{E} \cdot \overline{B} \cdot L + \overline{AL}$$

$$AB + AL + AE + (\overline{E} \cdot \overline{B} + \overline{E} \cdot \overline{L} + \overline{A} \cdot \overline{B} + \overline{A} \cdot \overline{L}) \overline{E} \cdot \overline{B} \cdot L + \overline{AL}$$

$$AB + AL + AE + E \cdot \overline{BL} \cdot \overline{E} \cdot \overline{L} + \overline{E} \cdot \overline{BL} \cdot \overline{AB} + \overline{E} \cdot \overline{BL} \cdot \overline{AL} + \overline{EL}$$

$$AB + AL + AE + \overline{E} \cdot \overline{BL} + \cancel{O} \cdot \overline{E} \cdot \overline{BL} + \overline{E} \cdot \overline{BL} \cdot \overline{A} + \overline{E} \cdot \overline{BL} \cdot \overline{A} + \overline{AL}$$

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$$A\bar{B} + A\bar{L} + AE + E\bar{B}L + O + \bar{E}\bar{B}L\bar{A} + \bar{E}\bar{B}L\bar{A} + \bar{A}L$$

$$A\bar{B} + A\bar{L} + AE + \bar{E}\bar{B}L + \bar{E}\bar{B}L\bar{A} + \bar{E}\bar{B}L\bar{A} + \bar{A}L$$

$$A\bar{B} + A\bar{L} + AE + \bar{E}\bar{B}L + \bar{E}\bar{B}L\bar{A} + \bar{A}L$$

$$A\bar{B} + A\bar{L} + AE + \bar{E}\bar{B}L + \bar{A}L$$

$$A(\bar{B} + \bar{L} + E) + L(\bar{E}\bar{B} + \bar{A})$$

2^y x w
LB A ENUM

$$2. W + (x \cdot \bar{y})(z + \bar{x}) \cdot (W \cdot \bar{x} + \bar{y}z) + (\bar{W} + xy)z$$

$$\therefore E + (A \cdot \bar{B})(L + \bar{A}) \cdot (E \cdot \bar{A} + \bar{B}L) + (\bar{E} + AB)L$$

$$\bar{E}((\bar{A} \cdot \bar{B}) + (L + \bar{A})) \cdot (E \cdot \bar{A} + \bar{B}L) + (\bar{E} + AB)L$$

$$\bar{E}(\bar{A} + \bar{B} + L + \bar{A})$$

$$\bar{E}(\bar{A} + B + L \cdot A)(E\bar{A} + \bar{B}L) + (\bar{E} + AB)L \quad AB + \bar{A} = B + \bar{A}$$

$$\bar{E}(\bar{A} + B + \bar{L})(E\bar{A} + \bar{B}L) + (\bar{E} + AB)L$$

$$E(\bar{A} + B + \bar{L})E(E\bar{A} + \bar{B}L) + (\bar{E} + AB)L$$

$$\cancel{EA} + \cancel{EB} + \cancel{EE} + E(E\bar{A} + E\bar{B}L + L\bar{E} + LAB}$$

$$\cancel{EA} + \cancel{EB} + \cancel{EE} + E\bar{A} + E\bar{B}L + L\bar{E} + LAB$$

$$(\bar{E}\bar{A} + EB + EL)(E\bar{A} + E\bar{B}L) + (\bar{E}B + AB)L$$

$$\bar{E}(E\bar{A} + \bar{B}L)\bar{A} + \bar{E}(E\bar{A} + \bar{B}L)B + \bar{E}(E\bar{A} + \bar{B}L)L + (\bar{E} + AB)L$$

$$\bar{E}E\bar{A}\bar{A} + \bar{E}\bar{B}L\bar{A} + \bar{E}E\bar{A}B + \bar{E}B\bar{B}L + \bar{E}E\bar{A}\bar{L} + \bar{E}\bar{B}L\bar{L} + L\bar{E} + ABL$$

$$O + \bar{E}\bar{B}L\bar{A} + O + O + O + L'E + LAB$$

$$LAB\bar{E} + LE + LAB$$

$$LE + LAB$$

$$A + AB = A$$

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$$3. (\bar{W} + \bar{X})(\bar{W} + \bar{Y} + \bar{Z}) \cdot (\bar{X} + \bar{Y}) + W \cdot \bar{X} + Y + \bar{Z}$$

