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20L-0921
4/01/21
DLD Section 2E2 LAB

Find Maxterms of from the following minterms:

Q1:

(i). $F(x, y, z) = \Sigma m(1, 3, 6, 7)$

$\overline{F}(x, y, z) = \Sigma_m(0, 2, 4, 5)$

$F(x, y, z) = \Pi_M(0, 2, 4, 5)$

(ii). $F(X, Y, z) = \Sigma m(0, 1, 2, 4, 6)$

~~$\overline{F}(x, y, z) = \Sigma_m(0, 1, 2, 4, 6)$~~

$\overline{F}(x, y, z) = \Sigma_m(3, 5)$

$F(x, y, z) = \Pi_M(3, 5)$

(iii).

$F(A, B, C) = \Sigma m(0, 3, 4, 5, 7)$

$F(A, B, C) = \Sigma_m(1, 6)$

$F(A, B, C) = \Pi_M(1, 6)$

Q2:

$F1(A, B, C) = \Sigma m(0, 2, 3, 4, 6)$

a) Find truth table ~~Product form~~

| A | B | C | index |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 2 |
| 0 | 1 | 1 | 3 |
| 1 | 0 | 0 | 4 |
| 1 | 0 | 1 | 5 |
| 1 | 1 | 0 | 6 |
| 1 | 1 | 1 | 7 |

$m_0 + m_2 + m_3 + m_4 + m_6 = F_1$

$1 + 0 + 0 + 0 + 0 = 1$

$0 + 0 + 0 + 0 + 0 = 0$

$0 + 1 + 0 + 0 + 0 = 1$

$0 + 0 + 1 + 0 + 0 = 1$

$0 + 0 + 0 + 1 + 0 = 1$

$0 + 0 + 0 + 0 + 0 = 0$

$0 + 0 + 0 + 0 + 1 = 1$

$0 + 0 + 0 + 0 + 0 = 0$

Q2 (a).

$$F1(A, B, C) = \Sigma m(0, 2, 3, 4, 6)$$

a) Find truth table

| A | B | C | Index | SOP | output of function |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | $\bar{A}.\bar{B}.\bar{C}$ | 1 |
| 0 | 0 | 1 | 1 | $\bar{A}.\bar{B}.C$ | 0 |
| 0 | 1 | 0 | 2 | $\bar{A}B\bar{C}$ | 1 |
| 0 | 1 | 1 | 3 | $\bar{A}BC$ | 1 |
| 1 | 0 | 0 | 4 | $A\bar{B}\bar{C}$ | 1 |
| 1 | 0 | 1 | 5 | $A\bar{B}C$ | 0 |
| 1 | 1 | 0 | 6 | $AB\bar{C}$ | 1 |
| 1 | 1 | 1 | 7 | $ABC$ | 0 |

(b)

Q2(b). Find minimal SOP expression for boolean function F1.

$F_1 = \Sigma m(0, 2, 3, 4, 6)$

$F_1 = m_0 + m_2 + m_3 + m_4 + m_6$

$= \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}\bar{C} + AB\bar{C}$

$= \bar{A}\bar{B}\bar{C} + A\bar{B}\bar{C} + \bar{A}B\bar{C} + \bar{A}BC + AB\bar{C}$

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

$= \bar{B}\bar{C} + B\bar{C} + \bar{A}BC$

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

$= \bar{C} + \bar{A}BC$ (Ans)

~~Q2(c). Not done IC type in class till yet so skipped.~~

~~Q3~~

~~(a). $F1(A, B, C) = \Sigma m(0, 2, 4, 6, 7, 8, 10, 12, 14, 15)$~~

~~find the truth table~~

| ~~A~~ | A | B | C | D |
|---|---|---|---|---|

Q2(c). Fill the following table

| IC type | Required No. of Gates | Gates per IC | Required No. of ICs |
|---|---|---|---|
| OR | 1 | 4 | 1 |
| AND | 1 | 4 | 1 |
| NOT | 2 | 4 | 1 |
| Total No. of ICs | | 3 | |

