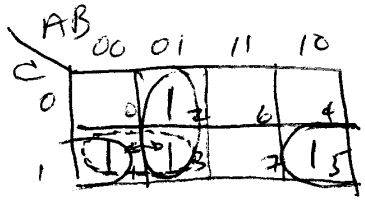
1 (c)



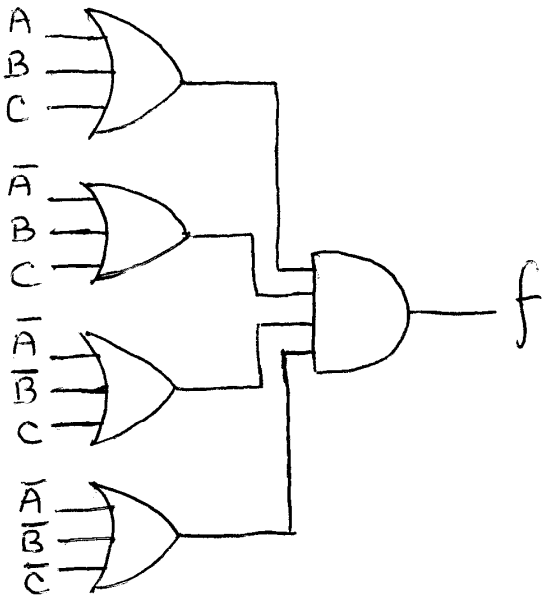

$f_{min} = \bar{A}B + \bar{B}C$

(d) Not hazard-free

$f_{h\text{-}free} = \bar{A}B + \bar{B}C + \underbrace{\bar{A}C}_{\text{redundant implicant needed.}}$

(a) $f(A,B,C) = \Pi M_i(0,4,6,7)$

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




(b) $f = (\underbrace{A \cdot \bar{A}}_{0} + B + C)(\bar{A} + \bar{B} + \underbrace{C \cdot \bar{C}}_{0})$

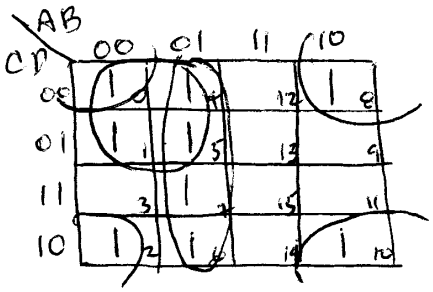
$f = (B+C)(\bar{A}+\bar{B}) = B\bar{A} + C\bar{A} + \underbrace{B\bar{B}}_{C} + C\bar{B}$

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

$f = B\bar{A} + \bar{B}C$ ) Consensus

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

2.




(a) Truth Table

| A | B | C | D | f | $m_i$ |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 | 2 |
| 0 | 0 | 1 | 1 | 0 | 3 |
| 0 | 1 | 0 | 0 | 1 | 4 |
| 0 | 1 | 0 | 1 | 1 | 5 |
| 0 | 1 | 1 | 0 | 1 | 6 |
| 0 | 1 | 1 | 1 | 1 | 7 |
| 1 | 0 | 0 | 0 | 1 | 8 |
| 1 | 0 | 0 | 1 | 0 | 9 |
| 1 | 0 | 1 | 0 | 1 | 10 |
| 1 | 0 | 1 | 1 | 0 | 11 |
| 1 | 1 | 0 | 0 | 0 | 12 |
| 1 | 1 | 0 | 1 | 0 | 13 |
| 1 | 1 | 1 | 0 | 0 | 14 |
| 1 | 1 | 1 | 1 | 0 | 15 |

(b) i. Not prime implicant
$\{m_2, m_6\}$, $\{m_8, m_{10}\}$

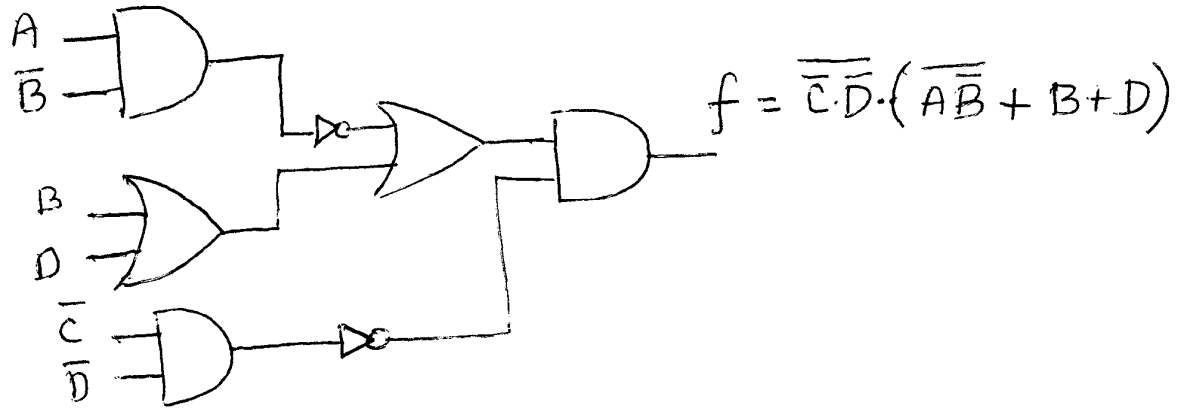
$\{m_0\}$, $\{m_0, m_4\}$, $\{m_5, m_7\}$