$$(E + \bar{A})(\bar{E} + \bar{B} + \bar{L}) \cdot (\bar{A} + \bar{B}) + E \cdot \bar{A} + \bar{B} \cdot \bar{L}$$

$$(E + \bar{A})(\bar{E} \cdot \bar{B} + \bar{L}) \cdot (\bar{A} \cdot \bar{B}) + E \cdot \bar{A} \cdot \bar{B} + \bar{L}$$

$$(E + \bar{A})(\bar{E} \cdot \bar{B} + \bar{L}) \cdot (\bar{A} \cdot \bar{B}) + E \bar{A} \bar{B} + E \bar{L}$$

E(L)

$$(E \bar{E} \bar{B} + E \bar{L} + \bar{A} \bar{E} \bar{B} + \bar{A} \bar{L})(\bar{A} \cdot \bar{B}) + E \bar{A} \bar{B} + E \bar{L}$$

$$(0 + E \bar{L} + A \bar{E} \bar{B} + \bar{A} \bar{L})(\bar{A} \cdot \bar{B}) + E \bar{A} \bar{B} + E \bar{L}$$

$$(E \bar{L} + A \bar{E} \bar{B} + \bar{A} \bar{L})(\bar{A} \cdot \bar{B}) + E \bar{A} \bar{B} + E \bar{L}$$

$$\bar{B} \bar{A} E \bar{L} + A \bar{A} \bar{E} \bar{B} + \bar{A} \bar{A} \bar{L} \bar{B} + E \bar{A} \bar{B} + E \bar{L}$$

$$\bar{A} \bar{B} E \bar{L} + 0 + \bar{A} \bar{L} \bar{B} + E \bar{A} \bar{B} + E \bar{L}$$

$$\bar{A} \bar{B} E \bar{L} + E \bar{L} + \bar{A} \bar{L} \bar{B} + E \bar{A} \bar{B}$$

$$E \bar{L} (\bar{A} \bar{B} + 1) + \bar{A} \bar{L} \bar{B} + E \bar{A} \bar{B}$$

$$E \bar{L} + \bar{A} \bar{L} \bar{B} + E \bar{A} \bar{B}$$

$$\bar{L}(E + \bar{A} \bar{B}) + \bar{A} \bar{L} \bar{B}$$

$$4. (\bar{W} + \bar{X})(Y + Z) + (W + X)(\bar{W} \cdot \bar{X}) + \bar{Y} Z$$

$$\frac{(\bar{E} + \bar{A})(B + L) + (E + A)(\bar{E} \cdot A + \bar{B} L)}{(\bar{E} + \bar{A}) + (B + L) + (E + A)(\bar{E} + \bar{A} + \bar{B} L)}$$

$$(\bar{E} \cdot \bar{A}) + (\bar{B} \cdot \bar{L}) + (E + A)(\bar{E} + \bar{A} + \bar{B} L)$$

$$E \cdot A + \bar{B} \bar{L} + E \bar{E} + E \bar{A} + E \bar{B} L + A \bar{E} + A \bar{A} + A \bar{B} L$$

$$E \cdot A + \bar{B} \bar{L} + 0 + E \bar{A} + E \bar{B} L + 0 + A \bar{E} + A \bar{B} L$$

$$E(A + \bar{A}) + A + \bar{B} \bar{L} + E \bar{A} + E \bar{B} L + A \bar{E} + A \bar{B} L$$

$$E(1) + \bar{B}(\bar{L} + L + \bar{B} \bar{L} + E \bar{B} L + A \bar{E} + A \bar{B} L)$$

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$$E + E\bar{B}L + \bar{B}\bar{L} + A\bar{B}L + A\bar{E}$$

$$E + \bar{B}\bar{L} + A\bar{E} + A\bar{B}L$$

$$E + \bar{B}\bar{L} + A + ABL$$

$$E + \bar{B}\bar{L} + A$$

5. $\overline{W + (X + Y)(\overline{W} \cdot Z)} + W \cdot \overline{X + YZ} + \overline{W + X} \cdot (Y + Z)$

$$\overline{E + (A + B)(\overline{E} \cdot L)} + E \cdot \overline{A + BL} + \overline{E + A} \cdot (B + L)$$

$$\overline{E \cdot (A + B) + (\overline{E} \cdot L)} + E \cdot (\overline{A})(\overline{B} + \bar{L}) + \overline{E} \cdot \overline{A} \cdot (B + L)$$

