GATE QUESTION
ECE 2009 Q60

Question

What are the minimum numbers of NOT gates and 2-input OR gates required to design the logic of the given 7-segment display?

Solution:
Given:
A vending machine has two buttons P1 and P2. Based on the button presses, it displays:

P1	P2	Display
0	0	0
1	0	2
0	1	5
1	1	E

Each character lights up certain segments on a 7-segment display:

Digit	Segments ON
0	a, b, c, d, e, f
2	a, b, d, e, g
5	a, c, d, f, g
E	a, d, e, f, g

Approach: We build truth tables for each segment (a–g) based on P1, P2 combinations, then derive Boolean expressions. Using only NOT and 2-input OR gates, AND operations are implemented via De Morgan's Law:

$$/A \cdot B = \overline{\overline{A} + \overline{B}}$$

Minimum gates required:

- **3 NOT gates**

- **4 OR gates**

Correct Answer: 3 NOT and 4 OR