

EE 2720, Spr. 2012

Homework #5 solution

Homework # 5 solution

In this HW

~~XXXXXXXXXX~~ Here I will denote winter c
by w_c and ~~XXXXXXXXXX~~ winter i

by M_i

Problem 1

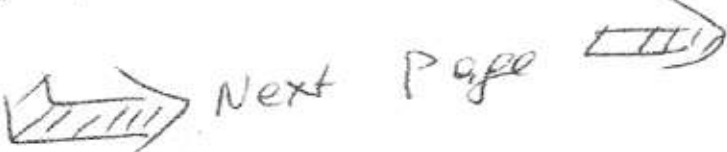

(a) we have: $F = \sum_{A, B, C, D} (0, 2, 4, 6, 9, 11, 13, 14, 15)$

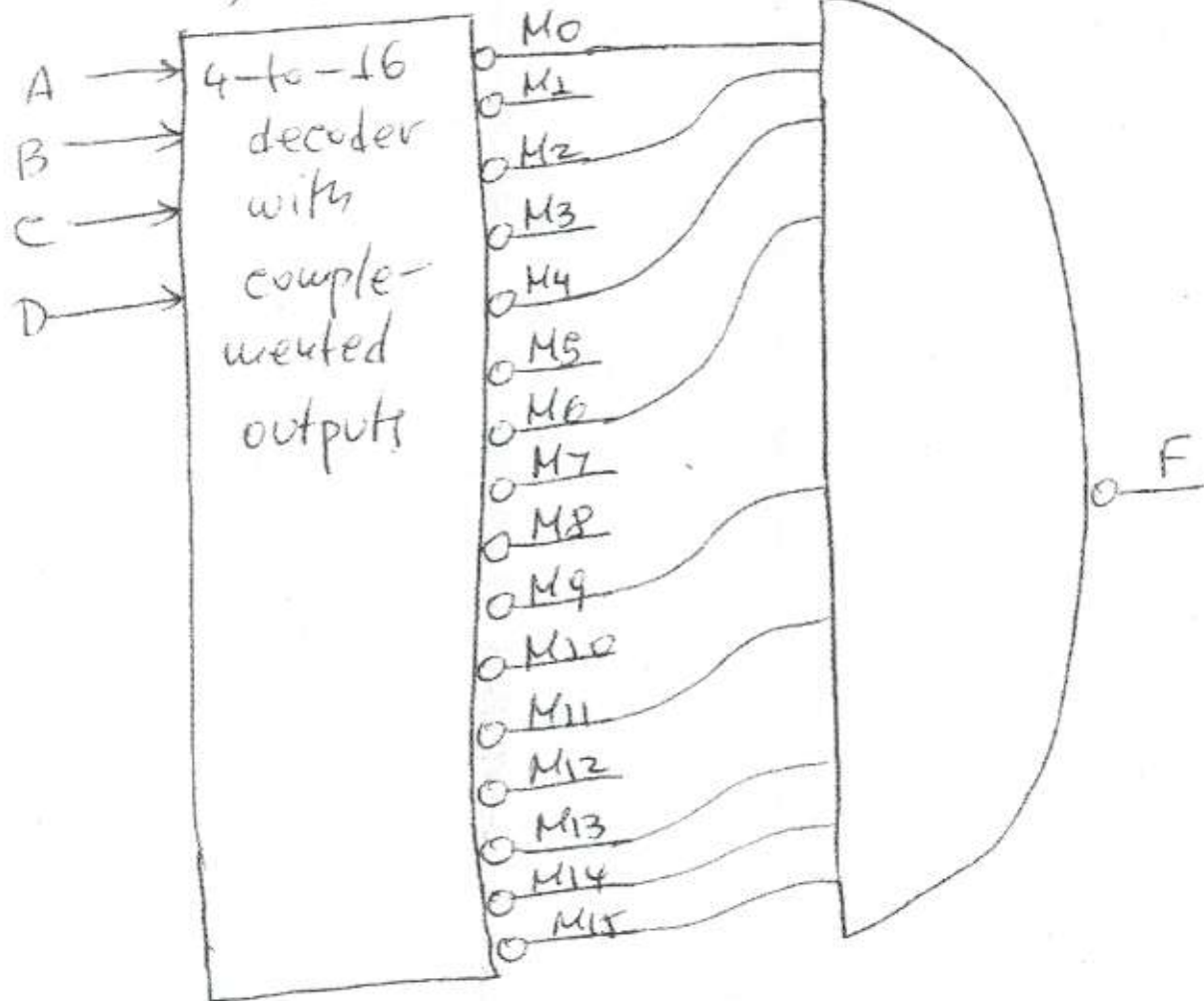
$$= m_0 w_2 + m_4 w_6 + m_9 w_{11} + m_{13} w_{15} + m_{14} w_{15}$$