$$E \cdot (\overline{A} \cdot \overline{B}) + (E \cdot L) + E(\overline{A})(\overline{B} + \bar{L}) + \overline{E} \overline{A} \cdot (B + L)$$

$$\bar{A}\bar{B}E + EL + \bar{A}\bar{B}E + \bar{A}E\bar{L} + \overline{E}\overline{A}B + E\bar{A}L$$

$$\bar{A}\bar{B}E + EL + \bar{A}\bar{B}E + \bar{A}EL + \bar{A}BE + \bar{A}EL$$

$$\bar{A}\bar{B}E + EL + \bar{A}EL + \bar{A}BE + \bar{A}EL$$

$$\bar{A}\bar{B}E + EL + \bar{A}EL + \bar{A}BE$$

$$\bar{A}\bar{B}E + E(L + \bar{A}\bar{L}) + \bar{A}BE$$

$$\bar{A}\bar{B}E + E(\bar{A} + L) + \bar{A}BE$$

$$\bar{A}\bar{B}E + \bar{A}\bar{E} + EL + \bar{A}BE$$

$$E\bar{A} + EL + \bar{A}BE$$

$$EL + \bar{A}(BE + E)$$

$$EL + \bar{A}(B + E)$$

$$EL + \bar{A}B + \bar{A}E$$

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Q: $F(x, y, z) = \sum(0, A_2, A_3, (A_2+A_3), 6)$

$$\sum(0, 5, 0, 5, 6) \rightarrow \sum(0, 5, 6)$$

x	y	z	X
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

$$\bar{x}yz + x\bar{y}z + xy\bar{z}$$

xy	z	0	1
00		1	0
01		0	0
11		1	0
10		0	1

No groups so final answer is
 $\bar{x}yz + x\bar{y}z + xy\bar{z}$

Prime implicants: $\bar{x}yz, x\bar{y}z, xy\bar{z}$

Necessary: $\bar{x}yz, x\bar{y}z, xy\bar{z}$

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$$Q: F(l, m, n) = \Pi(1, 2, 5, 0, 5, 5) \rightarrow (0, 12, 5)$$

x	y	z	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

$$(x + y + z)(x + y + \bar{z})(x + \bar{y} + z)(\bar{x} + y + z)$$

$$x + y(z + \bar{z}) * (x + \bar{y} + z)(\bar{x} + y + \bar{z})$$

$$(x + y)(x + \bar{y} + z)(\bar{x} + y + \bar{z})$$

xy	z	0	1
00	0	0	0
01	0	1	1
11	1	1	1
10	1	0	0

xy	z	0	1
00	0	0	0
01	0	1	1
11	1	1	1
10	1	0	0

$$(x + y)(x + \bar{y} + z)(\bar{x} + y + \bar{z})$$

$$(\bar{x} + \bar{y})(\bar{x} + y + \bar{z})(\bar{y} + z)$$

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Prime Imp: $(x+y)$, $(x+\bar{y}+z)$, $(\bar{x}+y+\bar{z})$

Essential: $(x+y)$, $(x+\bar{y}+z)$, $(\bar{x}+y+\bar{z})$

Q4: $A\bar{B}C + \bar{A}\bar{B} + AB\bar{C}D$

$\bar{E}\bar{A}N + \bar{E}\bar{A} + E\bar{A}\bar{N}U$

$\bar{E}\bar{A}\bar{N}U + \bar{E}\bar{A}(\bar{N}+\bar{U}) + \bar{E}\bar{A}(N+\bar{U})(\bar{U}+\bar{U}) + E\bar{A}\bar{N}U$

$\bar{E}\bar{A}\bar{N}U + \bar{E}AN\bar{U} + \bar{E}\bar{A}NU + \bar{E}\bar{A}\bar{N}U + \bar{E}\bar{A}\bar{N}\bar{U} + E\bar{A}\bar{N}\bar{U} + E\bar{A}\bar{N}U$

$\Sigma(m_0, m_1, m_2, m_3, m_{10}, m_{11}, m_{13})$

$\Pi(M_4, M_5, M_6, M_7, M_8, M_9, M_{12}, M_{14}, M_{15})$

$(E + \bar{A} + N + U)(E + \bar{A} + N + \bar{U})(E + \bar{A} + \bar{N} + U)(E + \bar{A} + \bar{N} + \bar{U})(\bar{E} + \bar{A} + \bar{N} + U)(\bar{E} + A + N + U)(\bar{E} + A + N + \bar{U})(\bar{E} + \bar{A} + \bar{N} + U)$

