

Q1. Two Boolean functions are given as:

$$F1(A, B, C, D) = \sum (m(1, 3, 4, 5, 7, 8, 9, 12), d(10, 11)).$$

$$F2(A, B, C, D) = \sum (m(0, 3, 5, 10, 13, 15), d(1, 7, 12)).$$

$$F3(A, B, C, D) = F1(A, B, C, D) \cdot F2(A, B, C, D)$$

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
| F1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | d | d | 1 | 0 | 0 | 0 |
| F2 | 1 | d | 0 | 1 | 0 | 1 | 0 | d | 0 | 0 | 1 | 0 | d | 1 | 0 | 1 |
| F3 | 0 | d | 0 | 1 | 0 | 1 | 0 | d | 0 | 0 | d | 0 | d | 0 | 0 | 0 |

$$F3 = \sum(m(3, 5), d(1, 7, 10, 12))$$

Use Karnaugh map to **simplify** the function $F_3(A, B, C, D)$. (Hints: $d \cdot 1 = d$; $d \cdot 0 = 0$)

| CD \ AB | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00 | 0 | d | 1 | 0 |
| 01 | 0 | 1 | d | 0 |
| 11 | d | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | d |

Obtain the simplified expression in the POS form.

$$F_3(A, B, C, D) = (B + D) \cdot (A + D) \cdot (A' + D') \cdot (A' + C')$$

Q2. Consider a Boolean function $F(A, B, C, D)$. It has the following Prime Implicants:

$$(B' + D'), (A' + B' + C), (A + C + D'), (A + B' + C'), (A' + C' + D').$$

(i) Draw the Karnaugh map for $F(A, B, C, D)$.

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

(ii) Obtain the simplified expression for F in the SOP form.

$$F = A' \cdot C' \cdot D' + A \cdot B' \cdot C' + A \cdot C \cdot D' + A' \cdot B' \cdot C$$

(iii) Specify the Essential Prime Implicants, if any.

$$A' \cdot C' \cdot D', A \cdot B' \cdot C', A \cdot C \cdot D', A' \cdot B' \cdot C$$