$$= (w_0 \cdot w_2 \cdot w_4 \cdot w_6 \cdot w_9 \cdot w_{11} \cdot w_{13} \cdot m_{14} \cdot w_{15})'$$

$$= (M_0 \cdot M_2 \cdot M_4 \cdot M_6 \cdot M_9 \cdot M_{11} \cdot M_{13} \cdot M_{14} \cdot M_{15})'$$

From the above we get the figure
shown on the next page

 Next Page 



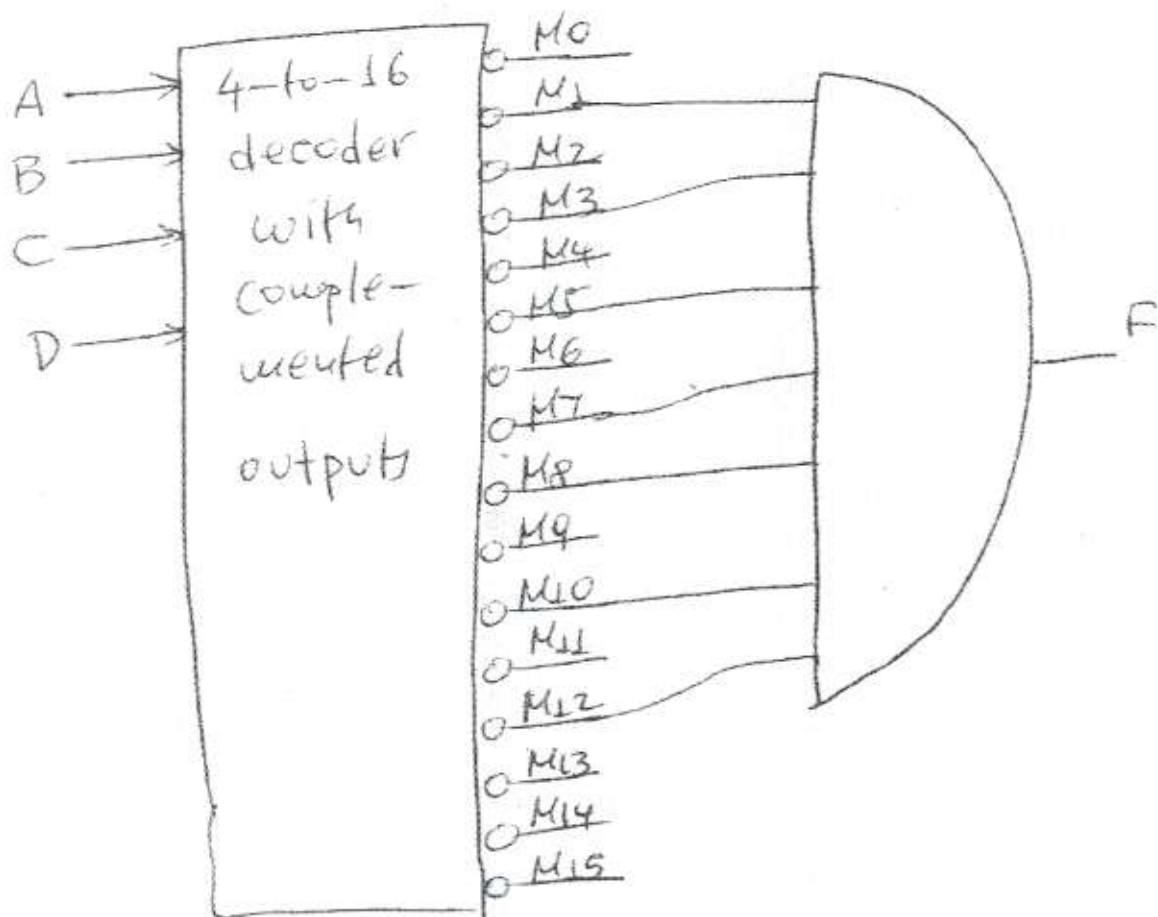
(b) we have:

$$F = \sum_{A, B, C, D} (0, 2, 4, 6, 9, 11, 13, 14, 15)$$

$$= \prod_{A, B, C, D} (1, 3, 5, 7, 8, 10, 12)$$

From the above we get the figure shown on the next page.

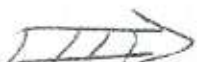
→ next page

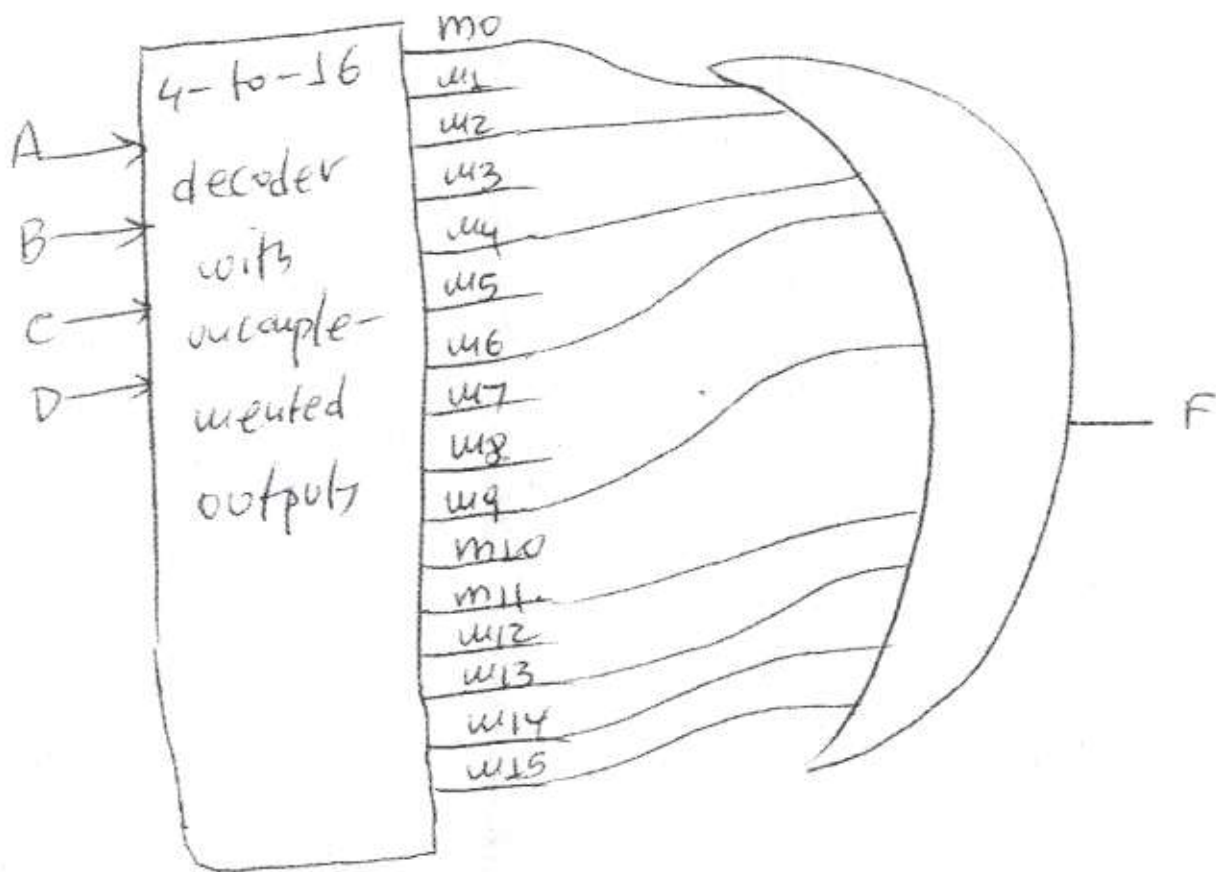


(c) we have

