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S.No. 7266

P 22 MCACC 11

(For candidates admitted from 2022–2023 onwards)

M.C.A. DEGREE EXAMINATION, NOVEMBER 2023

Computer Applications

**MATHEMATICAL FOUNDATIONS OF COMPUTER
APPLICATIONS**

Time : Three hours

Maximum : 75 marks

PART A — (20 marks)

Answer ALL questions.

I. (A) Multiple choice questions : (5 × 1 = 5)

1. Which symbol to use negation?

(a) $\neg$

(b) $\wedge$

(c) $\neg$

(d) $\vee$

2. Power set of empty set has exactly _____ subset.

(a) Two

(b) One

(c) Zero

(d) Three

3. An algebraic structure _____ is called a semigroup.

(a) $(P, *)$

(b) $(Q, +, *)$

(c) $(P, +)$

(d) $(+, *)$

4. A graph is a set of points called _____.

(a) Nodes

(b) Edge

(c) Fields

(d) Lines

5. Context free grammar is also known as _____ grammar.

(a) type 0

(b) type 1

(c) type 2

(d) type 3

(B) Fill in the blanks : (5 × 1 = 5)

6. $p \vee q$ is logically equivalent to _____.

7. The set of positive integer is _____.

8. Minimum subgroup of a group is called ———.

9. In a ——— the vertex set and the edge set are finite sets.

10. DFSA and NDFSA represent the ——— language.

II. Answer ALL questions : (5 × 2 = 10)

11. Write the following statement in symbolic form. If either Jerry takes calculus or ken takes sociology then Larry will take English.

12. If $A_1 = \{(1, 2), \{3\}\}$, $A_2 = \{\{1\}, \{2, 3\}\}$ and $A_3 = \{\{1, 2, 3\}\}$, then show that A_1 , A_2 and A_3 are mutually disjoint.

13. Define semigroups.

14. Define length of the path.

15. What is context sensitive grammar?

PART B — (5 × 5 = 25)

Answer ALL questions, choosing either (a) or (b).

16. (a) Construct the truth table for the statement formula $P \vee \neg Q$.

Or

(b) Prove $(P \rightarrow Q) \Leftrightarrow (\neg P \vee Q)$.

17. (a) Show that :

(i) $A - B = A \cap \sim B$ and

(ii) $A \subseteq B \Leftrightarrow \sim B \subseteq \sim A$.

Or

(b) If $A = \{\alpha, \beta\}$ and $B = \{1, 2, 3\}$ what are $A \times B$, $B \times A$, $A \times A$, $B \times B$ and $(A \times B) \cap (B \times A)$?

18. (a) Prove that a subset $S \neq \emptyset$ of G is a subgroup of $(G, *)$ iff for any pair of elements $a, b \in S$, $a * b^{-1} \in S$.

Or

(b) Prove that the Kernel of a homomorphism g from a group $\langle G, * \rangle$ to $\langle H, \Delta \rangle$ is a subgroup of $\langle G, * \rangle$.

19. (a) Define the following :

(i) Multigraph

(ii) Directed graph

(iii) Isomorphic

Or

(b) In a simple graph $G=(V,E)$ prove that every node of the digraph lies in exactly one strong components.

20. (a) Explain phrase structure with an example.

Or

(b) Explain direct derivative with an example.

PART C — ($3 \times 10 = 30$)

Answer any THREE questions.

21. Explain the rules for well formed formula and not well formed formula.

22. Show that for any two sets A and B $A - (A \cap B) = A - B$, and also define Boolean sum with an example.

23. Let H be a subgroup of a finite group G . Then prove that the order of H divides the order of G .

24. Prove that the number of vertices of odd degree in a graph is always even.

25. Consider the problem of trying to generate or produce the sentence "a monkey ate the banana".