

M.Sc. (Computer Science)-I Sem-I (Old)
1MSC1 - Paper-I : Discrete Mathematical Structure

P. Pages : 2
 Time : Three Hours



GUG/S/19/2878
 Max. Marks : 80

- Notes : 1. All questions are compulsory and carry equal marks.
 2. Draw neat and labeled diagram and use supporting data wherever necessary.
 3. Avoid vague answer and write specific answer related to questions.

- 1. Either**
- a) Prove that If A and B are finite set then $|A \cup B| = |A| + |B| - |A \cap B|$. **8**
- b) Construct the truth table for following. **8**
- i) $A \oplus B \oplus C$ ii) $(p \rightarrow q) \equiv ((\neg q) \rightarrow \sim p)$
- iii) $\sim (p \rightarrow q) \equiv (p \wedge \sim q)$ iv) $(p \wedge q) \rightarrow q$

OR

- c) Prove that statement is true by using mathematical induction. **8**
- $$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$
- d) Show that: **8**
- i) $\neg(P \wedge Q) \rightarrow (\neg P \vee (\neg P \vee Q)) \Leftrightarrow (\neg P \vee Q)$
- ii) $(P \vee Q) \wedge (\neg P \wedge (\neg P \vee Q)) \Leftrightarrow (\neg P \wedge Q)$

- 2. Either**
- a) To Prove **8**
- i) $p(n,r) = p(n-1, r) + r \cdot p(n-1, r-1)$
- ii) $p(n,r) = n \cdot p(n-1, r-1)$

- b) Let $x = \{1, 2, 3, 4\}$ and $R = \{(x, y) / x < y\}$ Draw diagram of R and it's Matrix. **8**

OR

- c) Let A, B and C be the subsets of u prove that $A \times (B \cup C) = (A \times B) \cup (A \times C)$. **8**
- d) Let $x = \{1, 2, 3\}$, $y = \{a, b\}$ and $z = \{5, 6, 7\}$. Consider the functions $f = \{(1, a), (2, a), (3, b)\}$ and $g = \{(a, 5), (b, 7)\}$ as in fig (a) and (b) Find the composition of gof. **8**

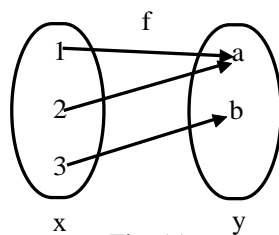


Fig. (a)

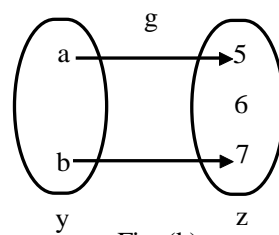
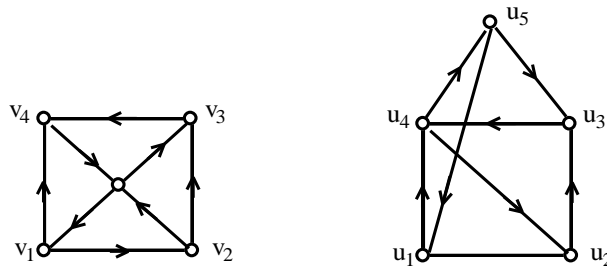


Fig. (b)

3. Either

a) Show that diagram showing fig. (a) and fig. (b) are Isomorphic. 8



b) Explain the following with example. 8

- i) Euler paths and circuits ii) Hamiltonian paths and circuits

OR

c) To prove $a \oplus (a * b) = a$ or $a * (a \oplus b) = a$ 8

d) What do you mean by Trees? Construct the tree for following. 8

- i) $((2 \times 7) + x) \div y \div (3 - 11)$
 ii) $(3 - (2 - (11 - (9 - 4)))) \div (2 + (3 + (4 + 7)))$

4. Either

a) Show that If 'f' is a homomorphism from a commutative semigroup $(S, *)$ onto a semigroup $(T, *)$, then $(T, *)$ is also commutative. 8

b) Let G be the grammar 8

- $S \rightarrow aB \mid bA$
 $A \rightarrow a \mid aS \mid bAA$
 $B \rightarrow b \mid bS \mid aBB$

for the string 'aaa bb abbba'

- Find a) Leftmost derivation b) Rightmost derivation c) Parse tree

OR

c) Prove the left cancellation law i.e. $ab = ac \Rightarrow b = c \forall a, b, c \in G$ (left Cancellation law) 8

d) Find the left linear and right linear grammar for following language. 8

- i) $0^*(1(0+1))^*$ ii) $(0+1)^*00(0+1)^*$ iii) $((0+10)11)^*00)^*$

5. Solve all questions.

a) Explain conditional statement and Biconditional statement with truth table. 4

b) Prove that ${}^nC_{n-r} = {}^nC_r, n \geq r \geq 1$ 4

c) Define following term's – 4

- i) Graph ii) Adjacent Node

d) Explain Moore Machine. 4