$$F = \sum_{A,B,C,D} (0, 2, 4, 6, 8, 11, 13, 14, 15)$$

From the above we get the figure shown on the next page.

 next page



(d) we have:

$$F = \prod_{A,B,C,D} (1, 3, 5, 7, 8, 10, 12)$$

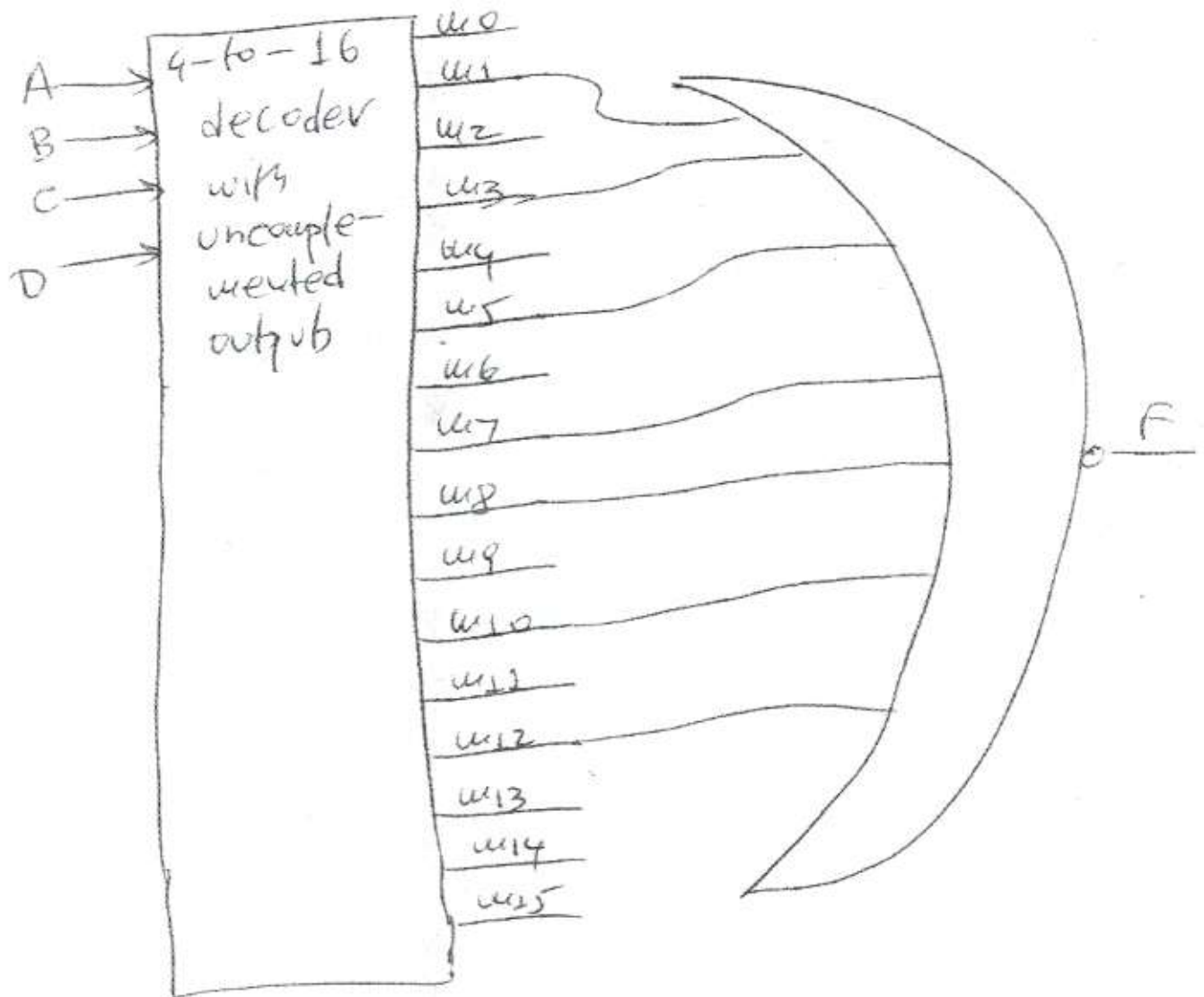
$$= M_1 \cdot M_3 \cdot M_5 \cdot M_7 \cdot M_8 \cdot M_{10} \cdot M_{12}$$

