

Problem1: $F(a,b,c) = \sum m(3, 4, 6, 7)$

$$F(a,b,c) = \sum m(3, 4, 6, 7)$$

| a \ bc | 00 | 01 | 11 | 10 |
|--------|----|----|----|----|
| 0 | 0 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 | 1 |

| a \ bc | 00 | 01 | 11 | 10 |
|--------|----|----|----|----|
| 0 | 0 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 | 1 |

$$F(a,b,c) = bc + a \cdot \bar{c}$$

| | | | |
|-----|-----|---|---|
| 000 | 000 | 0 | 0 |
| 001 | 001 | 1 | 1 |
| 010 | 011 | 3 | 3 |
| 011 | 010 | 2 | 2 |
| 100 | 110 | 6 | 6 |
| 101 | 111 | 7 | 7 |
| 110 | 101 | 5 | 5 |
| 111 | 100 | 4 | 4 |

Problem2: $F(a,b,c,d) = \sum m(5, 6, 7, 13, 14, 15)$

| ab \ cd | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | 0 | 1 | 3 | 2 |
| 01 | 4 | 5 | 7 | 6 |
| 11 | 12 | 13 | 15 | 14 |
| 10 | 8 | 9 | 11 | 10 |

$$F(a, b, c, d) = \sum m(5, 6, 7, 13, 14, 15)$$

| ab \ cd | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | | | | |
| 01 | | 1 | 1 | 1 |
| 11 | | 1 | 1 | 1 |
| 10 | | | | |

Diagram showing two groups of 1s circled: a vertical group of four 1s labeled I and a horizontal group of four 1s labeled \bar{I} .

$$I = bd + \bar{b}d$$

$$\bar{I} = bc$$

$$I + \bar{I} = bd + bc$$

$$F(a, b, c, d) = \bar{I} M(5, 6, 7, 13, 14, 15)$$

| ab \ cd | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | | | | |
| 01 | 0 | 0 | 0 | |
| 11 | 0 | 0 | 0 | |
| 10 | | | | |

Diagram showing two groups of 0s circled: a vertical group of four 0s labeled I and a horizontal group of four 0s labeled \bar{I} .

$$F = (\bar{b} + \bar{d}) \cdot (\bar{b} + \bar{c})$$

Problem3: $F(p, q, r, s) = m_0, m_1, m_2, m_4, m_6, m_8, m_{10}, m_{12}, m_{14}$

$$F(p, q, r, s) = m_0, m_1, m_2, m_4, m_6, m_8, m_{10}, m_{12}, m_{14}$$

| | | | | | |
|----|----|----|----|----|----|
| | | rs | | | |
| pq | | 00 | 01 | 11 | 10 |
| | 00 | 1 | 1 | | 1 |
| | 01 | 1 | | | 1 |
| | 11 | 1 | | | 1 |
| | 10 | 1 | | | 1 |

| | | | | | |
|----|----|----|----|----|----|
| | | rs | | | |
| pq | | 00 | 01 | 11 | 10 |
| | 00 | 1 | 1 | | 1 |
| | 01 | 1 | | | 1 |
| | 11 | 1 | | | 1 |
| | 10 | 1 | | | 1 |

$$I = \bar{s}$$

$$II = \bar{p}\bar{q}\bar{r}$$

$$\therefore F(p, q, r, s) = \bar{s} + \bar{p}\bar{q}\bar{r}$$

Five Variable K Maps:

$$F(a, b, c, d, e) =$$

$$\Pi M(0, 2, 8, 10, 16, 18, 24, 26)$$

$a=0$

| bc \ de | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | 0 | 1 | 3 | 2 |
| 01 | 4 | 5 | 7 | 6 |
| 11 | 12 | 13 | 15 | 14 |
| 10 | 8 | 9 | 11 | 10 |

$a=1$

| bc \ de | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | 16 | 17 | 19 | 18 |
| 01 | 20 | 21 | 23 | 22 |
| 11 | 28 | 29 | 31 | 30 |
| 10 | 24 | 25 | 27 | 26 |

Group of 8 (because of overlap & wrapping)

\therefore 3 variables can be eliminated

$a \times b \times c \checkmark d \times e \checkmark$

$c=0, e=0$

$$\therefore F = (c + e) \quad // \text{remember Maxterm}$$

| ab \ cde | 000 | 001 | 011 | 010 | 110 | 111 | 101 | 100 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| 00 | 0 | 1 | 3 | 2 | 6 | 7 | 5 | 4 |
| 01 | 8 | 9 | 11 | 10 | 14 | 15 | 13 | 12 |
| 11 | 24 | 25 | 27 | 26 | 30 | 31 | 29 | 28 |
| 10 | 16 | 17 | 19 | 18 | 22 | 23 | 21 | 20 |

$$F(a,b,c,d,e) = \overline{I}LM(0,2,8,10,16,18,24,26)$$

| ab \ cde | 000 | 001 | 011 | 010 | 110 | 111 | 101 | 100 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| 00 | 0 | | | 0 | | | | |
| 01 | 0 | | | 0 | | | | |
| 11 | 0 | | | 0 | | | | |
| 10 | 0 | | | 0 | | | | |

$$F(a, b, c, d, e) = \sum m(1, 5, 6, 7, 17, 21, 22, 23)$$

$a=0$

| | | | | |
|----|----|----|----|---|
| | 0 | 1 | 3 | 2 |
| 4 | 5 | 7 | 6 | |
| 12 | 13 | 15 | 14 | |
| 8 | 9 | 11 | 10 | |

$a=1$

| | | | |
|----|----|----|----|
| 16 | 17 | 19 | 18 |
| 20 | 21 | 23 | 22 |
| 28 | 29 | 31 | 30 |
| 24 | 25 | 27 | 26 |

• Prime Implicants ?

$a=0$

| bc \ de | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | 0 | 1 | 3 | 2 |
| 01 | 4 | 5 | 7 | 6 |
| 11 | 12 | 13 | 15 | 14 |
| 10 | 8 | 9 | 11 | 10 |

$a=1$

| bc \ de | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | 16 | 17 | 19 | 18 |
| 01 | 20 | 21 | 23 | 22 |
| 11 | 28 | 29 | 31 | 30 |
| 10 | 24 | 25 | 27 | 26 |

$$PI1 = (1, 5, 17, 21) = \bar{a} \cdot \bar{b} \cdot \bar{d} \cdot e$$

$$PI2 = (5, 7, 21, 23) = \bar{b} \cdot c \cdot e$$

$$PI3 = (6, 7, 22, 23) = \bar{b} \cdot c \cdot d$$

5 VARIABLE KMAP

$$Y(a,b,c,d,e) = \sum m(4,5,7,12,13,21,23)$$

A=0

| | | | |
|---|---|---|--|
| | | | |
| 1 | 1 | 1 | |
| 1 | 1 | | |
| | | | |

A=1

| | | | |
|--|---|---|--|
| | | | |
| | 1 | 1 | |
| | | | |
| | | | |

Answer: $b'ce + a'cd'$