

KULVIR SINGH

19 BCE 2074

I (i)  $(67 \cdot 24)_8 - (?)_2$

$$(67 \cdot 24)_8$$

$$= (110111 \cdot 010100)_2$$

(ii)  $(11100 \cdot 1001)_2 - (?)_{11}$

$$\begin{array}{r} 00011100 \cdot 1001 \\ \hline 1 \quad 10 \quad 9 \end{array}$$

(iii)  $(BC1 \cdot 30)_{11} - (?)_{10}$

$$(BC1 \cdot 30)_{11}$$

$$= 1101 \cancel{1} 1000001 \cdot 00110000$$

$$= (110111000001 \cdot 0011)_2$$

(iv)  $(10111 \cdot 0111)_2 - (?)_8$

$$\begin{array}{r} 010111 \cdot 011100 \\ \hline \end{array}$$

$$27 \cdot 34$$

$$(27 \cdot 34)_8$$

$$(67 \cdot 67)_8 \rightarrow (?)_{10}$$

$$\begin{aligned}
 & 67 \cdot 67 \\
 & = 8^1 \times 6 + 8^0 \times 7 + 6 \times 8^{-1} + 7 \times 8^{-2} \\
 & = 8 \times \cancel{6} + 7 \times 1 + \frac{6}{8} + \frac{7}{64} \\
 & = 48 + 7 + 0.75 + 0.109 \\
 & = (55.859)_{10}
 \end{aligned}$$

$$(vi) (10110 \cdot 0101)_2 \rightarrow (?)_{10}$$

$$\begin{aligned}
 & 10110 \cdot 0101 \\
 & = 2^4 \times 1 + 0 \times 2^3 + 2^2 \times 1 + 2^1 \times 1 + 2^0 \times 1 + 0 \times 2^{-1} + 1 \times 2^{-2} + \\
 & \quad 2^{-3} \times 0 + 2^{-4} \times 1 \\
 & = 16 + 4 + 2 + \frac{1}{4} + \frac{1}{16} \\
 & = (20.3125)_{10}
 \end{aligned}$$

$$(vii) (\cancel{97+4})_{10} (155)_{10} \rightarrow (?)_2$$

2	155	R
2	77	1
2	38	1
2	19	0
2	9	1
2	4	1
2	2	0
2	1	0

$$(10011011)_2$$

$$(vii) (9714)_{10} \rightarrow (?)_8$$

8	9	7	1	4	R
8	1	2	1	4	2
8	1	5	1	4	L
8	1	1	8	7	T
8	1	2	2	2	↑
100	2	7			

$(22762)_8$

$$(ix) (\text{DEAD.BEE})_{16} \rightarrow (?)_8$$

~~111101~~

~~10100~~

~~(00110111010101101101110110)2~~

1 5 7 2 5 5 . 5 7 5 6

$(157255.5756)_8$

$$(x) (\text{DEAD.BEE})_{16} \rightarrow (?)_2$$

D E A D . B E E  $\leftarrow (331)$   $\leftarrow (\text{DEAD.BEE})$   
 $\Rightarrow (110111010101101101111101110)_2 \leftarrow \text{Ans.}$

$$2. \text{ a) } ABC(A'BC' + AB'C + A'B'C)$$

$$:= (ABC)(A'BC') + (ABC)(AB'C) + (ABC)(A'B'C)$$

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

$$= A \cdot B \cdot 0 + A \cdot 0 \cdot C + 0 \cdot B \cdot C$$

$$= 0 + 0 + 0$$

$$= 0$$

$$\text{b) } XY(X'YZ' + XY'Z' + X'Y'Z)$$

$$= (X \cdot X')(Y \cdot Y) \cdot Z' + (X \cdot X)(Y \cdot Y')(Z') + (X \cdot X')(Y \cdot Y') \cdot Z'$$

$$= 0 \cdot Y \cdot Z' + X \cdot 0 \cdot Z' + 0 \cdot 0 \cdot Z'$$

$$= 0 + 0 + 0$$

$$= 0$$

$$\text{c) } XY + XY'Z' + XY'Z + XYZ$$

$$= XY + XY'Z' + XYZ$$

$$= XY(1 + Z + Z')$$

$$= XY \cdot 1$$

$$= XY$$

a) 184

+ 576

760

0001 1000 00100

0101 0111 0110

0110 1111 1010

0110

0111 0000 0000

0110

0111 0110 0000

7 6 0

(760) ← Ans.

b) 60

+ 55

115

0110 0000

0101 0101

1011 0101

0110

0001 0001 0101

1 1 1 5

(115) ← Ans.

