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

GATE Question Paper 2010, EE Question Number 52

Question 12 Analysis

Question:

The following Karnaugh map represents a function F.

F / X	00	01	11	10
0	1	1	1	0
1	0	0	1	0

A minimized form of the function F is

(A) $F = \overline{X}Y + YZ$ (B) $F = \overline{X}\overline{Y} + YZ$ (C) $F = \overline{X}\overline{Y} + Y\overline{Z}$ (D) $F = \overline{X}\overline{Y} + \overline{Y}Z$

Karnaugh Map Simplification Problem

Given: The following Karnaugh map represents a function F:

Step-by-Step Solution

1. **Identify variables:**
   - Let the variables be X, Y, and Z.
   - The rows are labeled by X, and the columns by YZ in Gray code order: 00, 01, 11, 10.
2. **Extract minterms:**
   - From the K-map, 1s appear at: $(X, YZ) = (0, 00), (0, 01), (0, 11), (1, 01)$
   - Corresponding minterms:

$$(0, 00) \rightarrow \overline{X}\,\overline{Y}\,\overline{Z}$$
$$(0, 01) \rightarrow \overline{X}\,\overline{Y}\,Z$$
$$(0, 11) \rightarrow \overline{X}\,Y\,Z$$
$$(1, 01) \rightarrow X\,\overline{Y}\,Z$$

3. **Group minterms in K-map:**
   - Group 1: $\overline{X}\,\overline{Y}\,\overline{Z} + \overline{X}\,\overline{Y}\,Z = \overline{X}\,\overline{Y}$ (common factor)
   - Group 2: $\overline{X}\,Y\,Z + X\,\overline{Y}\,Z = Z\,(\overline{X}\,Y + X\,\overline{Y}) = Z\,(\overline{X \oplus Y})$
   - But instead of factoring XOR, observe original terms: we keep $\overline{X}\,Y\,Z$ and $X\,\overline{Y}\,Z$ separate
4. **Final simplified expression:**

$$F = \overline{X}\,\overline{Y} + Y\,Z$$

Correct Option:

Option (B): $F = \overline{X}\,\overline{Y} + YZ$