

B.E. Third Semester (Information Technology) (CGS)
10712 : Discrete Structures : 3 IT 03

P. Pages : 2

Time : Three Hours



AU - 2531

Max. Marks : 80

- Notes :
1. Due credit will be given to neatness and adequate Dimensions.
 2. Assume suitable data wherever necessary.
 3. Illustrate your answer necessary with the help of neat sketches.

1. a) What is statement formula? What are the rules to generate well-formed formula? **5**
b) Show that the truth values of the following formulas are independent of their components **8**
i) $(P \wedge (P \rightarrow Q)) \rightarrow Q$
ii) $(P \rightarrow Q) \Leftrightarrow (\neg P \vee Q)$

OR

2. a) Obtain the Principal conjunctive normal form of $(\neg P \rightarrow R) \wedge (Q \Leftrightarrow P)$. **6**
b) Show that $S \vee R$ is tautologically implied by $(P \vee Q) \wedge (P \rightarrow R) \wedge (Q \rightarrow S)$ **7**
3. a) Explain with example. **8**
i) Set ii) Subset
iii) Equality of set iv) Proper subset.
b) Show that **6**
 $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
By i) formal proof ii) Venn diagram

OR

4. a) What is Recursion? Explain it with its properties. **7**
b) Given $S = \{1, 2, 3, 4, \dots, 10\}$ and a relation R on S . Where $R = \{(x, y) \mid x+y=10\}$.
What are the properties of the relation R . **7**
5. a) What is context free grammer (CFG)? What is the CFG for the following language **6**
 $L(G) = \{a^n b a^n \mid n \geq 1\}$
b) Write down the composition table for **7**
 $\langle Z_7, +_7 \rangle$ and $\langle Z_7, *_7 \rangle$.

OR

6. a) What is coset? Find the left coset of $\{[0], [3]\}$ in the group $\langle Z_6, +_6 \rangle$. **7**
b) Show that if every element in a group is its own inverse, then the group must be abelian. **6**

7. a) Write the following Boolean expression in an equivalent sum of product canonical form of three variables x_1, x_2 and x_3 8
 i) $x_2 * x_3'$
 ii) $(x_1 \oplus x_2)'$

- b) Draw the diagram of the Lattices $\langle S_n, D \rangle$ for $n = 8, 12, 45, 75$ 6

OR

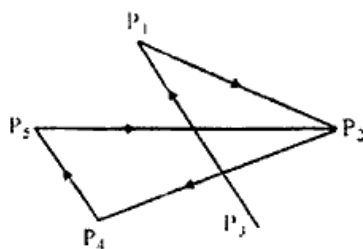
8. a) Prove the following Boolean identities 7
 i) $a \oplus (a' * b) = a \oplus b$
 ii) $a * (a' \oplus b) = a * b$
 iii) $(a * b) \oplus (a * b') = a$

- b) Explain with example 7
 i) Sublattice ii) Distributed lattice

9. a) Explain WARSHALL algorithm with suitable example. 6
 b) Show that in a complete binary tree the total number of edges is given by $2(n_i - 1)$. Where n_i is the total number of terminal nodes. 7

OR

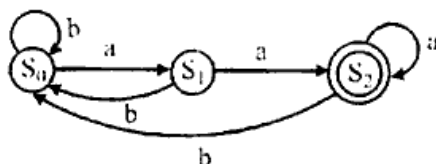
10. a) Explain storage representation and manipulation of graphs with suitable example. 6
 b) Obtain 7
 i) Adjacency matrix ii) Path matrix of the graph



11. Explain deterministic and non-deterministic finite automata with example. Also construct DFA which will accept all decimal numbers divisible by 4. 13

OR

12. What is FSM. Consider the FSM whose diagram is given below. 13



- i) List the values of transition function f_ω for $\omega = abba$.
 ii) List the values of transition function f_ω for $\omega = babab$.