$(\bar{E} + \bar{A} + \bar{N} + U)(\bar{E} + \bar{A} + \bar{N} + \bar{U})$

Q5: $(A + \bar{B})(B + C)$

$(B + \bar{A})(\bar{A} + E)$

$(B + \bar{A} + E) \cancel{(B + \bar{A} + \bar{E})} (A + E + \bar{B})(A + E + \bar{B})$

M_2, M_3, M_6, M_4

$\Pi = (0, 2, 3, 4) \rightarrow \Sigma(1, 5, 6, 7)$

$\bar{B}\bar{A}E + B\bar{A}E + BA\bar{E} + BAE$

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$$Q6: F(e,f,g,h) = \Pi(0, 7, 6, 5, 0, 7, 11, 5, 12, 14)$$

$$\Pi(0, 5, 6, 7, 11, 12, 14)$$

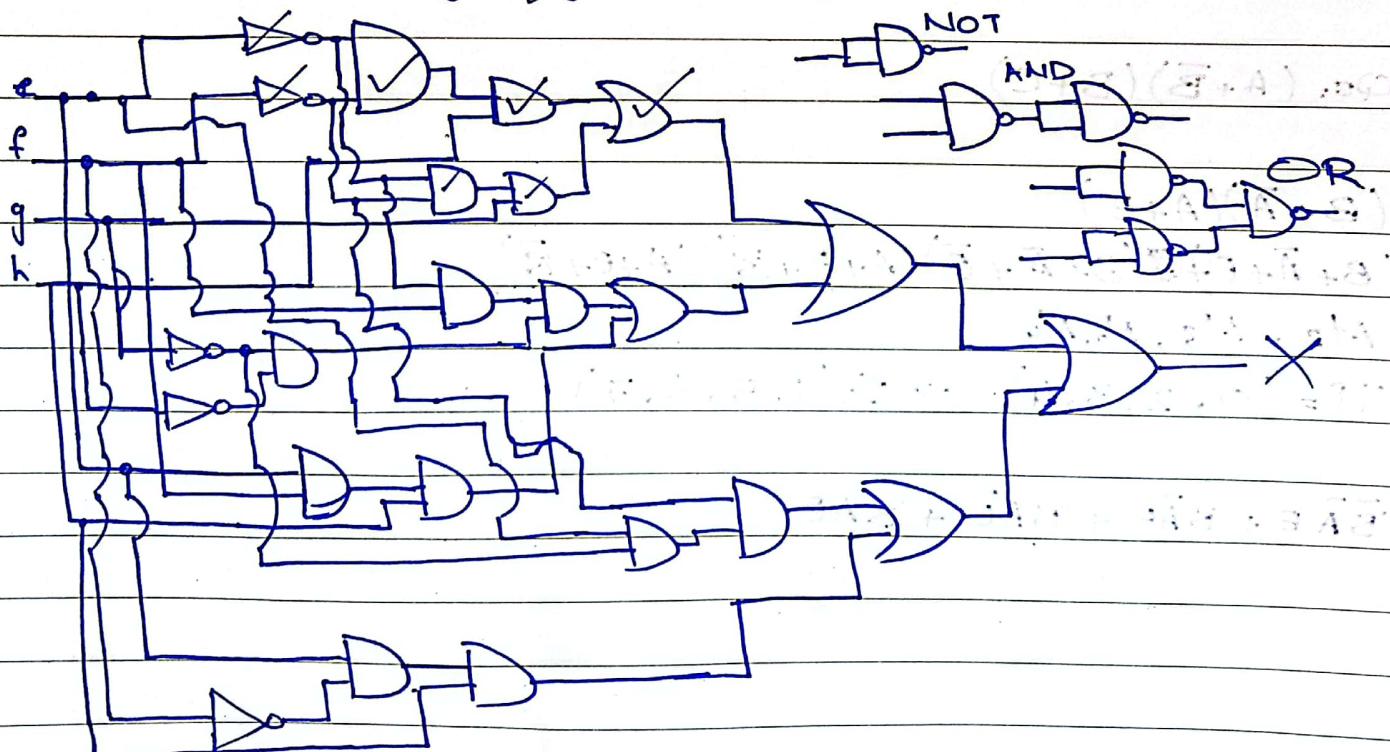
$$\Sigma(1, 2, 3, 4, 8, 9, 10, 13, 15)$$

