

$$\begin{aligned}
 Q1) F(PQRS) &= PQ + \bar{P}QR + \bar{P}Q\bar{R}S \\
 &= PQ(R + \bar{R})(S + \bar{S}) + \bar{P}QR(S + \bar{S}) + \bar{P}Q\bar{R}S \\
 &= PQRS + PQR\bar{S} + PQ\bar{R}S + PQ\bar{R}\bar{S} + \bar{P}QRS \\
 &\quad + \bar{P}QR\bar{S} + \bar{P}Q\bar{R}S
 \end{aligned}$$

$$= m_{15} + m_{14} + m_{13} + m_{12} + m_7 + m_6$$

Truth Table for  $F(PQRS)$  (Karnaugh Map):

| PQ \ RS | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00      | 0  | 0  | 0  | 0  |
| 01      | 1  | 1  | 0  | 0  |
| 11      | 1  | 1  | 1  | 1  |
| 10      | 0  | 0  | 0  | 0  |

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| PQ \ RS | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00      | 0  | 0  | 0  | 0  |
| 01      | 1  | 1  | 0  | 0  |
| 11      | 1  | 1  | 1  | 1  |
| 10      | 0  | 0  | 0  | 0  |

$$= PQ + QS + QR$$

$$Q2) F(PQRS) = \{0, 2, 5, 7, 8, 10, 13, 15\}$$

2, 7, 8, 15 → Don't care

Truth Table for  $F(PQRS)$  (Karnaugh Map):

| PQ \ RS | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00      | 1  | 0  | 0  | 1  |
| 01      | 0  | 1  | 1  | 0  |
| 11      | 0  | 1  | 1  | 0  |
| 10      | 1  | 0  | 0  | 1  |

$$QS + \bar{Q}\bar{S}$$

$$Q3) F(PQRST) = \sum (0, 2, 4, 7, 8, 10, 12, 16, 18, 20, 23, 24, 25, 26, 27, 28)$$

Truth Table for  $F(PQRST)$  (Karnaugh Map):

| ST \ PQ | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00      | 1  | 0  | 0  | 1  |
| 01      | 1  | 1  | 0  | 0  |
| 11      | 1  | 1  | 1  | 0  |
| 10      | 1  | 0  | 0  | 1  |

Truth Table for  $F(PQRST)$  (Karnaugh Map):

| ST \ PQ | 00 | 01 | 11 | 10 |
|---------|----|----|----|----|
| 00      | 1  | 0  | 0  | 1  |
| 01      | 1  | 1  | 0  | 0  |
| 11      | 1  | 1  | 1  | 0  |
| 10      | 1  | 0  | 0  | 1  |

$$F = ST + \bar{R}\bar{T} + PQR + \bar{Q}RST$$

$$4) F(W, X, Y, Z) = \sum_m(0, 8, 5, 6, 7, 10, 12, 13) + \sum_d(2, 9, 15)$$

| W \ YZ | 00 | 01 | 11 | 10 |
|--------|----|----|----|----|
| 00     | 1  |    | 1  | 1  |
| 01     |    | 1  | 1  | 1  |
| 11     | 1  | 1  | X  |    |
| 10     |    | X  | X  | 1  |

$$F(W, X, Y, Z) = XZ + \bar{W}Y + \bar{X}Y\bar{Z} + WX\bar{Y} + \bar{W}XZ$$

$$5) i) \bar{A} + AB = 0$$

$$if A=0 \Rightarrow \bar{A}=1 \Rightarrow \bar{A} + AB = 1 \quad \times$$

$$A=1$$

$$A=0$$

$$if B=1 \text{ then } AB=1 \Rightarrow \bar{A} + AB=1 \quad \times$$

$$\therefore B=0$$

ii)

$$AB = AC$$

$$A=1 \text{ \& } B=0$$

$$AB=0$$

$$1 \cdot C = 0$$

$$\therefore C=0$$

iii)