$$\begin{array}{r} 3475 \\ 1353 \\ \hline 4828 \end{array}$$

$$\begin{array}{r}
 0011\ 0100\ 0111\ 0101 \\
 0\ 001\ 0011\ 0101\ 0011 \\
 \hline
 0100\ 0111\ 1100\ 1000
 \end{array}$$

0110  
 0100 1000 0010 1000  
 4 8 2 8

$(4828) \rightarrow \underline{\text{Ans}}$

a) 5.982

$$982 \rightarrow 9.999$$

5.982

$$\underline{4.017} \rightarrow 9'$$

+ 1

$$\underline{\underline{5.017}} \rightarrow 10'$$

b) 9207

9999

9207

$$\underline{792} \rightarrow 9'$$

+ 1

$$\underline{\underline{793}} \rightarrow 10'$$

c) 98127634

99999999

98127634

$$\underline{1872365} \rightarrow 9'$$

+ 1

$$\underline{\underline{1872366}} \rightarrow 10'$$

1000000

d) 72049900

99999999

72049900

$$\underline{7950099} \rightarrow 9'$$

+ 1

$$\underline{\underline{7950100}} \rightarrow 10'$$

c) 00000000

$$\begin{array}{r} 9999999 \\ - 0000000 \\ \hline 9999999 \\ + \quad \quad \quad 1 \\ \hline 10000000 \end{array} \rightarrow 10's$$

d) 10011100

$$\begin{array}{r} 11111100 \\ - 10011100 \\ \hline 11000110 \end{array} \rightarrow 1's$$
  
$$\begin{array}{r} + \quad \quad \quad 1 \\ \hline 1100100 \end{array} \rightarrow 2's$$

e) 10011101

$$\begin{array}{r} 11111101 \\ - 10011101 \\ \hline 1100010 \end{array} \rightarrow 1's$$
  
$$\begin{array}{r} + \quad \quad \quad 1 \\ \hline 10011001 \end{array} \rightarrow 2's$$

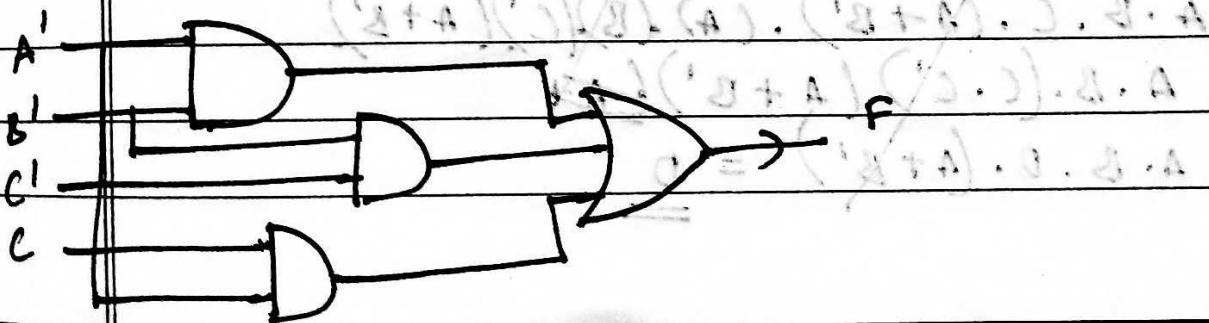
c) 10101000

$$\begin{array}{r}
 11111111 \\
 10101000 \\
 \hline
 1010111 \rightarrow 1's \\
 + 1 \\
 \hline
 1011000 \rightarrow 2's
 \end{array}$$

d) 10000000

$$\begin{array}{r}
 11111111 \\
 10000000 \\
 \hline
 1111111 \rightarrow 1's \\
 + 1 \\
 \hline
 10000000 \rightarrow 2's
 \end{array}$$

$$\begin{aligned}
 6g) \quad & AB'C' + A'B'C' + A'BC' + A'B'C \\
 & = (A+A') \cdot B'C' + A'BC' + A'B'C \\
 & = B'C' + A'BC' + A'B'C \\
 & = B'(C'+A'C) + A'BC' \\
 & = B'(C'+A') \cdot (C'+C) + A'BC' \\
 & = B'(C'+A') \cdot 1 + A'BC' \\
 & = B'C' + B'A' + A'BC' \\
 & = B'C' + A'(B'+BC) \\
 & = \cancel{B'C'} + A'(B'+B) \cdot (B'+C) \\
 & = (A+B+C) \cdot B'C' + A' \cdot 1 \cdot (B'+C) \\
 & = B'C' + A'B' + A'C = F. (A+B)
 \end{aligned}$$