	ef\gh	00	01	11	10
00	0	(1)	(1)	(1)	
01	(1)	0	0	0	
11	0	(1)	(1)	0	
10	(1)	(1)	0	(1)	

$$\bar{e}\bar{f}h + \bar{e}\bar{f}g + \bar{e}\bar{f}\bar{g}\bar{h} + \bar{e}\bar{f}h + e\bar{f}\bar{g} + e\bar{f}h$$

Prime Implicants: $\bar{e}\bar{f}h, \bar{e}\bar{f}g, \bar{e}\bar{f}\bar{g}\bar{h}, efh, e\bar{f}\bar{g}, e\bar{f}h$

Essentials: $\bar{e}\bar{f}h, \bar{e}\bar{f}g, \bar{e}\bar{f}\bar{g}\bar{h}, efh, e\bar{f}\bar{g}, e\bar{f}h$



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$$\text{Q: } F(i, j, k, l) = \sum(2, 7, 6, 5, 0, 12, 6, 5, 12, 14) \\ \sum(0, 2, 5, 6, 7, 12, 14)$$

ij	kl	00	01	11	10
00	1	0	0	1	1
01	0	1	1	1	1
11	1	0	0	1	1
10	0	0	0	0	1

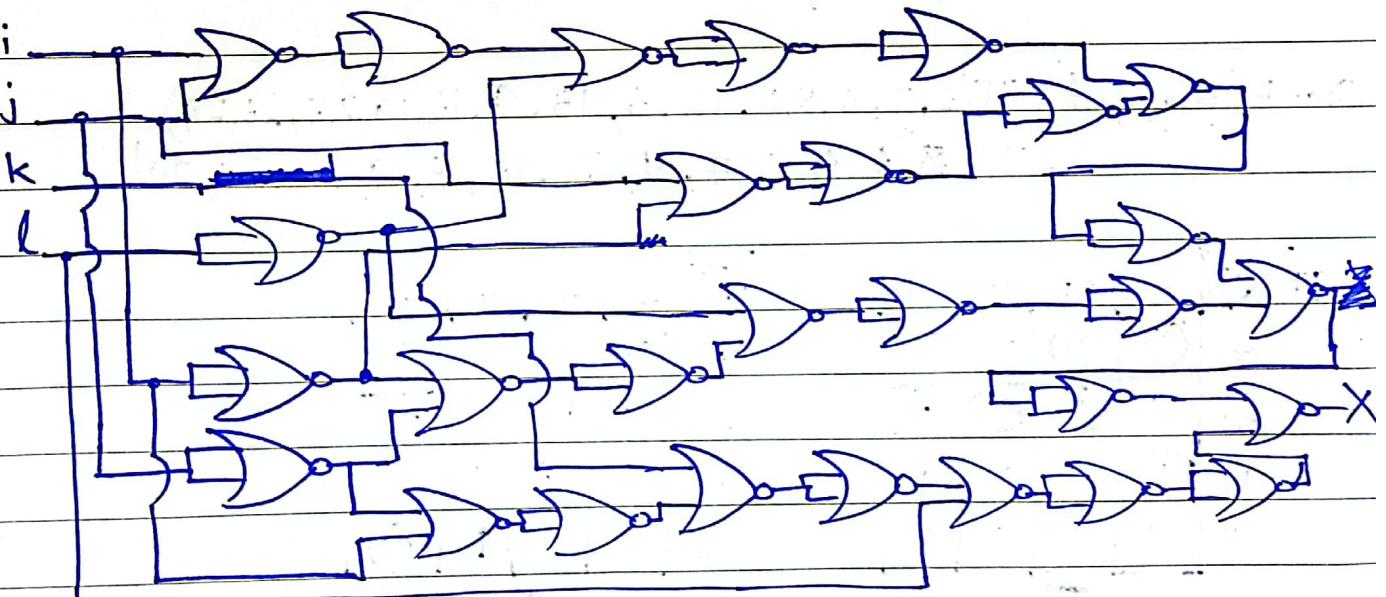
ij	kl	00	01	11	10
00	1	0	0	1	1
01	0	1	1	1	1
11	1	0	0	1	1
10	0	0	0	0	1

$$(i + \bar{j} + k + l)$$

$$(i+j+\bar{l})(\bar{i}+\bar{j}+\bar{l})(\bar{i}+j)(\bar{i}+k+\bar{l})(\bar{i}+\bar{k}+\bar{l})(i+\bar{l})(\bar{i}+j+l)$$

