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ESC201 | **Mini-Quiz VI** | **01/04/2025**

Total Marks: 5 | **Time: 10 minutes**

Instructions

- **Please write your name and roll number first.**
- **Read the question carefully and answer it in the question paper itself.**

1) We need to design a digital hardware which classifies the decimal numbers between 0 to 15 as prime numbers i.e. the hardware outputs a logic "1" if the decimal number is prime and logic "0" otherwise.

(a) Write the truth table for this hardware design. (**1 mark**)

(b) Looking at the truth table realized in part (a), would it be optimal to use the SOP form or POS form to represent this Boolean function? Why? (**1 mark**)

(c) Using K-Map, find the minimized expression for the Boolean function to be implemented using this hardware. (**3 marks**)

FYI: 0 and 1 are not considered prime numbers.

(1)

Truth table → (1)

a)

	A	B	C	D	Out
0 →	0	0	0	0	0
1 →	0	0	0	1	0
2 →	0	0	1	0	1
3 →	0	0	1	1	1
4 →	0	1	0	0	0
5 →	0	1	0	1	1
6 →	0	1	1	0	0
7 →	0	1	1	1	1
8 →	1	0	0	0	0
9 →	1	0	0	1	0
10 →	1	0	1	0	0
11 →	1	0	1	1	1
12 →	1	1	0	0	0
13 →	1	1	0	1	1
14 →	1	1	1	0	0
15 →	1	1	1	1	0

∵ Total no. of "1" entries are lower for the output, it is better to use SOP form: minimal no. of minterms.

AB \ CD	00	01	11	10
00	0	0	1	1
01	0	1	1	0
11	0	1	0	0
10	0	0	1	0

→ Correct K-MAP with grey code and entries → (1)

→ Appropriate grouping → (1)

$$Out = \bar{B}CD + \bar{A}\bar{B}C + \bar{A}B\bar{D} + B\bar{C}D$$

Note: This final solution can be different for different grouping styles.

→ if 4 minterms → (1) if more than 4 → (0.5)