$$= (M_1' + M_3' + M_5' + M_7' + M_8' + M_{10}' + M_{12}')'$$

$$= (m_1 + m_3 + m_5 + m_7 + m_8 + m_{10} + m_{12})'$$

From the above we get the figure show on next page

2729 ~~XXXXXXXXXX~~ HW # 5 sol. cont. (5)



Problem 2: Since a decoder with uncomplemented outputs generates the minterms, we have to express F as a canonical sum.

Since F is given as a product-of-sums expression, it is easier to obtain the canonical product from which we can easily get the canonical sum. We have

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

~~$(A' + B + C' + D) \cdot (A' + B + C' + D')$~~

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

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

$$(B + C' + D + A) \cdot (B + C' + D + A')$$

$$(A + C' + D' + B) \cdot (A + C' + D' + B')$$

$$= \begin{pmatrix} A' & B & C' & D \\ \downarrow & \downarrow & \downarrow & \downarrow \\ 1 & 0 & 1 & 0 \end{pmatrix} \cdot \begin{pmatrix} A' & B & C' & D' \\ \downarrow & \downarrow & \downarrow & \downarrow \\ 1 & 0 & 1 & 1 \end{pmatrix} \cdot \begin{pmatrix} A & B & C' & D \\ \downarrow & \downarrow & \downarrow & \downarrow \\ 0 & 0 & 1 & 0 \end{pmatrix}$$