Prime Implicants

Essential: $(i+j+\bar{l})$, $(\bar{i}+\bar{j}+\bar{l})$, $(\bar{i}+j)$, $(i+\bar{j}+k+l)$



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$$Q8: F(a,b,c,d,e) = \sum(3, 7, 6, 5, 0, 12, 13, 13, 11, 17, 23, 27, 30)$$

$$= \sum(0, 3, 5, 6, 7, 11, 12, 13, 17, 23, 27, 30)$$

		abc		de				bc		de			
		00	01	11	10			00	01	11	10		
a	b	c	d	e		a	b	c	d	e			
00	1	0	1	0		00	0	1	0	0			
01	0	1	1	1		01	0	0	1	0			
11	1	1	0	0		11	0	0	0	1			
10	0	0	1	0		10	0	0	1	0			

Circuit on next page

$$\text{Prime Implicants: } \bar{a}\bar{b}cde + \bar{a}bcd + \bar{a}\bar{c}\bar{d}e + \bar{a}\bar{b}de + \bar{a}\bar{b}cd + a\bar{b}\bar{c}\bar{d}e + a\bar{b}cde + a\bar{b}cd + a\bar{b}\bar{c}de$$

E Essential Same as prime.

$$Q9: F(p,q,r,s,t) = \prod(1, 7, 6, 5, 0, 12, 6, 18, 4, 16, 19, 27, 26, 29)$$

$$= \prod(0, 1, 5, 6, 7, 9, 12, 16, 18, 19, 27, 26, 29)$$

		qr		st				qr		st			
		00	01	11	10			00	01	11	10		
p	q	r	s	t		p	q	r	s	t			
00	0	0	1	1		00	0	1	1	1			
01	1	0	0	0		01	1	1	0	0			
11	0	1	1	1		11	1	0	1	1			
10	1	0	1	1		10	1	1	0	0			