Q3(a). $F_1(A, B, C, D) = \Sigma_m(0, 2, 4, 6, 7, 8, 10, 12, 14, 15)$

| A | B | C | D | Index | SOP | output of function |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | $\bar{A}\bar{B}\bar{C}\bar{D}$ | 1 |
| 0 | 0 | 0 | 1 | 1 | $\bar{A}\bar{B}\bar{C}D$ | 0 |
| 0 | 0 | 1 | 0 | 2 | $\bar{A}\bar{B}C\bar{D}$ | 1 |
| 0 | 0 | 1 | 1 | 3 | $\bar{A}\bar{B}CD$ | 0 |
| 0 | 1 | 0 | 0 | 4 | $\bar{A}B\bar{C}\bar{D}$ | 1 |
| 0 | 1 | 0 | 1 | 5 | $\bar{A}B\bar{C}D$ | 0 |
| 0 | 1 | 1 | 0 | 6 | $\bar{A}BC\bar{D}$ | 1 |
| 0 | 1 | 1 | 1 | 7 | $\bar{A}BCD$ | 1 |
| 1 | 0 | 0 | 0 | 8 | $A\bar{B}\bar{C}\bar{D}$ | 1 |
| 1 | 0 | 0 | 1 | 9 | $A\bar{B}\bar{C}D$ | 0 |
| 1 | 0 | 1 | 0 | 10 | $A\bar{B}C\bar{D}$ | 1 |
| 1 | 0 | 1 | 1 | 11 | $A\bar{B}CD$ | 0 |
| 1 | 1 | 0 | 0 | 12 | $AB\bar{C}\bar{D}$ | 1 |
| 1 | 1 | 0 | 1 | 13 | $AB\bar{C}D$ | 0 |
| 1 | 1 | 1 | 0 | 14 | $ABC\bar{D}$ | 1 |
| 1 | 1 | 1 | 1 | 15 | $ABCD$ | 1 |

Q3(b). Find the minimal SOP expression for Boolean function $F_1$.

$$F_1 = m_0 + m_2 + m_4 + m_6 + m_7 + m_9 + m_{10} + m_{12} + m_{14} + m_{15}$$

$$= \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}C\bar{D} + \bar{A}B\bar{C}\bar{D} + \bar{A}BC\bar{D} + \bar{A}BCD + A\bar{B}\bar{C}\bar{D} + A\bar{B}C\bar{D} + AB\bar{C}\bar{D} + ABC\bar{D} + ABCD$$

$$= \bar{A}\bar{B}\bar{C}D + A\bar{B}\bar{C}\bar{D} + A\bar{B}C\bar{D} + A\bar{B}CD + \bar{A}B\bar{C}\bar{D} + AB\bar{C}\bar{D} + \bar{A}BC\bar{D}$$

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

$$= \bar{B}\bar{C}D + \bar{B}C\bar{D} + B\bar{C}\bar{D} + BC\bar{D} + BCD$$

$$= \bar{B}\bar{C}\bar{D} + B\bar{C}\bar{D} + \bar{B}C\bar{D} + BC\bar{D} + BCD$$

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

$$= \bar{C}\bar{D} + C\bar{D} + BCD$$

$$= \bar{D} + BCD \quad \text{(final Ans).}$$

(c).

| IC Type | Required No. of Gates | Gates per IC | Required No. of ICs |
|---|---|---|---|
| OR | 1 | 4 | 1 |
| AND | 1 | 4 | 1 |
| NOT | 1 | 4 | 1 |

Total no ICs = 3

Q4). $F2 = [(A + BC')(A'C')]' + C$

| A | B | C | A' | B' | C' | F |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 0 | 1 | 1 | 1 | 0 | 1 |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 0 | 0 | 1 |