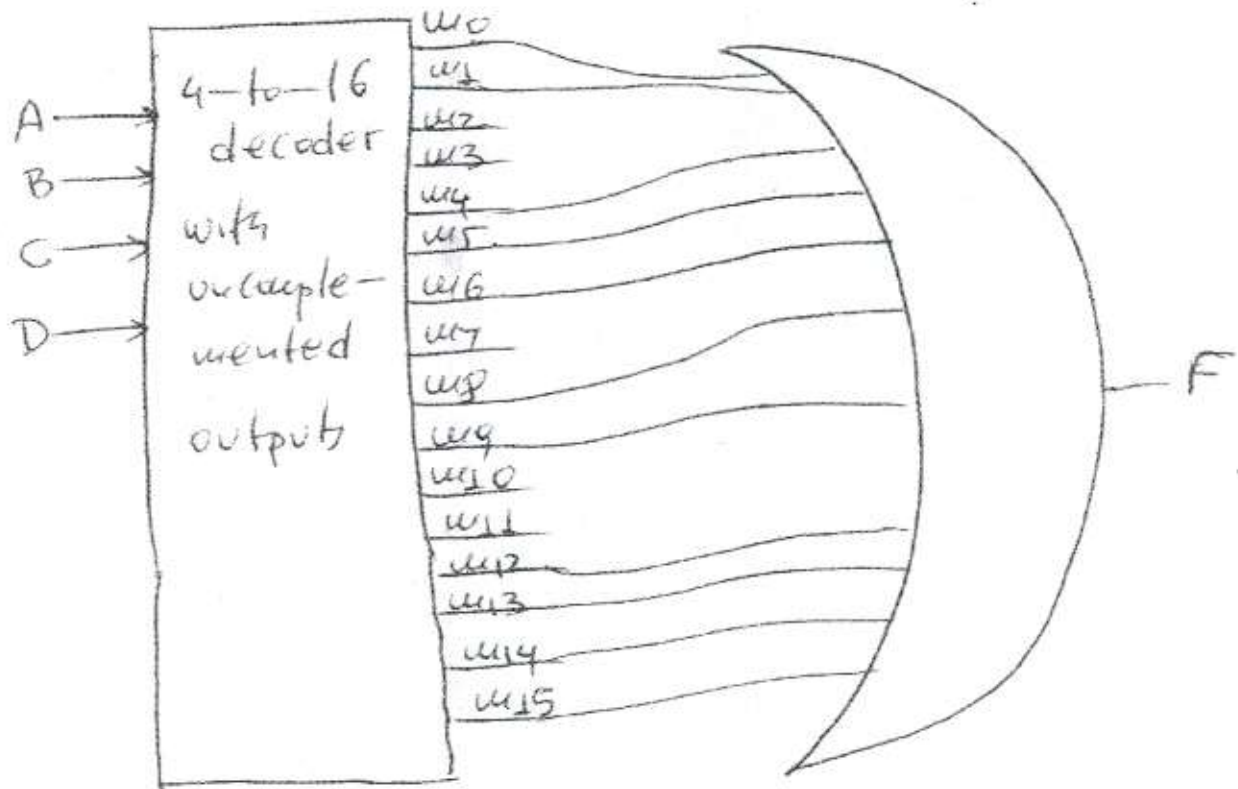
$$\begin{pmatrix} A' & B & C' & D \\ \downarrow & \downarrow & \downarrow & \downarrow \\ 1 & 0 & 1 & 0 \end{pmatrix} \cdot \begin{pmatrix} A & B & C' & D' \\ \downarrow & \downarrow & \downarrow & \downarrow \\ 0 & 0 & 1 & 1 \end{pmatrix} \cdot \begin{pmatrix} A & B' & C' & D \\ \downarrow & \downarrow & \downarrow & \downarrow \\ 0 & 1 & 1 & 1 \end{pmatrix}$$

$$= \prod_{A,B,C,D} (3, 3, 7, 10, 11) \Rightarrow \text{next page}$$

Pr. 2 cont.