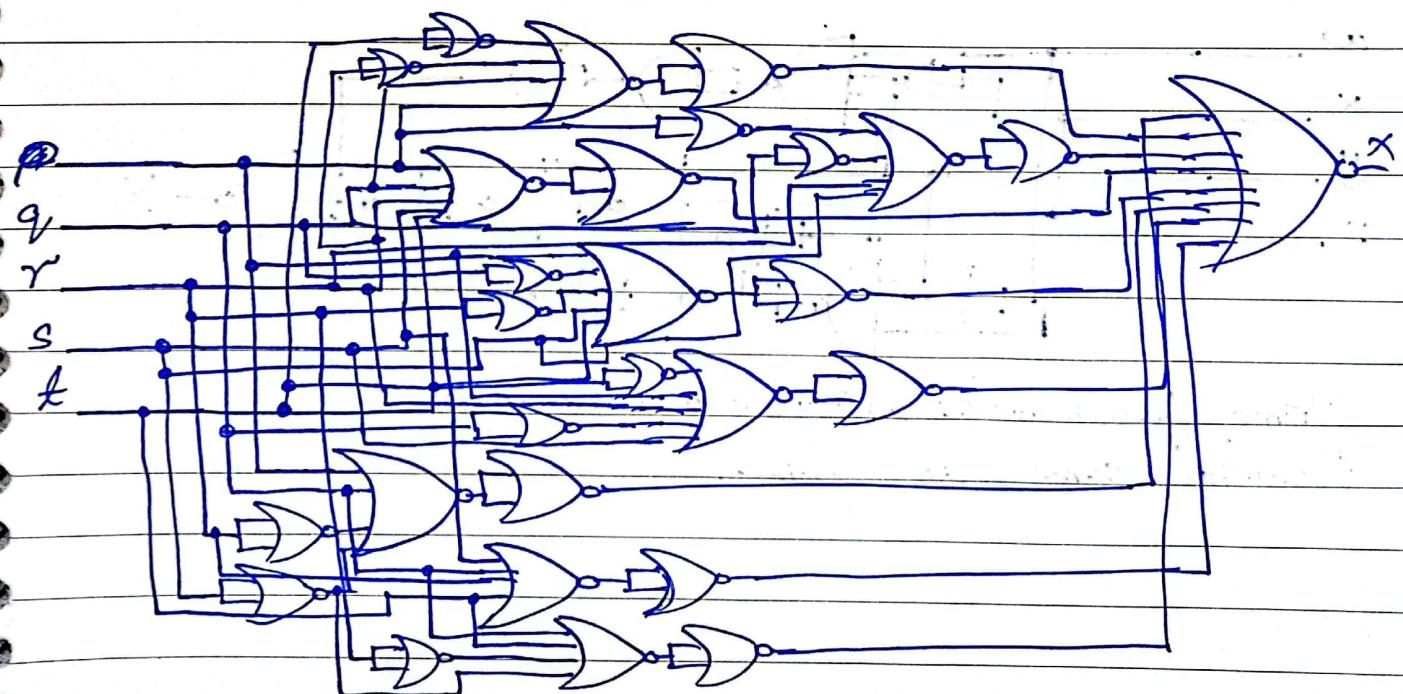
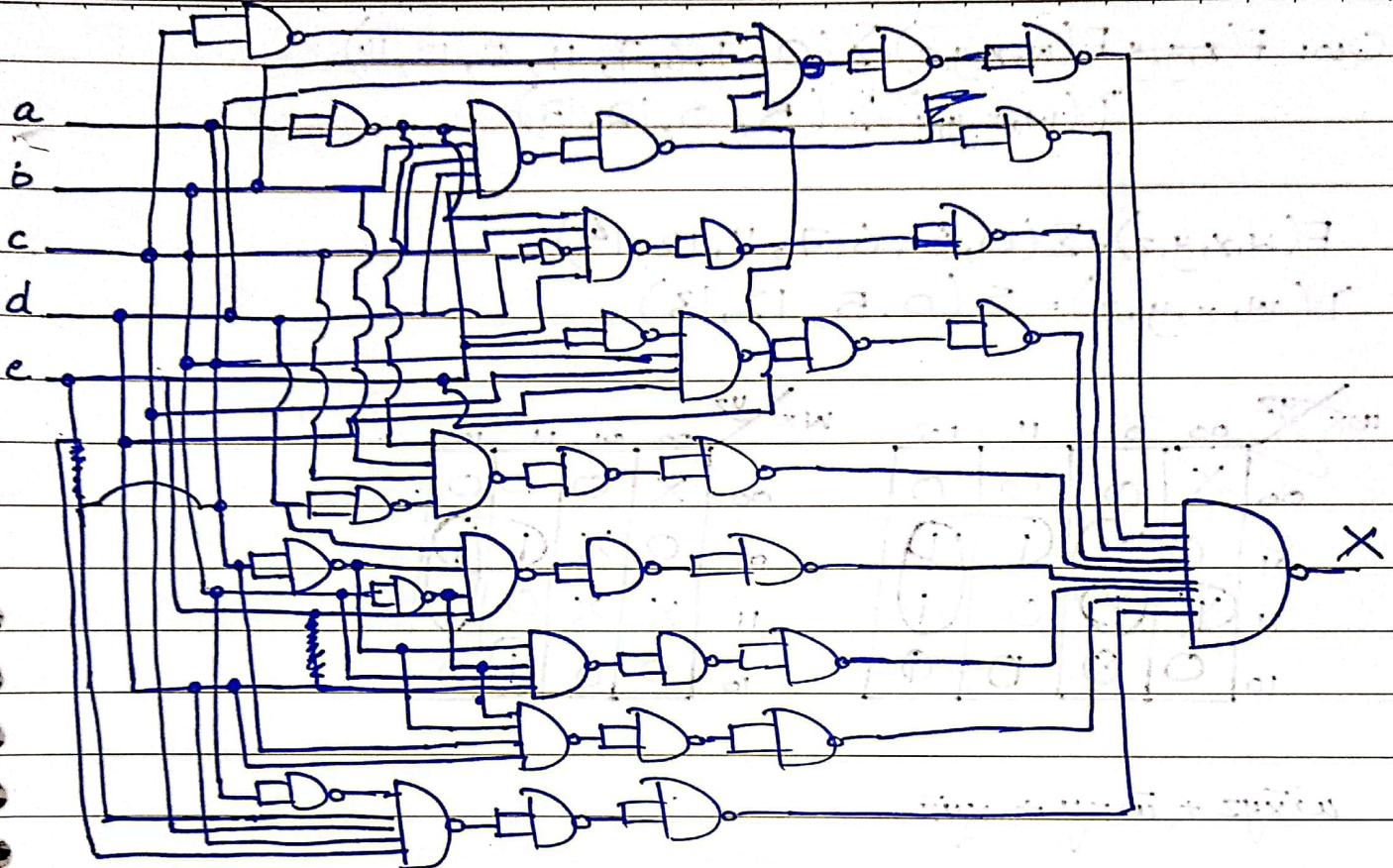
$$\text{Prime Implicants: } \cancel{(p+q+r+s)}(p+q+\bar{r}+\bar{t})(p+q+\bar{r}+\bar{s})$$

