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# GATE QUESTION ECE 2010 Q52

**Statement for Linked Answer Questions: 52**

The following Karnaugh map represents a function $F$.

| F | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| X = 0 | 1 | 1 | 1 | 0 |
| X = 1 | 0 | 0 | 1 | 0 |

**52.** A minimized form of the function $F$ is

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

**Answer:** (B)

**Solution:**

| X \ YZ | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 | 0 |

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

**Group 1 – Horizontal Pair (X = 0):**

- Covers cells: $(X = 0, Y = 0, Z = 0)$ and $(X = 0, Y = 0, Z = 1)$
- Minterms: $X'Y'Z'$, $X'Y'Z$
- Common literals: $X' = 1$, $Y' = 1$, $Z$ varies
- **Simplified term:** $X'Y'$

**Group 2 – Vertical Pair (YZ = 11):**

- Covers cells: $(X = 0, Y = 1, Z = 1)$ and $(X = 1, Y = 1, Z = 1)$
- Minterms: $X'YZ$, $XYZ$
- Common literals: $Y = 1$, $Z = 1$, $X$ varies
- **Simplified term:** $YZ$

**Final Simplified SOP Expression:**

$$F = X'Y' + YZ$$

**Answer: (B)**