$$= \sum_{A, B, C, D} (0, 1, 4, 5, 6, 8, 9, 12, 13, 14, 15)$$

we now have

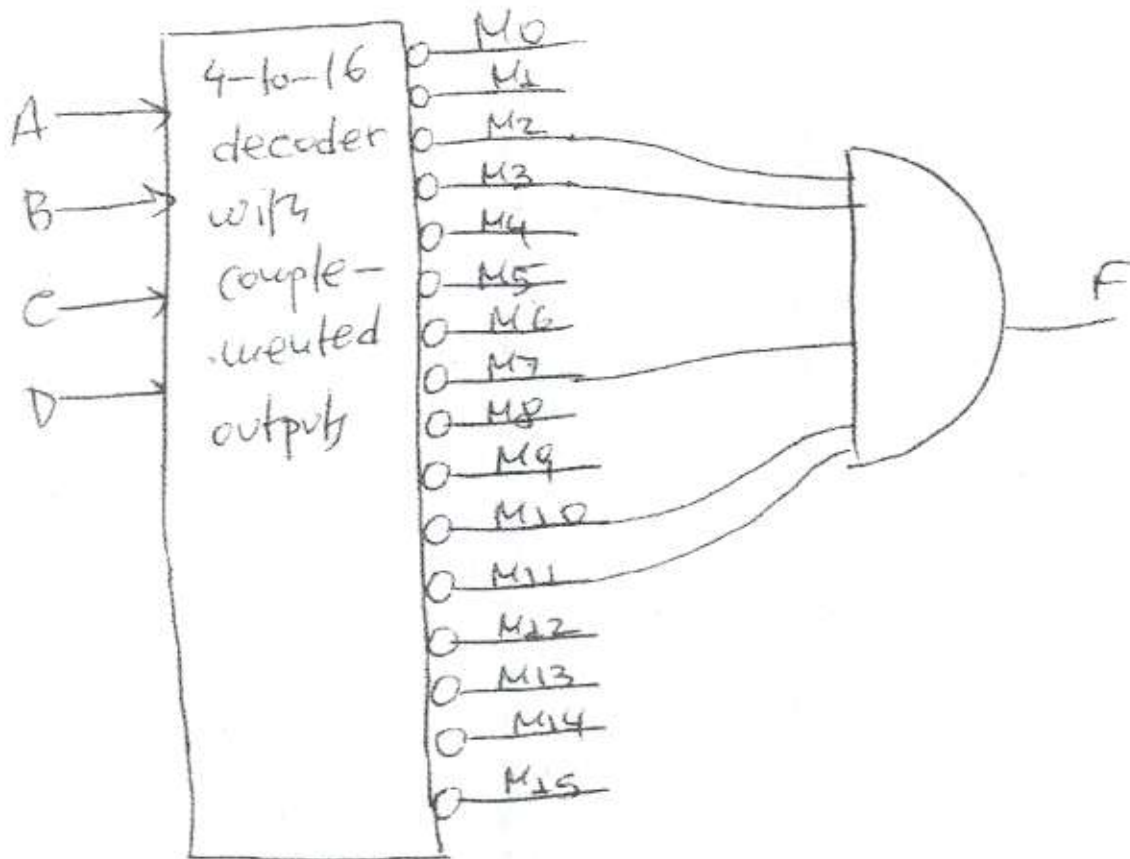


Pr. 3: From problem 2 we found out

$$\text{that } F = \prod_{A, B, C, D} (2, 3, 7, 10, 11)$$

We thus have the figure of next page

next page



Problem 4 : Since a decoder with couple-vented outputs generates the minterms, we have to express F as a canonical product. Since F is given as sum-of-products, it is easier to obtain ~~the~~ the canonical sum from which we can easily get the canonical product. We have :

————> next page

Pr. 4 cont.

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

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

$$+ A \cdot C' \cdot D' \cdot (B + B')$$

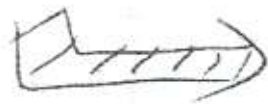
$$= \underset{\substack{0 \\ 1}}{A'} \cdot \underset{\substack{1 \\ 0}}{B} \cdot \underset{\substack{0 \\ 1}}{C'} \cdot D + \underset{\substack{0 \\ 1}}{A'} \cdot \underset{\substack{1 \\ 0}}{B} \cdot \underset{\substack{0 \\ 1}}{C'} \cdot \underset{\substack{0 \\ 1}}{D'} + \underset{\substack{1 \\ 0}}{A} \cdot \underset{\substack{1 \\ 0}}{B} \cdot \underset{\substack{0 \\ 1}}{C'} \cdot D$$

$$+ \cancel{\underset{\substack{0 \\ 1}}{A'} \cdot \underset{\substack{1 \\ 0}}{B} \cdot \underset{\substack{0 \\ 1}}{C'} \cdot D} + \underset{\substack{1 \\ 0}}{A} \cdot \underset{\substack{1 \\ 0}}{B} \cdot \underset{\substack{0 \\ 1}}{C'} \cdot \underset{\substack{0 \\ 1}}{D'} + \underset{\substack{1 \\ 0}}{A} \cdot \underset{\substack{0 \\ 1}}{B'} \cdot \underset{\substack{0 \\ 1}}{C'} \cdot \underset{\substack{0 \\ 1}}{D'}$$