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

$$A=1$$

$$B=0$$

$$C=0$$

$$1 \cdot 0 + 1 \cdot 1 + 0 \cdot D = 1 \cdot D$$



$$(7) (P + \bar{Q}) (P\bar{Q} + PR) (\bar{P}\bar{R} + \bar{Q})$$

$$(P\bar{Q} + PR + P\bar{Q} + PR\bar{Q}) (\bar{P}\bar{R} + \bar{Q})$$

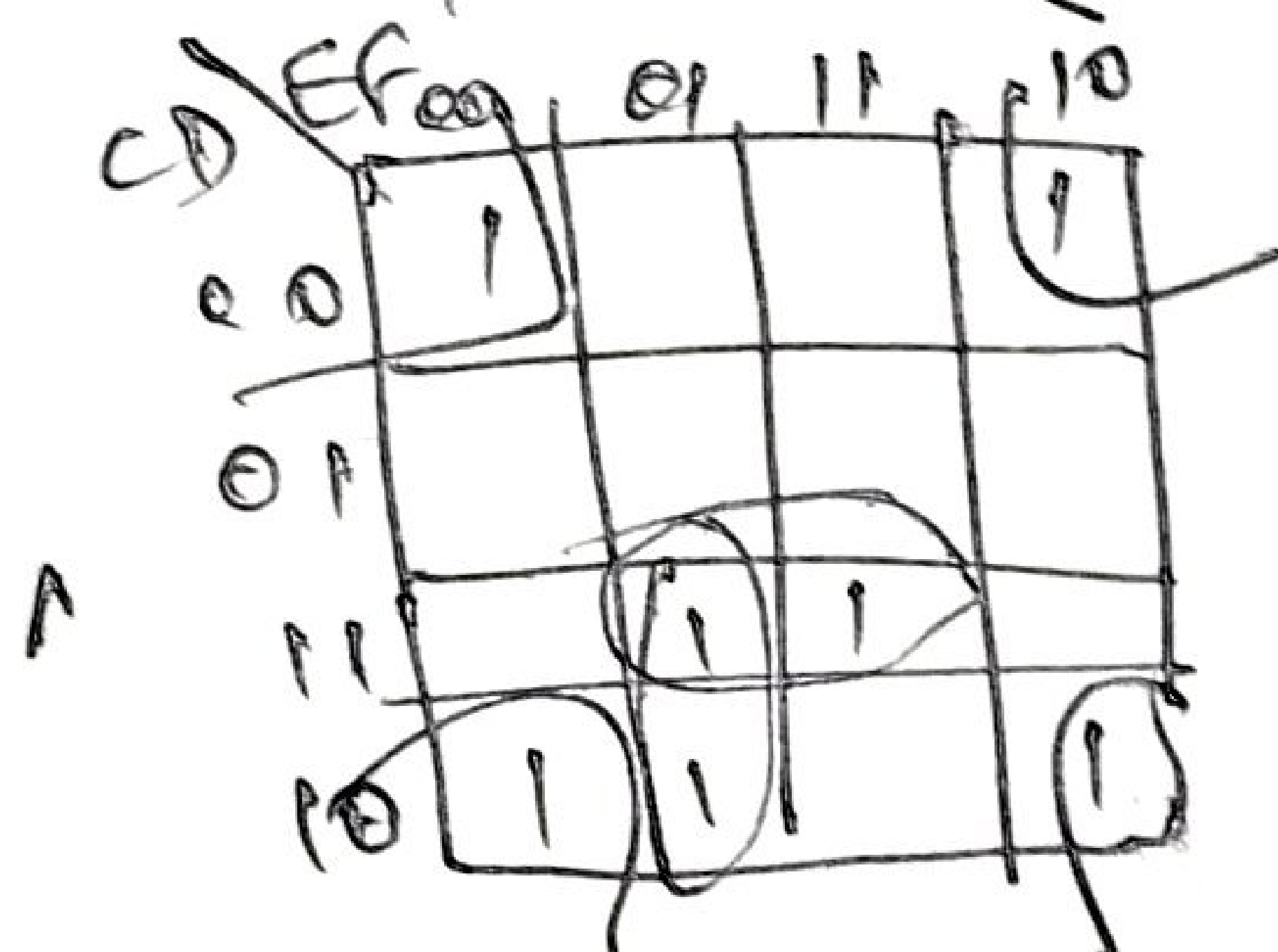
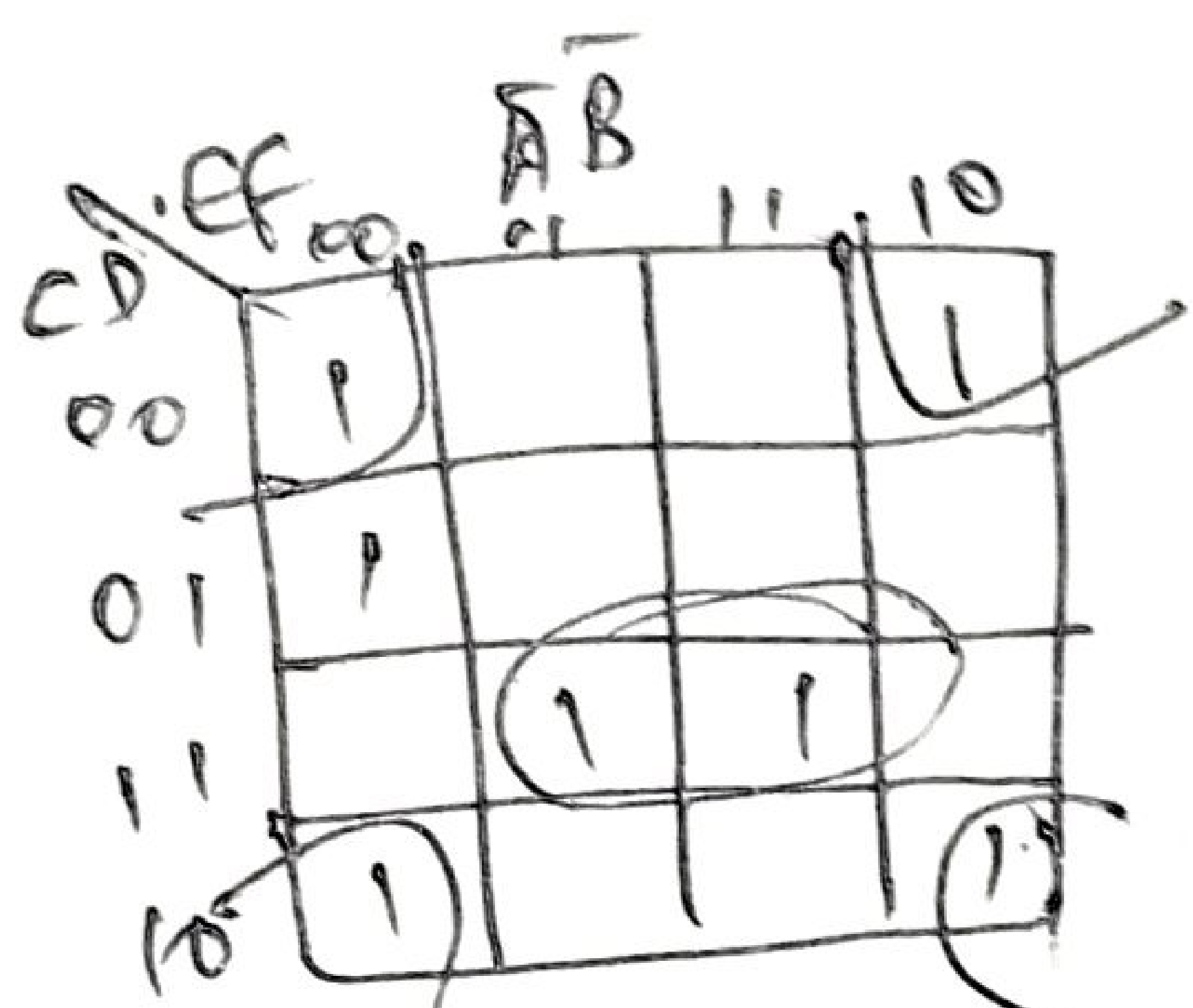
$$(\bar{Q} + PR) (\bar{P}\bar{R} + \bar{Q})$$