$$b) A'B'C + AD'C + A'B'C + ABC' + AB'C' + A'BC' + A'B'C'$$

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

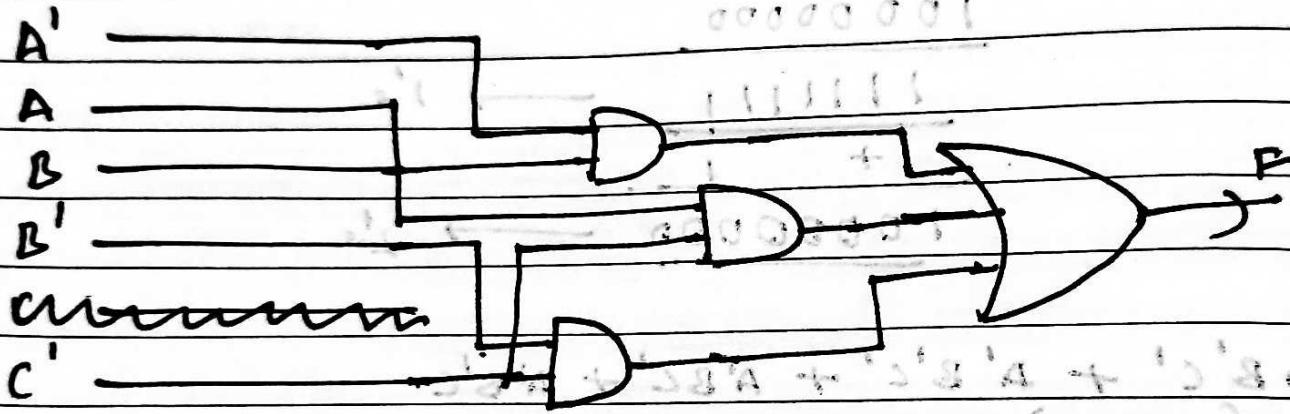
$$= A'B'C + AD'C + ABC' + (A + A'), B'C' + A'BC'$$

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

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

$$= A'B \cdot 1 + B'C' + AC'(1)$$

$$= A'B + B'C' + AC' = P$$



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

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

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

$$= ((A \cdot A + A \cdot B + A \cdot C) + AB' + B \cdot B' + CB' + AC' + BC' + CC') \cdot (AA + BA + C'A + AB' + BB' + C'B' + AC + BC + CC')$$

$$= ((A + AB + AC) + AB' + 0 + (B' + AC' + BC' + 0)) \cdot (AA + AB + AC' + AB' + 0 + CB' + AC + BC + 0)$$

$$\Rightarrow (A \cdot 1 + B) + AC + AB' + CB' + AC' + BC'$$

$$= (A(1) + B + C + B' + C') \cdot (A(1) + B + C' + B' + C) + C'B' + BC$$

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

$$= (A + BC + C'B') \cdot A + (A + BC + C'B') \cdot CB' + (A + BC + C'B') \cdot BC'$$

$$= A \cdot A + ABC + AC'B' + ACB' + BB'C'C + C'B'C'B' + A'BC' + BCBC' + C'B'C'B'$$

$$= A(1) + BC + B'C' + (B' + BC') + C + B' + B + C' + C$$

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

$$= A + 1 + 1$$

$$= \underline{1}$$

	x	y	z	$xy + z$	$x'$	$y'$	$z'$	$x'y'z'$	$xy_2 + x'y_2$
0	0	0	0	0	1	1	1	1	0
0	0	1	0	0	1	1	0	0	0
0	1	0	0	0	1	1	0	0	0
0	1	1	0	0	1	0	0	0	0
1	0	0	0	0	0	1	1	0	0
1	0	1	0	0	0	1	0	0	0
1	1	0	0	0	0	0	1	0	0
1	1	1	0	1	0	0	0	0	0

	A	B	C	$A'$	$B'$	$A+B$	$A+C$	$A'+B'$	$(A+B)(A+C)X(A'+B')$
0	0	0	0	1	1	0	0	1	0
0	0	1	0	1	1	0	0	0	0
0	1	0	1	0	0	1	0	0	0
0	1	1	0	1	0	1	1	0	0
1	0	0	0	0	1	1	0	1	1
1	0	1	0	1	0	1	1	1	1
1	1	0	0	0	0	1	0	0	0
1	1	1	0	0	0	1	1	0	0

	A	B	C	$AB$	$AC$	$AB+AC$
0	0	0	0	0	$(0+0) + (0+0) + A$	=
0	0	1	0	0	$0 + 0 + A$	=
0	1	0	0	0	0	=
0	1	1	0	0	0	=
1	0	0	0	0	0	=
1	0	1	0	1	1	=
1	1	0	1	0	1	=
1	1	1	1	1	1	=

$$\begin{aligned}
 8a) \quad F(A, B, C) &= (A' + B) \cdot \cancel{C} \cdot (B' + C) \\
 &= (0 + A' + B) \cdot (0 + B' + C) \\
 &\quad * \quad \cancel{C} \text{ (QD)} \\
 &= (C C' + A' + B) \cdot (A A' + B' + C) \\
 \underline{\text{Maxterms}} \quad &= (A' + B + C) (A' + B + C') (A + B' + C) (A' + B' + C)
 \end{aligned}$$

$$F = \pi(0, 4, 5, 2, 6)$$

~~(0, 2, 4, 5, 6)~~

$$F' = \pi(0, 1, 3, 7)$$

$$= M_0 \cdot M_1 \cdot M_2 \cdot M_7$$

$$\begin{aligned}
 F = (F')' &= m_0 + m_1 + m_3 + m_7 \\
 &= \sum(0, 1, 3, 7)
 \end{aligned}$$

$$\underline{\text{Minterms}} = \overline{A'B'C'} + A'B'C + A'BC + ABC$$

$$b) \quad F(x, y, z) = 1$$

$$= \cancel{(x+x')} \cdot \cancel{(y+y')} \cdot \cancel{(z+z')}$$

$$= (x'y + x'y' + x'y + x'y') \cdot (z + z')$$

$$\begin{aligned}
 \underline{\text{Minterms}} &= xyz + xy'z + x'yz + x'y'z + xyz' + \\
 &\quad x'y'z' + x'yz' + x'y'z
 \end{aligned}$$

$$\underline{\text{Maxterms}} = \underline{\text{None}}$$

$$i) f(A, B, C) = AB + \cancel{AC} + AC$$

$$= AB + AC$$

$$\begin{aligned}f(A, B, C) &= AB(b) + A(c') \cdot c \\&= AB(c+c') + A(B+B') \cdot c \\&= AB + ABC' + ABC + AB'C\end{aligned}$$

$$\text{Minterms} = ABC + ABC' + AB'C$$

$$F = \sum(7, 6, 5)$$

$$F' = \sum(0, 2, 1, 3, 4)$$

$$= m_0 + m_1 + m_2 + m_3 + m_4$$

$$F = (F')' = M_0 \cdot M_1 \cdot M_2 \cdot M_3 \cdot M_4$$

$$= \prod(0, 1, 2, 3, 4)$$

$$\text{Maxterms} = \frac{(A+B+C)}{(A'+B+C)} \cdot \frac{(A+B+C')}{(A+B'+C)} \cdot \frac{(A+B'+C')}{(A+B'+C)}$$

$$9g) F(A, B, C, D, E) = \sum(0, 1, 4, 5, 16, 17, 21, 25, 29)$$

	C'D'E'	C'D'E	C'DE	C'DE'	CDE'	CDE	C'D'E	C'D'E'
AB\CD	000	001	011	010	110	111	101	100
A'B'	00	1	1	0	0	0	1	1
A'B	01	0	0	0	0	0	0	0
AB	11	0	1	0	0	0	1	0
AB'	10	1	1	0	0	0	1	0

$$F = A'B'D' + B'C'D' + AC'D'E + ACD'E \quad \leftarrow \text{Ans}$$

96)  $F(w, x, y, z) = x'z + w'xy' + w(x'y + xy')$

$$= x'z + w'xy' + wxy' + wxy'$$
$$= x'z + (w' + w)xy' + wxy'$$
 ~~$= x'z + xy' + wxy'$~~

~~8/1~~  
10a)

$$F(x, y, z) = \prod (0, 1, 4, 5)$$

$$= M_0, M_1, M_4, M_5$$

$x \swarrow yz \quad yz' \quad y'z' \quad y'z$

$x$	$yz$	$yz'$	$y'z'$	$y'z$
$z$	0, 0			1
$x'$	0	0	1	0

$\underline{y} \rightarrow \text{Ans}$

b)  $F(\omega, \pi, y, z) = \overline{\prod} (1, 2, 5, 7, 13, 15)$

$\omega x$	$yz$	$yz'$	$y'z'$	$y'z$
$\omega + x$	0	0, 0		1
$\omega + x'$	1	0, 0		0
$(5 + \omega)x$	0	0, 0		1
$\omega x'$	1	0, 0		0

Quad I :  $\omega + z'$

Quad II :  $\pi' + z'$

$$\therefore (\omega + z'). (\pi' + z')$$

$$11) f(A, B, C, D, E, F, G) = \sum(20, 28, 52, 60)$$

	A	B	C	D	E + F + G	
20	5	4	3	2	1, 0, 1, 0, 0	
	$2^4$	$2^2$			$\rightarrow 20$	
	$2^4$	$2^3$	$2^2$		$\rightarrow 28$	
	$2^5$	$2^4$	$2^2$		$\rightarrow 52$	
	$2^5$	$2^4$	$2^3$	$2^2$	$\rightarrow 60$	

20. 0 0 1 0 1 0 0

28. 0 0 1 0 0 1 0 0 (1,0)

52. 0 1 0 1 0 1 0 (0,0)

60. 0 1 0 1 1 0 0 (1,0)

(20, 28)  $\rightarrow$  0 0 0 0 1 - 1 0 0 1 0 1 0 0

(20, 52)  $\rightarrow$  0 1 0 - 1 0 1 0 0 1 0 0 0 1

(52, 60)  $\rightarrow$  0 0 0 1 0 1 1 - 1 0 0 1 0 1 0 1

1 0 1 0 - (1,0) 1 0 0 1 1

(20, 28, 52, 60)  $\rightarrow$  0 - 1 - 1 0 0 0 1 1 1

F = ~~A' B' C' D'~~ A' C E F G'  $\rightarrow$  Prime Implicants

1 0 1 - 1 (P1, P2)

1 0 - 1 1 (P3, P4)

Essential Prime Implicants

$$F = A' C E F' G'$$

A' C E F' G'	20	28	52	60
(20, 28, 52, 60)	x	x	x	x

$$F = A' C E F' G'$$

$$11.5) F(A, B, C, D, E, F, G) = \sum (20, 28, 29, 52, 60, 102, 103, 127)$$

20	0	0	1	0	1	0	0
28	0	0	1	1	1	0	0
29	0	1	0	0	1	1	0
52	0	1	1	0	1	0	0
60	0	1	1	1	1	0	0
102	1	1	0	0	1	0	0
103	1	1	0	0	1	0	1
127	1	1	1	1	1	0	1

20	0	0	1	0	1	0	0
28	0	0	1	1	1	0	0
29	0	1	0	0	1	1	0
52	0	1	1	0	1	0	0
102	1	1	0	0	1	0	0
39	0	1	0	0	1	1	1
60	0	1	1	1	1	0	0
103	1	1	0	0	1	0	1
127	1	1	1	1	1	0	1

$\Rightarrow A \& C \& D \& E \cdot F' \cdot G$

$$(20, 28) \quad 0 \quad 0 \quad 1 \quad -1 \quad 0 \quad 0$$

$$(20, 52) \quad 0 \quad -1 \quad 0 \quad 1 \quad 0 \quad 0$$

$$(28, 60) \quad 0 \quad -1 \quad 1 \quad 1 \quad 0 \quad 0$$

$$(29, 52) \quad 0 \quad 1 \quad 0 \quad 0 \quad 1 \quad 1 \quad - \quad \Rightarrow A' \& C' \& D' \& E \& F$$

$$(52, 60) \quad 0 \quad 1 \quad 1 \quad -1 \quad 0 \quad 0$$

$$(102, 103) \quad 1 \quad 1 \quad 0 \quad 0 \quad 1 \quad 0 \quad - \quad \Rightarrow A \& C' \& D' \& E \& F'$$

$$\begin{array}{l} (20, 28, 52, 60) \Rightarrow 0 - 1 - 100 \Rightarrow A' C E F' G' \\ (20, 52, 28, 10) \Rightarrow 0 - 1 - 100 \Rightarrow A' C E F' G' \end{array}$$

Prime Implicants

$$F = ABCDEF'G + A' C E F' G' + A' B C D' E F + A B C' D' E F'$$

Essential Prime Implicants.

	20	28	38	52	60	102	103
$A B C D E F' G$	122			0010011			
$A' C E F' G'$	20, 28, 52, 60	*	*	1010011	*		
$A' B C' D' E F'$		38, 39		1011111			
$A B C' D' E F'$		102, 103		0010110	*		
				0011100			
				0010110			

Ans:  $F = ABCDEF'G + A' C E F' G' + A B C' D' E F + A B C' D' E F'$