$$(p+\bar{q}+\bar{r}+s+t) \neq (p+\bar{q}+r+s+\bar{t})(pq+qr+st)(q+\bar{r}+\bar{s}+\bar{t})$$

$$(\bar{p}+\bar{q}+\bar{r}+s+\bar{t}) + (\bar{p}+\bar{q}+r+\bar{s})$$

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Circuit Q8



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Q10: ~~Q10~~

$$F(x,y,z) = F(w,x,y,z) = \sum(0, 1, 6, 7, 11, 12, 14)$$

$$D(w,x,y,z) = \sum(5, 0, 12, 13)$$

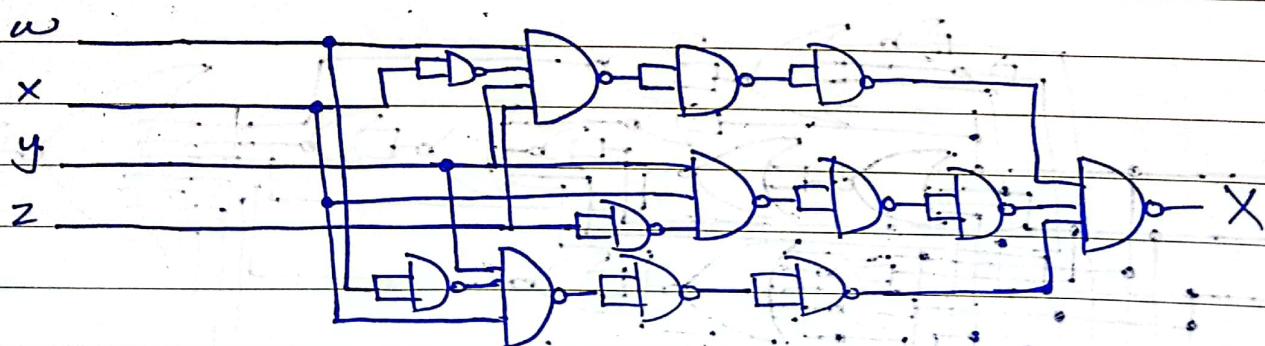
$$F(w,x,y,z) = \sum(0, 5, 6, 7, 11, 12, 14)$$

$$D(w,x,y,z) = \sum(0, 5, 12, 13)$$

wx\yz	00	01	11	10
00	X	0	0	0
01	0	X	1	1
11	X	X	0	1
10	0	0	0	0

wx\yz	00	01	11	10
00	X	0	0	0
01	0	X	1	1
11	X	X	0	1
10	0	0	1	0

$$\bar{w}\bar{x}yz + \bar{w}xy + xy\bar{z}$$



$$\text{Prime Implicants: } \bar{w}\bar{x}yz + \bar{w}xy + xy\bar{z}$$

Essential same as prime.

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Q11. $F(w, x, y, z) = \overline{\Pi}(1, 5, 0, 7, 11, 12, 14) \quad \Pi(0, 1, 5, 7, 11, 12, 14)$
 $D(w, x, y, z) = \sum(7, 6, 9, 10, 11) \quad \Sigma(6, 7, 9, 10, 11)$

wx\yz	00	01	11	10
00	0	0	1	1
01	1	0	X	X
11	0	1	1	0
10	1	X	X	X

$$(w+x+y)(w+y+\bar{z})(w+\bar{x}+\bar{z})(\bar{w}+\bar{x}+z)$$