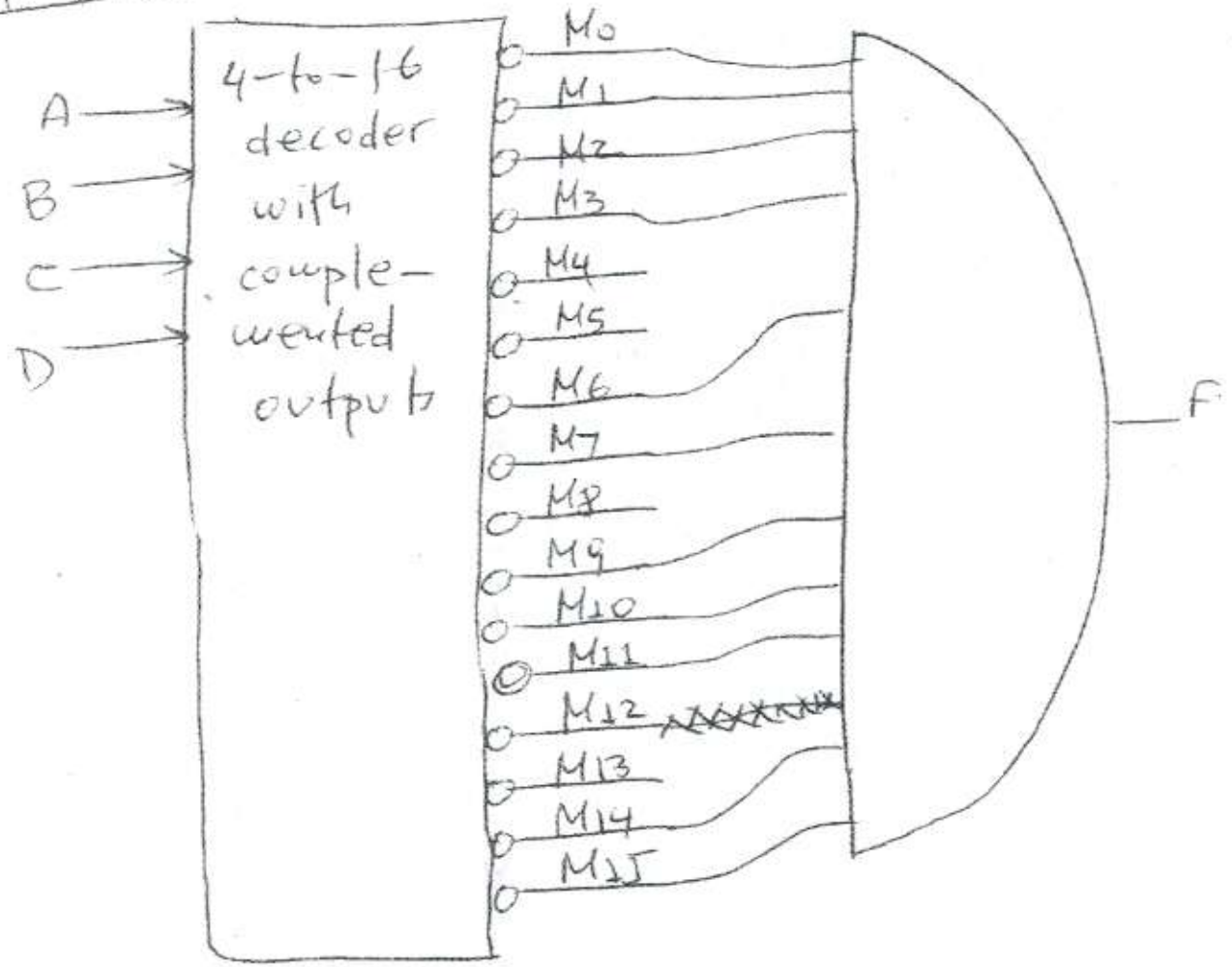
$$= \sum_{A, B, C, D} (4, 5, 8, 12, 13)$$

$$= \prod_{A, B, C, D} (0, 1, 2, 3, 6, 7, 9, 10, 11, 14, 15)$$

From the above we get the figure
shown on next page



Pr. 4 cont.



Problem 5: From problem 4 we found

out that $F = \sum_{A,B,C,D} (4, 5, 8, 12, 13)$

we thus have the figure shown on next page

—————> next page.

Pr. 5 cont.:

