

1108  
B.E., (Computer Science and Engineering)  
Third Semester  
CS-303: Discrete Structures

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section.

x-x-x

Q1. Attempt the following:-

- I. What is indegree and outdegree of a graph?
- II. Define POSETS.
- III. Define abelian group.
- IV. Differentiate between an ordered and unordered partition of a finite set.
- V. Explain the Pigeonhole principle.
- VI. Give an example of graph that has Euler Circuit but not Hamiltonian Circuit.
- VII. Differentiate predicate logic and propositional logic.
- VIII. Discuss recurrence relations.
- IX. Define lattice with example.
- X. What do you mean by chromatic number?

(10)

Section A

Q2(a) Let R and S be the following relations on  $A = \{1, 2, 3\}$ :

$R = \{(1, 1), (1, 2), (2, 3), (3, 1), (3, 3)\}$ ,

$S = \{(1, 2), (1, 3), (2, 1), (3, 3)\}$

Find a)  $R \cup S, R \cap S, R^c$ ;

b)  $S^2 = S \circ S$ .

(b) Prove that If R is an equivalence relation on a set A, show that  $R^{-1}$  is also an equivalence relation on A.

(05+05)

Q3(a) Let  $f: R \rightarrow R$  be defined by  $f(x) = 3x - 7$ . Find a formula for the inverse function  $f^{-1}: R \rightarrow R$

(b) Let  $A = \{1, 2, 3, 4\}$ , give an example of a mapping which is (i) neither symmetric nor anti-symmetric, (ii) anti-symmetric and reflexive but not transitive.

(05+05)

Q.4

(a) Test the validity of the following arguments :

- 1. If milk is black then every crow is white.
- 2. If every crow is white then it has 4 legs.
- 3. If every crow has 4 legs then every Buffalo is white and brisk.
- 4. The milk is black.
- 5. So, every Buffalo is white.

b) Prove the validity of following arguments without using truth table.

$(p \wedge q) \rightarrow r, p \rightarrow q \vdash p \rightarrow ((p \wedge q) \wedge r)$

(05+05)



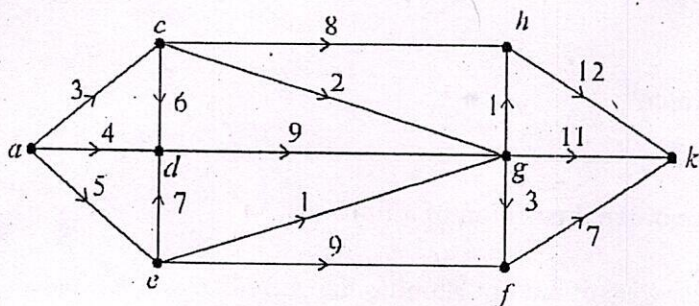
Section B

Q.5(a) How many 5-digits telephone numbers can be constructed using the digits 0 to 9 if each number starts with 67, for example 67125 etc., and no digit appears more than once?

(b) If  $A(n) - 9A(n-1) + 26A(n-2) - 24A(n-3) = 0$  for  $n \geq 3$  with,  $A(0) = 0$ ,  $A(1) = 1$  and  $A(2) = 10$ . Determine the sequence from its generating function.

(05 + 05)

Q.6(a) Find the shortest path from a to k using Dijkstra's Algorithm.



- (b) Define and give example of
- Homeomorphic graph
  - Complete bipartite graph.

(05 + 05)

Q.7 Consider the set  $Q$  of rational numbers, and let  $*$  be the operation on  $Q$  defined by

$$a * b = a + b - ab$$

- Find: (i)  $3 * 4$ ; (ii)  $2 * (-5)$ ; (iii)  $7 * (1/2)$ .
- Is  $(Q, *)$  a semigroup? Is it commutative?
- Find the identity element for  $*$ .
- Do any of the elements in  $Q$  have an inverse? What is it?

(10)

x-x-x