

M.Sc. (Computer Science) (CBCS Pattern) Semester-I  
**PSCSCT02 - Discrete Mathematics - II**

P. Pages : 2

Time : Three Hours



**GUG/S/25/11143**

Max. Marks : 80

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

**Either**

1. a) What is set? Explain different operations on set? 8
- b) Prove that the statement is true by using mathematical induction. 8
- $$1^2 + 3^2 + 5^2 + \dots + (2n-1)^2 = \frac{n(2n-1)(2n+1)}{3}$$

**OR**

- c) Show that – 8
- i)  $(A-B)-C = (A-C)-(B-C)$
  - ii)  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
- d) Obtain the principle conjunctive normal form of the given formula – 8
- $$(\neg P \rightarrow R) \wedge (Q \rightleftharpoons P)$$

**Either**

2. a) What is relation? Explain properties of relation with suitable example. 8
- b) Explain extended pigeonhole principle. Show that if 9 colours are used to paint 100 houses, at least 12 houses will be of same colour. 8

**OR**

- c) Let  $A = \{1, 2, 3\}$  and  $B = \{1, 2, 3, 4\}$  and  $R'$  and  $S'$  be the relations from A and B whose matrices are as – 8

$$M_R = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix} \cdot M_S = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \end{bmatrix}$$

Find  $\bar{S}$ ,  $R \cap S$ ,  $R \cup S$  and  $R^{-1}$

- d) Write about Warshall's Algorithm in detail. 8

**Either**

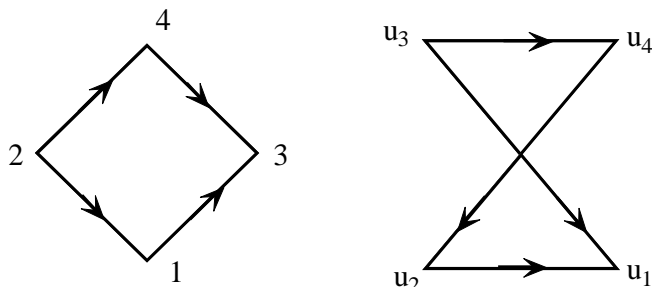
3. a) Explain following terms – 8
- i) Mixed graph
  - ii) Multigraph
  - iii) Undirected graph
  - iv) Null graph

- b) Prove that in a distribute lattice the complement of a element is unique. 8

**OR**

- c) Define following – 8  
 i) Partially ordered set  
 ii) Hasse diagram

- d) Show that the following graph are isomorphic – 8



**Either**

4. a) Prove that – 8  
 $(ab)^{-1} = b^{-1} a^{-1}$  for all  $a, b \in G$ .

- b) Show that if  $G$  is an abelian group then every subgroup of  $G$  is normal subgroup. 8

**OR**

- c) 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 'aaabbabbba' find :  
 i) Leftmost derivation  
 ii) Rightmost derivation

- d) Let  $T$  be the set of all even integer. Show that the semigroup  $(\mathbb{Z}, +)$  and  $(T, +)$  are isomorphic. 8

5. Attempt all the questions –

- a) Construct a Truth table for  $\sim(p \vee q) \equiv \sim p \wedge \sim q$  4  
 b) Determine distinguishable permutation of – 4  
 i) BOOLEAN ii) MISSISSIPPI  
 c) Discuss in short about Euler paths and circuits with example. 4  
 d) Write a note on Abelian group. 4

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