$$(P\bar{Q} + PR) (\bar{P}\bar{R} + \bar{Q})$$

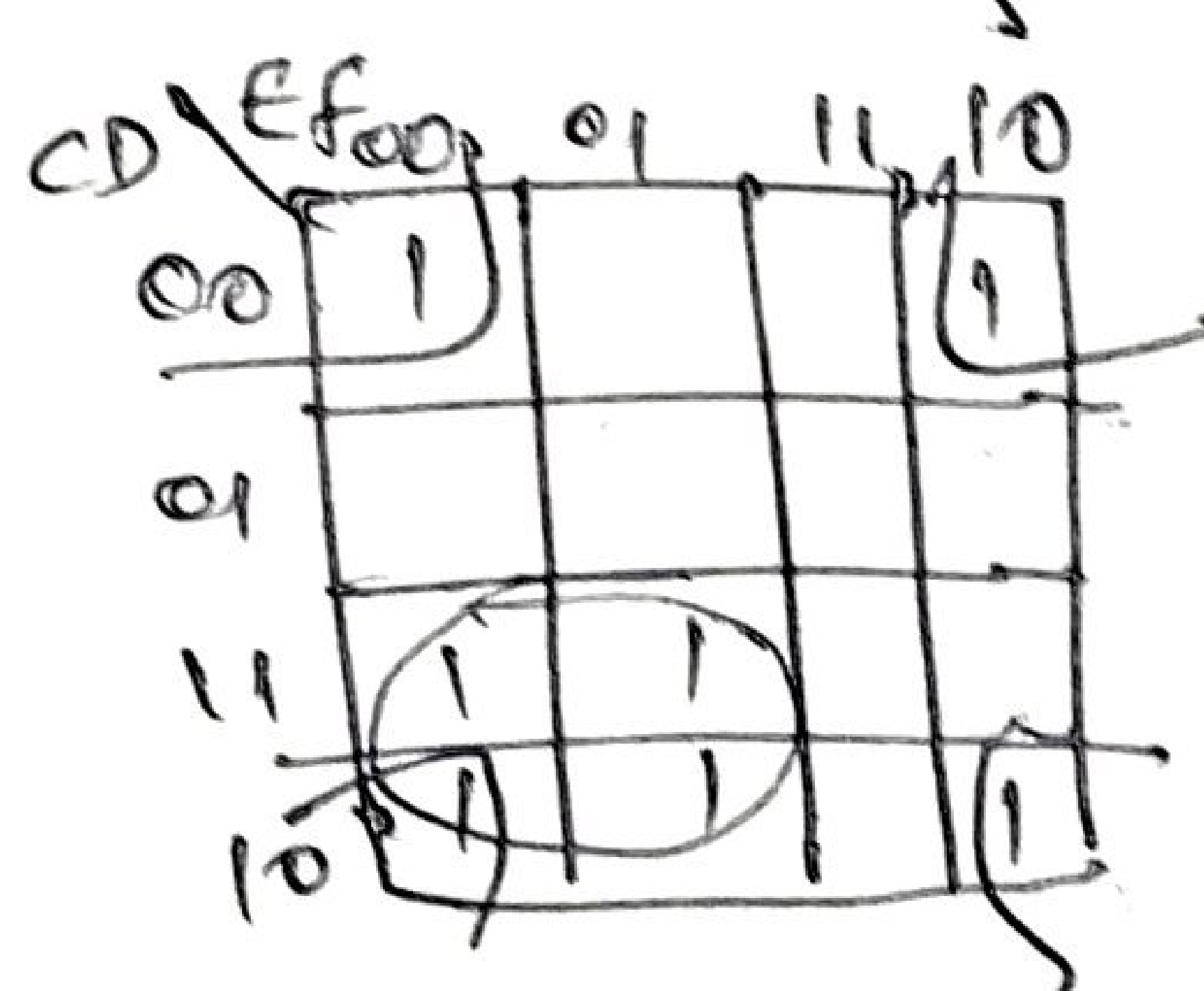
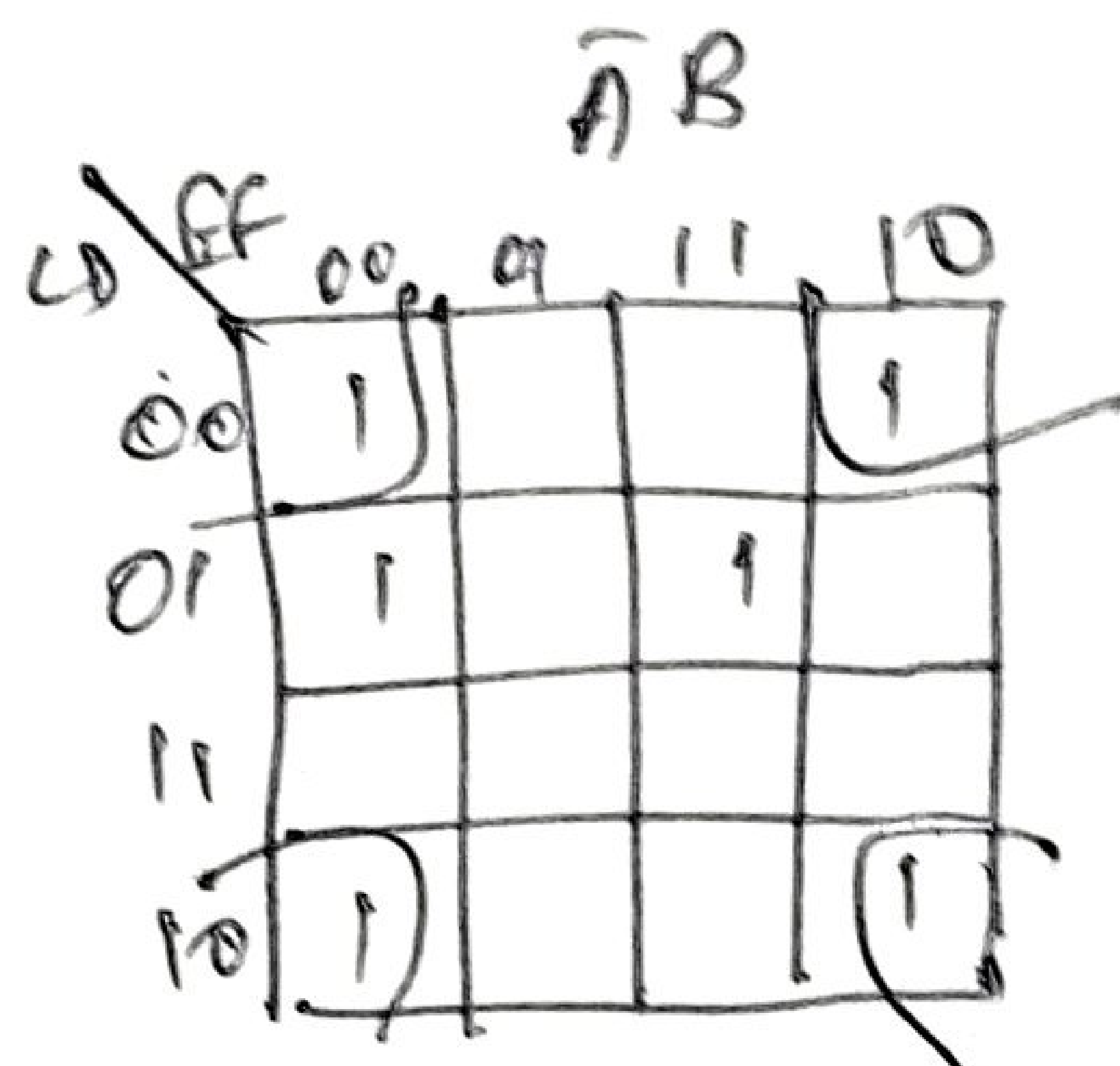
$$P\bar{Q} + PR\bar{Q}$$

$$P\bar{Q}$$

(8)



$A\bar{B}$



$AB$

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

(10)

$$f = \bar{x}\bar{y} + xy + \bar{x}y$$

$$= (\bar{x}\bar{y} + \bar{x}y) + xy$$

$$= \bar{x}(\bar{y} + y) + xy$$

$$= \bar{x} + xy$$

$$= \bar{x} + y$$