ii. Non-essential prime implicant:
$\{m_0, m_2, m_4, m_6\} \leftrightarrow \bar{A}\bar{D}$

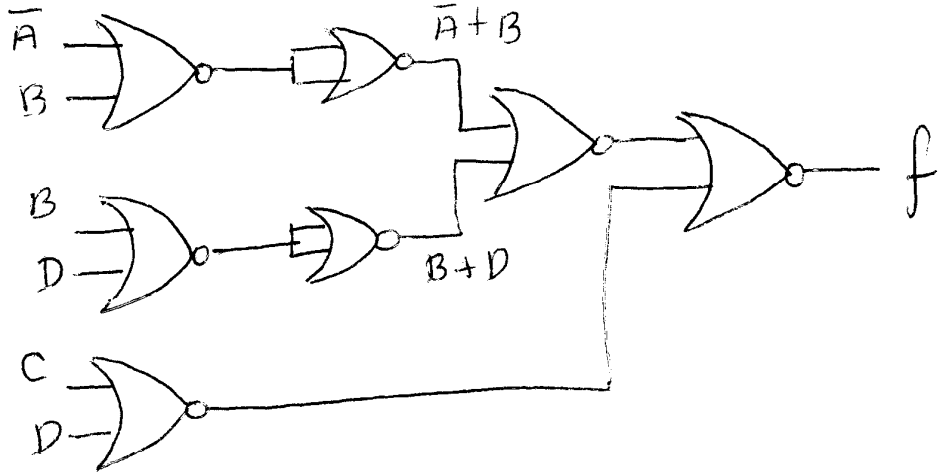
iii. Essential prime implicants:
$\{m_0, m_2, m_8, m_{10}\}$
$\{m_0, m_1, m_4, m_5\}$
$\{m_4, m_5, m_6, m_7\}$

(c) $f_{min} = \bar{A}B + \bar{A}\bar{C} + \bar{B}\bar{D}$

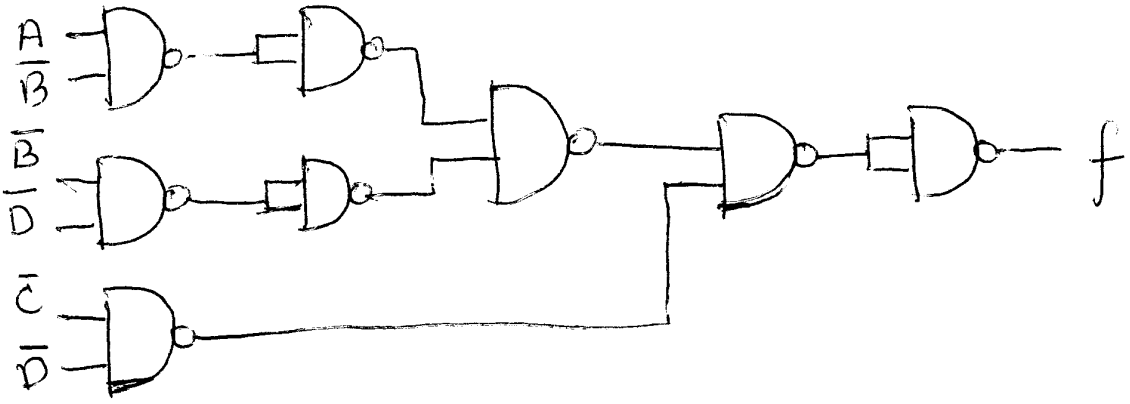
3. (a)


A
$\overline{B}$
B
D
$\overline{C}$
$\overline{D}$
$f = \overline{\overline{C}\cdot\overline{D}}\cdot\left(\overline{A\overline{B}} + B + D\right)$

(b)


$\overline{A}$
B
$\overline{A}+B$
B
D
$B+D$
C
D
f

(c)


A
$\overline{B}$
$\overline{B}$
$\overline{D}$
$\overline{C}$
$\overline{D}$
f