

UNIT-II: Gate-Level Minimization Techniques

Part-A: Multiple Choice Questions

1. Karnaugh Map (K-map) is used for:

- A) Coding
- B) Simplification of Boolean functions
- C) Error detection
- D) Memory design

Answer: B

2. A 2-variable K-map contains:

- A) 2 cells
- B) 4 cells
- C) 8 cells
- D) 16 cells

Answer: B

3. A 3-variable K-map contains:

- A) 4 cells
- B) 8 cells
- C) 16 cells
- D) 32 cells

Answer: B

4. A 4-variable K-map contains:

- A) 8 cells
- B) 16 cells
- C) 32 cells
- D) 64 cells

Answer: B

5. Adjacent K-map cells differ by only:

- A) Two bits
- B) Three bits
- C) One bit
- D) Four bits

Answer: C

6. SOP stands for:

- A) Sum of Products
- B) Sum of Powers
- C) Series of Products
- D) Standard Output Process

Answer: A

7. POS stands for:

- A) Product of Sum
- B) Product of Sums
- C) Power of Sum
- D) Process of Sum

Answer: B

8. In SOP, grouping is done using:

- A) Maxterms
- B) Minterms
- C) Variables
- D) Literals

Answer: B

9. In POS, grouping is done using:

- A) Minterms
- B) Maxterms
- C) Variables
- D) Bits

Answer: B

10. Don't-care conditions are represented by:

- A) 0
- B) 1
- C) X
- D) Z

Answer: C

11. Groups in K-map should contain:

- A) 3 cells
- B) Powers of 2
- C) 5 cells
- D) 7 cells

Answer: B

12. Largest possible grouping gives:

- A) Maximum expression
- B) Simplest expression
- C) Complex circuit
- D) None

Answer: B

13. NAND gate implementation is mainly used because it is:

- A) Costly
- B) Universal
- C) Slow
- D) Sequential

Answer: B

14. NOR gate is also a:

- A) Universal gate
- B) Basic gate
- C) Arithmetic gate
- D) Storage gate

Answer: A

15. Prime implicants are obtained by:

- A) Smallest grouping
- B) Largest possible grouping
- C) Single cells
- D) None

Answer: B

16. Essential prime implicants cover:

- A) Common cells
- B) At least one unique minterm
- C) No minterms
- D) All variables

Answer: B

17. K-map method is practical up to:

- A) 2 variables
- B) 4 variables
- C) 10 variables
- D) 16 variables

Answer: B

18. K-map reduces:

- A) Hardware complexity
- B) Voltage

- C) Frequency
- D) Current

Answer: A

19. SOP implementation mainly uses:

- A) AND-OR
- B) OR-AND
- C) XOR
- D) NOT

Answer: A

20. POS implementation mainly uses:

- A) OR-AND
- B) AND-OR
- C) NAND
- D) XOR

Answer: A

Part-B: Fill in the Blanks

1. K-map stands for **Karnaugh Map**.
2. A 2-variable K-map has **4** cells.
3. A 3-variable K-map has **8** cells.
4. A 4-variable K-map has **16** cells.
5. Adjacent cells differ by **one** bit.
6. SOP means **Sum of Products**.
7. POS means **Product of Sums**.
8. SOP uses **minterms**.
9. POS uses **maxterms**.
10. Don't-care conditions are represented by **X**.
11. K-map groups are formed in powers of **2**.
12. The largest grouping gives the **simplest** expression.
13. NAND is a **universal** gate.
14. NOR is a **universal** gate.

15. Prime implicants are **maximum** groups.
16. Essential prime implicants cover at least one **unique minterm**.
17. K-map simplifies Boolean **functions**.
18. SOP is implemented using **AND-OR** logic.
19. POS is implemented using **OR-AND** logic.
20. K-map reduces **hardware complexity**.