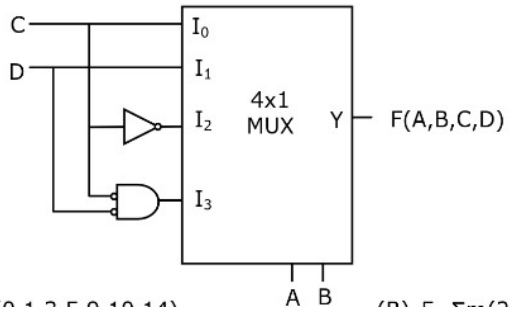
Name: Ashok Kumar Reddy K
Batch: 2
ID: cometfwc016
Date: 6th june 2025

GATE Question Paper 2010, EC Question Number 39

Question 39 Analysis

Question:

the Boolean function realized by the logic circuit shown is



A) $\sum m(0, 1, 3, 5, 9, 10, 14)$

B) $\sum m(2, 3, 5, 7, 8, 12, 13)$

C) $\sum m(1, 2, 4, 5, 11, 14, 15)$

D) $\sum m(2, 3, 4, 5, 8, 9, 12)$

Solution: Logic Circuit using 4x1 Multiplexer

Given: A 4x1 MUX has:

- Select lines: A and B (Y = Output)
- Inputs:

$$I_0 = C$$
$$I_1 = D$$
$$I_2 = \overline{C}$$
$$I_3 = C \cdot D$$

Recall: A 4x1 MUX selects one of the four inputs I_0, I_1, I_2, I_3 based on select inputs A and B as follows:

A	B	Selected Input
0	0	I_0
0	1	I_1
1	0	I_2
1	1	I_3

Substitute the Inputs

$$Y = F(A, B, C, D) = \begin{cases} C & \text{if } AB = 00 \\ D & \text{if } AB = 01 \\ \overline{C} & \text{if } AB = 10 \\ C \cdot D & \text{if } AB = 11 \end{cases}$$

Final Expression

$$F(A, B, C, D) = A'B'C + A'BD + AB'\overline{C} + ABDC$$

Minimized SOP (Optional)

No further simplification unless Karnaugh map is used — expression already in SOP form.

Complete Truth Table:

A	B	C	D	F(A,B,C,D)
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

A) $\sum m(0, 1, 3, 5, 9, 10, 14)$

B) $\sum m(2, 3, 5, 7, 8, 12, 13)$

C) $\sum m(1, 2, 4, 5, 11, 14, 15)$

D) $\sum m(2, 3, 4, 5, 8, 9, 12)$ (Correct Answer)