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(2) $568.23 \rightarrow 5\times10^2 + 6\times10 + 8\times10^0 + 2\times10^{-1} + 3\times10^{-2}$

(3) (a) $37 \rightarrow$

2	37	
2	18	1
2	9	0
2	4	1
2	2	0
	1	0

100101

(b) $0.625 \rightarrow$ $0.625\times2 \rightarrow 1.250$ 1

$0.250\times2 \rightarrow 0.50$ 0

0.101 $0.50\times2 \rightarrow 1.00$ 1

(c) 25.15625

2	25	
2	12	1
2	6	0
2	3	0
	1	1

11001

$0.15625\times2 \rightarrow$

0.31250 0

$0.3125\times2 \rightarrow$

0.625 0

$0.625 \rightarrow 101$

$\therefore 25.15625 \rightarrow \boxed{11001.00101}$

(4) Range $\rightarrow$ ~~-2^8 to 2^8~~

0 to $2^{n}-1$

$0 - 2^8-1$

~~0 to 255~~

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(5) Binary to decimal

(a) $11011 \rightarrow 1+2+8+16 \rightarrow 27$

(b) $10110101 \rightarrow \cancel{1+4+8+32+128}$ $128+32+16+4+1$

$\cancel{173}$ 181

(c) $1101101 \rightarrow 1+2+16+32+128$

179

(d) $10101.1011 \rightarrow 1+4\cancel{8}+16+\frac{1}{2}+\frac{1}{8}+\frac{1}{16}$

$\rightarrow 21.6875$

(e) $0.1101 \rightarrow \frac{1}{2}+\frac{1}{4}+\frac{1}{16} \Rightarrow 0.8125$

(d) $10.101 \rightarrow 2+\frac{1}{2}+\frac{1}{8} \Rightarrow 2.625$

(6) Decimal to Octal

(a) 266 →

2	266	
2	133	0
2	66	1
2	33	0
2	16	1
2	8	0
2	4	0
2	2	0
2	1	0
		0

100001010

↓

binary

412 octal.

(b) $(127)_{10} \rightarrow (1\,111\,111)_2$

177 octal

(c) 0.5625

0.5625×2	$\rightarrow 1.1250$	1
0.1250×2	$\rightarrow 0.25$	0
0.25×2	$\rightarrow 0.5$	0
0.5×2	$\rightarrow 1$	1

$(0.1001)_2$

0.44

(d) 89.16257

		2	89		
$0.16257 \times 2 \rightarrow 0.32514$	0	2	44	1	
$0.32514 \times 2 \rightarrow 0.65028$	0	2	22	0	1011001
$0.65028 \times 2 \rightarrow 1.30056$	1	2	11	0	
$0.30056 \times 2 \rightarrow 0.60112$	0	2	5	1	
$0.60112 \times 2 \rightarrow 1.20224$	1	2	2	1	
			1	0	

1 011 001 . 001 0

131.10

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(7) Decimal to hexa

(a) 829 → $(11\,0011\,1101)_2$

33D

(b) 778.7625 → $(1100001010)_2$ → 778.

0.7625 × 2 1.525 1

1.05 1

0.1 0

0.2 0

0.4 0

0.8

∴ $(1100001010.1100)_2$

binary

$\underbrace{11}\,\underbrace{0000}\,\underbrace{1010}\,.\underbrace{1100}$

30A.C

(c) 423 → $(1\,1010\,0111)$

1 A 7

1A7

(d) 2598.675 → (101000100110)

0.675 × 2 → 1.35 1

0.7 0

1.4 1

0.8 0

$\underbrace{1010}_{A}\,\underbrace{0010}_{2}\,\underbrace{0110}_{6}\,.\underbrace{1010}_{A}$ A26.A

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(8) hexa to decimal

a) $2A5 \rightarrow (0010\,1010\,0101)_2$

$\downarrow$

$(677)_{10}$ decimal

b) $0.F1C \rightarrow (0.1111\,0001\,1100)_2$

$\downarrow$ 15 $\downarrow$ 12

$$\frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + \frac{1}{2^4} + \frac{1}{2^8} + \frac{1}{2^9} + \frac{1}{2^{10}}$$

$\rightarrow 0.9443$

c) $EF.B1 \rightarrow 11101111.10110001$

$(239)_{10}$ $\frac{1}{2} + \frac{1}{2^3} + \frac{1}{2^4} + \frac{1}{2^8}$

$(239.0691)_{10}$ decimal

d) $0.9D9 \rightarrow 0.1001\,1101\,1001$

$$= \frac{1}{2} + \frac{1}{2^4} + \frac{1}{2^5} + \frac{1}{2^6} + \frac{1}{2^8} + \frac{1}{2^9} + \frac{1}{2^{12}}$$

$= 0.61547851$5

e) $BBC.10 \rightarrow 101110111100.00010000$

$3004 + 1/2^4$

3004.0625

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Octal → decimal

(9) (a) 755

→ $(111101101)_2$

→ binary → $(477)_{10}$ decimal

(b) 0.24

→ $(0.010100)_2$

→ binary → $\frac{1}{2^2} + \frac{1}{2^4}$

⇒ 0.25 + 0.0625

$(0.3125)_{10}$ decimal

(c) $(146.21)_8$

→ $(1100110.010001)_2$

⇓

$(102.265625)_{10}$

(d) $(4057.06)_8$

→ $(100000101111.00011)_2$

⇓

$(2095.09375)_{10}$

(10) Binary → Hexa

a) $\underbrace{10}\underbrace{1101}\underbrace{1011}$ → $(2DB)_{16}$

b) $\underbrace{110}\underbrace{1110}\underbrace{1100}$ → $(6EC)_{16}$

c) $\underbrace{101}\,\underbrace{0100}.\underbrace{1011}\,\underbrace{0100}$ → $(54.B4)_{16}$

d) $\underbrace{0010}\underbrace{1111}\underbrace{1011}.\underbrace{0111}\underbrace{1100}$ → $(2FB.7C)_{16}$

(11) Hexa → Binary

a) 4BAC → $(01001011.10101100)_2$

b) 29A6 → $(0010\ 1001\ 1010\ 0110)_2$

c) DC5A.3E4 → $(1101110001011010.001111100100)_2$

d) 3A9E.B0D → $(0011101010011110.101100001101)_2$

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(12) Hexa → Octal

(a) $(B9F.AE)_{16} \rightarrow (101110011111.10101110)_2$

$(5637.534)_8$

(b) $(27A9)_{16} \rightarrow (0010011110101001)_2$

$(23651)_8$

(c) $(85C.BD3)_{16} \rightarrow (100001011100.101111010011)$

$(4134.5723)_8$

(13) Octal → Hex

(a) $(3562)_8 \rightarrow (011101110010)_2$

$(772)_{16}$

(b) $(4567.266)_8 \rightarrow (100101110111.010110110)_2$

$(977.5B0)_{16}$

(c) $(756.603)_8 \rightarrow (111101110.110000011)_2$

$\Rightarrow (1EE.C18)_{16}$

(14) Binary → Octal

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(a) $(101111)_2 \longrightarrow (57)_8$

(b) $(011010111)_2 \longrightarrow (327)_8$

(c) $(1000100.100110011)_2 \longrightarrow (104.463)_8$

(d) $(001010101101.111011100)_2 \longrightarrow (1255.734)_8$

15 Octal → Binary

(a) $(46)_8 \rightarrow (100110)_2$

(b) $(407)_8 \rightarrow (100000111)_2$

(c) $(1256)_8 \rightarrow (001010101110)_2$

(d) $(367.52)_8 \rightarrow (011110111.101010)_2$

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(1) **BCD**

(i) 125
0001 0010 0101

(ii) 156
000101010110

(iii) 98
10011000

(iv) 69
01101001

2421

(i) 125
10001011
0001 00100101

(ii) 156
10111100
0001 01010110

(iii) 98
11111110

(iv) 69
1100 1111
0110

XS-3

(i) 125
010001011000

(ii) 156
010010001001

(iii) 98
11011100

(iv) 69
1001 1101

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(2) BCD → Decimal

(i) 0110 → $(6)_{10}$

(ii) 0001 → $(1)_{10}$

(iii) $\underbrace{0100}\underbrace{0101}$ → $(45)_{10}$

(iv) $\underbrace{1001}\underbrace{1000}$ → $(98)_{10}$

(v) $\underbrace{1000}\underbrace{0111}\underbrace{0000}$ → $(870)_{10}$

(3) (i) 1000 + 0110

$$\begin{array}{r} 1000 \\ +\ 0110 \\ \hline 1110 \end{array}$$

(ii)

$$\begin{array}{r} 00100101 \\ +\ 00100111 \\ \hline 01001000 \end{array}$$

(iii)

$$\begin{array}{r} 01010001 \\ +\ 01011000 \\ \hline 10101001 \end{array}$$

(iv)

$$\begin{array}{r} 10011000 \\ 10010111 \\ \hline 100101111 \end{array}$$

(4)

	7	4	2	1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	1	0	0	0
8	1	0	0	1
9	1	0	1	0

(5)

2421

a) 3864 → 0011 1100 1100 0100

b) 123 → 0001 0010 0011

c) 654 → 0110 0101 0100

d) 468 → 0100 0110 1110

(6) Self complementing are the codes in which, when no. is represented, if 9's complement of the no. is taken in decimal & represented in the code then this representation is 0s & 1s exchanged of the code of original no.

Eg → 123

Code → 0001 1000 1001

9's complement of no. in decimal →

$$\begin{array}{r} 999 \\ 123 \\ \hline 876 \end{array}$$

876 in binary → 1110 0111 0110

123 → 1 0001 1000 1001

876 → 1110 0111 0110

(6) i) 64

→ 10100100

ii) 12

→ 0111 0110

iii) 65

→ 10101011

iv) 46

→ 01001010

(7) (i) $(743210)_8$

$$\begin{array}{r} 777777 \\ 743210 \\ \hline 7's \rightarrow 034567 \end{array}$$

(ii) $(9876123)_{10}$

$$\begin{array}{r} 9999999 \\ 9876123 \\ \hline 9's \rightarrow 0123876 \end{array}$$

(iii) $(12345F)_{16}$

$$\begin{array}{r} FFFFFF \\ -\ 12345F \\ \hline EDCBA0 \end{array}$$

(iv) $(543210)_6$

$$\begin{array}{r} 555555 \\ -\ 543210 \\ \hline 012345 \end{array}$$

(8) If parity codes will have odd no. of 1s then error →

(a) 100110010 → (4) → no error
(b) 011101010 → (5) → Error
(c) 01010101010101010 → (10) → no error

(9) If parity codes will have even no. of 1s then error →

(a) 1110110 → (2) → Error
(b) 00110001 → (3) → No error
(c) 0101010101010101010 → (7) → No error

(10)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
P_1	P_2	1	P_4	1	0	0	P_8	1	0	0	1	0	1	0

$P_1 = XOR(1,1,0,1,0,0,0)$

$= \underline{1}$

$P_2 = XOR(1,0,0,0,0,1,0)$
$= 0$
$P_4 = XOR(1,0,0,1,0,1,0)$
$= 1$
$P_8 = XOR(1,0,0,1,0,1,0)$
(iii) $= 1$

Hamming Code = 1011100110 01010

(ii) (i) 0 000111 01010

1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	1	1	1	0	1	0	1	0
P_1	P_2		P_4				P_8				

$C_1 = XOR(0,0,1,1,1,1)$
$= 0$

$C_2 = XOR(0,0,1,1,0,1)$
$= 1$

$C_4 = XOR(0,1,1,1,0)$
$= 1$

$C_8 = XOR(0,1,0,1,0)$
$= 0$

$C = 0110 = 6$

We have error in 6^{th} bit so corrected data will be
01011010

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(ii) 101110000110

1	2	3	4	5	6	7	8	9	10	11	12
1	0	1	1	1	0	0	0	0	1	1	0
P_1	P_2		P_4				P_8				

C_1 = XOR(1,1,1,0,0,1) = 0
C_2 = XOR(0,1,0,0,1,1) = 1
C_4 = XOR(1,1,0,0,0) = 0
C_8 = XOR(0,0,1,1,0) = 0

C = 0010 = 2

We have error in 2^{nd} bit corrected data will be
11000110

(iii) 101111110100

1	2	3	4	5	6	7	8	9	10	11	12
1	0	1	1	1	1	1	1	0	1	0	0
P_1	P_2		P_4				P_8				

C_1 = XOR(1,1,1,1,0,0) = 0
C_2 = XOR(0,1,1,1,1,0) = 0
C_4 = XOR(1,1,1,1,0) = 0
C_8 = XOR(1,0,1,0,0) = 0

C = 0000 = 0

We have error in no bit.
11110100

(12) (i) 1111

→ 1010

(ii) 0011

→ 0010

(iii) 0101

→ 0110

(iv) 10101010

→ 11001100

(13) (i) 0110

→ 0101

(ii) 0001

→ 0001

(iii) 01000101

→ 01100111

(iv) 10011000

→ 11010100

(v) 100110010

→ 110101011

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(1) $A + \bar{A}.B + A.B = A + B$

Truth Table :-

$\bar{A}$	A	B	$A.B$	$\bar{A}.B$	$A+B$	$A+\bar{A}.B+A.B$
1	0	0	0	1	0	0
1	0	1	0	1	1	1
0	1	0	0	1	1	1
0	1	1	1	0	1	1

(2)

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

Hence proved

(3) Given - $A.\bar{B} + \bar{A}.B = C$ —— (1)

To prove - $A.\bar{C} + \bar{A}.C = B$ —— (2)

Complementing both sides,

$$\overline{A.\bar{B} + \bar{A}.B} = \bar{C}$$
$$(\bar{A}+B).(A+\bar{B}) = \bar{C} \quad \text{—— (3)}$$

Putting eqn (3) in (2)

$\Rightarrow A(\bar{A}+B)(A+\bar{B}) + \bar{A}C = B$

$\Rightarrow A(\cancel{A\bar{A}}^{0} + \bar{A}\bar{B} + BA + \cancel{B\bar{B}}^{0}) + \bar{A}C$

$\Rightarrow A(\bar{A}\bar{B} + BA) + \bar{A}C$

$\Rightarrow \cancel{A\bar{A}\bar{B}}^{0} + ABA + \bar{A}C$

$\Rightarrow AAB + \bar{A}C$ — (4)

Putting value of C from eqn (1) in eqn (4) -

$\Rightarrow AAB + \bar{A}(\bar{A}B + AB)$

$\Rightarrow AAB + \bar{A}AB + \bar{A}B$

$\Rightarrow AB + \bar{A}B$

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

(4) (i) $F(A,B,C) = AB + A\bar{B}C + \bar{A}B\bar{C} + B\bar{C}$

SOP

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

$= B + AC$

POS $(A+B).(B+C)$

(ii) $F(A,B,C,D) = \Sigma(5,6,9,10,11,13,14,15)$

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

SOP → $AC + AD + BC\bar{D} + B\bar{C}D$

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

(iii) $F(A,B,C,D,E) = \Sigma(0,1,2,3,4,5,8,9,10,11)$

A = 0   A = 1

BC \ DE	00	01	11	10
00	1	1	1	1
01	1	0	0	1
11	0	0	0	0
10	1	1	1	1

A=0

BC \ DE				
	0	0	0	0
	0	0	0	0
	0	0	0	0
	0	0	0	0

A=1

SOP → $\bar{A}.(\bar{C}+\bar{B}\bar{E}) = \bar{A}\bar{C} + \bar{A}\bar{B}\bar{E}$

POS → $A.(\bar{B}+\bar{C}).(\bar{C}+\bar{E})$

(iv) $F(A,B,C,D,E) = \Pi(0,1,2,4,5,6,9,11,12,13,14,15)$

BC \ DE	00	01	11	10
00	0	0	1	0
01	0	0	1	0
11	0	0	0	0
10	1	0	0	1

A=0

BC \ DE	00	01	11	10
00	1	1	1	1
01	1	1	1	1
11	1	1	1	1
10	1	1	1	1

A=1

SOP $\Rightarrow$ $A + (\bar{B}DE + B\bar{C}\bar{E}).\bar{A} = (\bar{A}BE + \bar{A}BC + \bar{A}\bar{B}\bar{D} + \bar{D}\bar{B}\bar{E})$

