

[4457] - 111

S.E. (Computer Engineering/Information Technology) (Semester - I)

DISCRETE STRUCTURE

(2008 Course)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:-

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q. 8, Q.9 or Q.10, Q.11 or Q.12.
- 2) Assume suitable data wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Neat diagrams must be drawn wherever necessary.

- Q1)** a) With the help of mathematical induction prove that $8^n - 3^n$ is multiple of 5. [6]
- b) What is multiset? Explain its significance with examples. [2]
- c) Among the integers 1 to 1000 [8]
- i) How many of them are not divisible by 3 nor by 5 nor by 7.
 - ii) How many are not divisible by 5 or 7 but divisible by 3.

OR

- Q2)** a) Salad is made with combination of one or more eatables, how many different salads can be prepared from onion, carrot, cabbage, and cucumber? [2]
- b) It is known that in university 60% of professors play tennis, 50% of them play bridge, 70% jog, 20% play tennis and bridge, 40% play bridge and jog and 30% play tennis and jog. If someone claimed that 20% professors jog and play tennis and bridge, would you believe his claim? Why? [6]
- c) With the help of venn diagram prove the following : [8]
- i) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
 - ii) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
 - iii) $(A - B) - C = A - (B \cup C)$

- Q3)** a) Define the following terms with suitable example: [8]
- Group
 - Monoid
 - Isomorphism
 - Automorphism
- b) Let $R = \{0^\circ, 60^\circ, 120^\circ, 180^\circ, 240^\circ, 300^\circ\}$ and $*$ is binary operation, so that for a and b in R , $a*b$ is overall angular rotation corresponding to successive rotations by a and then by b . Show that $(R, *)$ is a group. [8]

OR

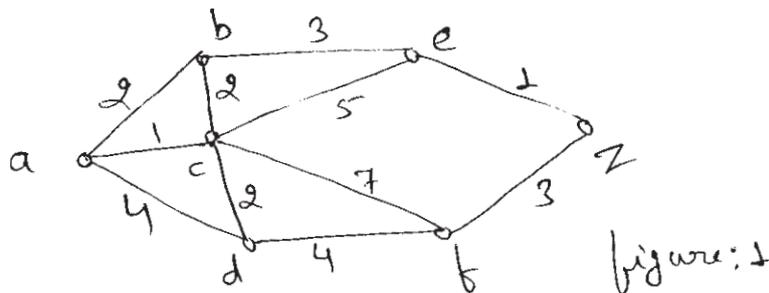
- Q4)** a) Define the following terms with suitable example: [8]
- Ring
 - Integral domain
 - Field
 - Cyclic Group
- b) Consider an algebraic system $A = \{1, 5, 7, 11\}$ under multiplication modulo 12. Prove that it is a group. Also find whether it is an abelian group or not? Justify your answer. [8]

- Q5)** a) Find the transitive closure by using warshall's algorithm $A = \{1, 2, 3, 4, 5, 6\}$ and $R = \{(x, y) \mid |x - y| = 2\}$. [8]
- b) Show that the set of all divisors of 70 forms a lattice. [8]

OR

- Q6)** a) Let $A = \{1, 2, 3, 4, 5, 6\}$ and $\pi = [\{1, 2\}, \{3, 4, 5\}, \{6\}]$, Find the equivalence relation determined by π also draw its diagram. [8]
- b) What is function? How it differ from the relation? Explain the types of function with a suitable example. [8]

- Q7)** a) Find the shortest distance in the given *figure 1* from a to z by using Dijkstra shortest path algorithm. [8]



- b) List and explain the necessary & sufficient conditions for Hamiltonian and Eulerian path with suitable examples. [8]

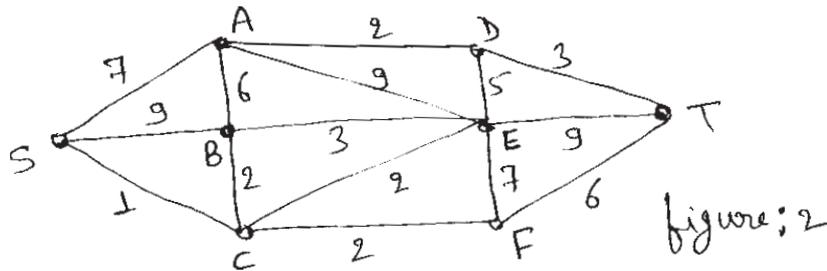
OR

- Q8)** a) i) Show that if G is connected planar graph with N vertices, E edges and R regions then $N - E + R = 2$. [8]
 ii) Show that a complete graph with n vertices consist of $n(n-1)/2$ edges.
 b) i) What is Travelling salesman problem? How it can be solved? [8]
 ii) Explain the applications of graph theory with suitable examples.

- Q9)** a) For the following set of weights, construct an optimal binary tree. For each weight in the set, give the corresponding code words. [8]

8, 9, 12, 14, 16, 19.

- b) Find the minimum spanning tree of the *figure 2* using Prim's algorithm. [8]

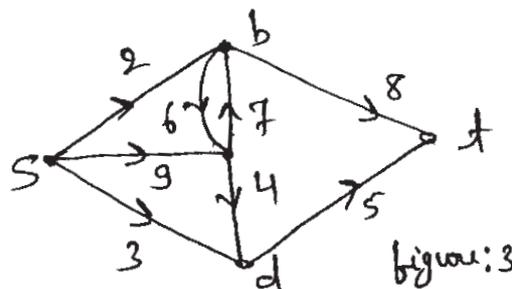


OR

- Q10)** a) Define the following terms with reference to tree : [8]

- M-ary Tree
- Optimal Binary Tree
- Height of a Tree
- Huffman code

- b) Find the Maximum flow of the given Transport network in *figure 3*. [8]



- Q11)** a) In a college 25% students failed in Maths, 15% student failed in Physics and 10% students failed in both Maths and Physics. A student is selected randomly then what is the probability that : **[8]**
- i) If he failed in Physics, he also failed in Maths.
 - ii) He failed in maths or Physics.
- b) A problem on probability is given to four students A, B, C, D. The probability of solving that problem are $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{4}$ and $\frac{2}{5}$ respectively. **[8]**
- i) What is the probability that the problem will be solved?
 - ii) exactly one of them will solve the problem
- c) Write the rule of sum & rule of product. **[4]**

OR

- Q12)** a) Find the number of arrangements that can be made out of the letters : **[6]**
- i) ASSASSINATION
 - ii) MISSISSIPPI
- b) Two cards are drawn at random from an ordinary deck of 52 cards. Find the probability of (a) Both are spades (b) one is spade and one is heart. **[8]**
- c) There are 10 points in a 2D plane. Four of them are collinear. Find the number of different straight lines that can be drawn by joining these points. **[6]**

