Roll No.

Total Pages : 3

BT-4/J-22

44151

DISCRETE MATHEMATICS Paper–PC-CS-202A

[Time : Three Hours]

[Maximum Marks: 75]

Note : Attempt *five* questions in all, selecting at least *one* question from each unit.

UNIT-I

- 1. (a) Prove that $[p \Rightarrow (q \Rightarrow r)] \Rightarrow [(p \Rightarrow q) \Rightarrow (p \Rightarrow r)]$ is a tautology.
 - (b) Prove that $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$

(c) Prove the following proposition by PMI (Principle of Mathematical Induction):

1+2+3+...+n=n(n+1)/2

2. Explain Principle of Inclusion and exclusion. A survey on a sample of 25 new cars was conducted to see which of three popular options, Air conditioning (A), Radio (R), Power windows (P) were installed. The survey found that 15 had air conditioning, 4 had radio and power windows, 12 had radio, 3 had all three options, 5 had air conditioning and power windows, 2 had no options and 9 had air conditioning and radio.

(i) Only power windows

(ii) Only one of the windows

(iii) Air conditioning and radio but not power windows(iv) Only radio

UNIT-II

3. (a) Let $A = \{4, 6, 8, 10\}$ and $R = \{(4, 4), (4, 10), (6, 6), (6, 8), (8, 10)\}$. Find the transitive closure using Warshall's Algorithm and also write steps of the Warshall's Algorithm

(b) Define Relations. Let $X = \{1, 2, 3, 4, 5, 6\}$ and R be a relation defined as $(x, y) \in R$, if and only if x - y is divisible by 3. List the elements of Relation R.

4. (a) Consider a set $D_{45} = \{1, 3, 5, 9, 15, 45\}$ and let the relation \leq be the relation (divides) be a partial ordering on D_{45} :

(i) Determine GLB and LUB of B, B is subset of D_{45} , where $B = \{9, 15, 45\}$

(ii) Determine GLB and LUB of B, B is subset of D_{45} , where $B = \{1, 3, 5\}$

(iii) Draw Hasse diagram for D_{45}

(b) Differentiate between Symmetric, Antisymmetric and Asymmetric relations with suitable examples.

UNIT-III

5. (a) Solve the recurrence relation $a_{r+2} - 5a_{r+1} + 6a_r = 2$ by using method of generating functions satisfying the initial conditions $a_0 = 1$ and $a_1 = 2$.

(b) How many people at least in a group of 85 people have

same initials?

6. (a) Describe types of functions with suitable examples.

(b) From a committee consisting of 6 men and 7 women, in how many ways can a committee be constructed, if committee consists of (i) 3 men and 4 women (ii) 4 members, which has at least one woman.

UNIT-IV

- 7. (a) Define the following terms with suitable examples:
 - (i) Monoid(ii) Abelian Group(iii) Ring Homomorphism(iv) Group
 - (b) Let G ={-1, 0, 1}, verify whether G forms a group under usual addition.
- 8. (a) Consider an algebraic system (Q,*), where Q is the set of rational numbers and * is defined as a*b=a+b-ab
 ∀ a,b∈Q. Determine whether (Q,*) is a group.
 - (b) Define a Semigroup. Write properties for a Semigroup.Explain with a suitable example.