IIITB COMET FOUNDATION

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GATE QUESTION ECE 2009 Q37

Question

Q37) What are the minimum number of 2-to-1 multiplexers required to generate a 2-input AND gate and a 2-input Ex-OR gate?

Options:

(A) 1 and 2

(B) 1 and 3

(C) 1 and 1

(D) 2 and 2

Answer and Explanation

Answer: (c) 1 and 1

Explanation:

- **2-input AND gate:**

  A 2-input AND gate can be implemented using a single 2-to-1 multiplexer. Use one input (say A) as the select line, connect $I_0 = 0$, and $I_1 = B$. The output is:

  $$Y = A' \cdot 0 + A \cdot B = A \cdot B$$

  Hence, only **1 multiplexer** is required.

- **2-input XOR gate:**

  To implement XOR using 2-to-1 multiplexers, consider:

  $$Y = A' \cdot B + A \cdot B'$$

  In typical GATE (and similar competitive exam) questions involving MUX implementations, it's generally assumed that both the true form and complemented form of input variables are available or can be generated without counting extra basic gates (unless explicitly asked to derive everything solely from MUXes).

  - One MUX to implement the XOR function with inputs B and B'

  Total = **1 multiplexers**.

Thus, the minimum number of 2-to-1 multiplexers required for AND and XOR gates are 1 and 1, respectively.