POS $\Rightarrow$ $(B+D+A).(\bar{B}+\bar{E}+A).(\bar{B}+\bar{C}+A).(A+B+E)$

(5) (i) $F(A,B,C,D,E,F) = \sum m(0,1,2,4,5,7,8,9,10,$
$14,15,17,19,20,28,29,34,36,$
$40,41,42,43)$

	list I ABCDEF		list II ABCDEF		list III ABCDEF
0	000000 ✓	(0,1)	00000_ ✓	(0,1,4,5)	000_0_
1	000001 ✓	(0,2)	0000_0 ✓	(0,1,8,9)	00_00_
2	000010 ✓	(0,4)	000_00 ✓	(0,2,8,10)	00_0_0
4	000100 ✓	(0,8)	00_000 ✓	(2,10,34,42)	_0_010
8	001000 ✓	(1,5)	000_01 ✓	(8,9,40,41)	_0100_
5	000101 ✓	(1,9)	00_001 ✓	(8,10,40,43)	_010_0
9	001001 ✓	(1,17)	0_0001	(40,41,42,43)	1010__
10	001010 ✓	(2,10)	00_010 ✓		
17	010001 ✓	(2,34)	_00010 ✓		
20	010100 ✓	(4,5)	00010_ ✓		
34	100010 ✓	(4,20)	0_0100		
36	100100 ✓	(4,36)	_00100		
40	101000 ✓	(8,9)	00100_ ✓		
7	000111 ✓	(8,10)	0010_0 ✓		
14	001110 ✓	(8,40)	_01000 ✓		
19	010011 ✓	(5,7)	0001_1		
28	011100 ✓	(9,41)	0100_1 ✓		
41	101001 ✓	(10,14)	01_100		
42	101010 ✓	(17,19)	10_010		
15	001111 ✓	(20,28)	10100_ ✓		
29	011101 ✓	(34,42)	1010_0 ✓		
43	101011 ✓	(40,41)	10100_ ✓		
		(40,42)	1010_0		

(7,15)	00_111
(14,15)	00111_
(28,29)	01110_
(41,43)	1010_1
(42,43)	10101_

PI Table

Minterms	0	1	2	4	5	7	8	9	10	14	15	17	19	20	28	29	34	36	40	41	42	43
(1,17)		x										x										
(4,20)			,	x										x								
(4,36)				x														x				
(5,7)					x	x																
(10,14)									x	x												
(17,19)												x	x									
(20,28)														x	x							
(14,15)										x	x											
(28,29)															x	x						
(0,1,4,5)	x	x		x	x																	
(0,1,8,9)	x	x				*	x	x														
(0,2,8,10)	x					*	x	*	x													
(2,10,34,42)		x						*	x								x				x	
(8,9,40,41)						*	x	x											x	x		
(8,10,40,42)						*	x	*	x										x		x	
(40,41,42,43)																		*	x	x	x	x

$$F = \bar{A}B\bar{C}\bar{D}F + \bar{A}BCD\bar{E} + \bar{B}\bar{B}E\bar{F} + A\bar{B}C\bar{D}$$
$$+ \bar{A}\bar{B}\bar{D}\bar{E} + \bar{A}\bar{B}CDE + \bar{A}\bar{C}D\bar{E}\bar{F}$$

(ii) $F(A,B,C,D,E,F) = \Sigma m(6,7,8,9) + d(10,11,12,13,14,15)$

list I

	ABCDEF
8	001000 ✓
6	000110 ✓
9	001001 ✓
10	001010 ✓
12	001100 ✓
7	000111 ✓
11	001011 ✓
13	001101 ✓
14	001110 ✓
15	001111 ✓

list II

	ABCDEF
(8,9)	00100_
(8,10)	0010_0
(8,12)	001_00
(6,7)	00011_
(6,14)	00_110
(9,11)	0010_1
(9,13)	001_01
(10,11)	00101_
(10,14)	001_10
(12,13)	00110_
(12,14)	0011_0
(7,15)	00_111
(11,15)	001_11
(13,15)	0011_1
(14,15)	00111_

list III

	ABCDEF
(8,9,10,11)	0010__
(8,9,12,13)	001_0_
(8,10,12,14)	001__0
(6,7,14,15)	00_11_
(9,11,13,15)	001__1
(10,11,14,15)	001_1_
(12,13,14,15)	0011__

list IV

	ABCDEF
(8,9,10,11,12,13,14,15)	001___

PI Table

Minterms.	6	7	8	9	10	11	12	13	14	15
(6,7,14,15)	×	×							×	×
(8,9,10,11,12,13,14,15)			×	×	×	×	×	×	×	×

Essential terms → 00_11_ , 001___

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

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(iii) $F(A,B,C,D,E,F) = \Sigma m(0,1,2,8,9,15,17,21,24,25,27,31)$

list I

	ABCDEF
0	000000
1	000001
2	000010
8	001000
9	001001
17	010001
24	011000
21	010101
25	011001
25	001111
27	011011
31	011111

list II

	ABCDEF
(0,1)	00000_
(0,2)	0000_0
(0,8)	00_000
(8,24)	0_1000
(1,9)	00_001
(1,17)	0_0001
(8,9)	00100_
(9,25)	0_1001
(17,21)	010_01
(17,25)	01_001
(24,25)	01100_
(25,27)	0110_1
(15,31)	0_1111
(27,31)	011_11

list III

	ABCDEF	
(0,8,1,9)	00_00_	$\bar{A}\bar{B}\bar{D}\bar{E}$
(1,9,17,25)	0__001	$\bar{A}\bar{D}\bar{E}F$
(1,17,9,25)	0__001	
(8,9,24,25)	0_100_	$\bar{A}C\bar{D}\bar{E}$

Prime Implecant Table

	0	1	2	8	9	15	17	21	24	25	27	31
(0,2)	X		X									
(17,21)							X	X				
(25,27)										X	X	
(15,31)						X						X
(27,31)											X	X
(0,1,8,9)	X	X		X	X							
(1,9,17,25)		X			X							
(8,9,24,25)				X	X				X			

~~$F = \bar{A}\bar{B}\bar{C}\bar{E}\bar{F} + \bar{A}\bar{B}DF + \bar{A}\bar{B}\bar{D}\bar{E}\bar{F} + \bar{A}CD\bar{E}F + \bar{A}\bar{B}CDF$~~

$f = 0000\_0 + 010\_01 + 0110\_1 + 0\_1111 + 00\_00\_ + 0\_100\_$

$= \bar{A}\bar{B}\bar{C}\bar{D}\bar{F} + \bar{A}B\bar{C}\bar{E}F + \bar{A}BC\bar{D}F + \bar{A}CDEF + \bar{A}\bar{B}\bar{D}\bar{E} + \bar{A}C\bar{D}\bar{E}$

(iv) $F(A,B,C,D,E,F) = \sum m(0,4,12,16,19,24,27,28,29,31)$

	list I ABCDEF	list II	ABCDEF
0	000000	(0,4)	000_00
4	000100	(0,16)	0_0000
16	010000	(4,12)	00_100
12	001100	(16,24)	01_000
24	011000	(12,28)	0_1100
19	010011	(24,28)	011_00
28	011100	(19,27)	01_011
27	011011	(28,29)	01110_
29	011101	(27,29)	011_11
31	011111	(29,31)	0111_1

Since no pairs are grouped, we skip this step and directly make the prime implicant table

Pairs	0	4	12	16	19	24	27	28	29	31
(0,4)	x	x								
(0,16)	x			x						
(4,12)		x	x							
(16,24)				x		x				
(12,28)			x					x		
(24,28)						x		x		
(19,27)					x		x			
(28,29)								x	x	
(27,31)							x			x
(29,31)									x	x

$f = \bar{A}\bar{B}\bar{C}\bar{E}\bar{F} + \bar{A}B\bar{D}F + \bar{A}B\bar{D}\bar{E}\bar{F} + \bar{A}CD\bar{E}\bar{F} + \bar{A}BCDF$

6 (i) $\prod M(1,4,5,11,12,14) \cdot d(6,7,15)$

AB \ CD	00	01	11	10
00	1	0	1	1
01	0	0	x	x
11	0	1	x	0
10	1	1	0	1

SOP

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

(ii) $\prod M(3,6,8,11,13,14) \cdot d(1,5,7,10)$

AB \ CD	00	01	11	10
00	1	x	0	1
01	1	x	x	0
11	1	0	1	0
10	0	1	0	x

POS

$$F = [(A+\bar{D}) \cdot (\bar{B}+\bar{C}+D) \cdot (\bar{B}+C+\bar{D}) \cdot (\bar{A}+B+\bar{C}) \cdot (\bar{A}+B+C+D)]$$