Total No. of Questions—8] [Total No. of Printed Pages—4+1

Seat No.	

[4957]-1071

S.E. (Computer) (First Semester) EXAMINATION, 2016

DISCRETE STRUCTURES

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Neat diagrams must be drawn wherever necessary.

(*ii*) Figures to the right indicate full marks.

(*iii*) Assume suitable data, if necessary.

1. (*a*) Use mathematical induction to show that :

$$1^2 - 2^2 + 3^2 - 4^2 + \ldots + (-1)^{n-1} n^2 = (-1)^{n-1} \cdot \frac{n(n-1)}{2}. \quad [4]$$

(*b*) The converse of statements is given. Write inverse and contra-positive statements. [3]

(*i*) If he is considerate of others, then a man is a gentleman.

(*ii*) If a steel rod is stretcher, then it has been heated.

(*c*) Use Warshall's algorithm to compute the transitive closure of $R \cup S$ for the relations R and S defined on A = {1,2,3,4} described as : [6]

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

P.T.O.

Or

2. (*a*) Let A and B be sets such that $(A \cup B) \subseteq B$ and $B \not\subset A$. Draw the corresponding Venn diagram. [3]

(*b*) Among 100 students, 32 study mathematics, 20 study physics, 45 study biology, 15 study mathematics and biology, 7 study mathematics and physics, 10 study physics and biology and 30 do not study any of the three subjects. [6]

(*i*) Find the number of students studying all three subjects.

(*ii*) Find the number of students studying exactly one of the three subjects.

(*b*) Let R and S be two relations whose corresponding diagraphs are shown in fig 2.1, Compute : [4]

(*i*) R^{-}

(*ii*) $R \cap S$

(*iii*) $R \cup S$

(*iv*) S^{-1}.

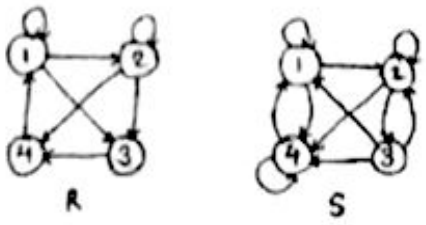


Fig. 2.1

3. (*a*) Consider the Binary operation * on Q, the set of rational numbers defined by $a * b = a + b - ab$, $\forall a, b \in Q$. Determine whether * is group. [6]

(*b*) Use Dijkstra's algorithm to find the shortest path between *a* and *z* for Fig. 3.1. [6]

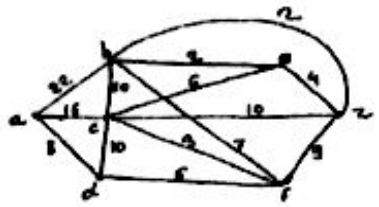


Fig. 3.1.

Or

4. (*a*) Show that (F, +, .) is a field where F is set of all rational numbers and + and are ordinary addition and multiplication operations. [6]

(*b*) Use nearest neighbour method to find the Hamiltonian circuit starting from '*a*' in the Fig. 4.1, find its weight. [6]

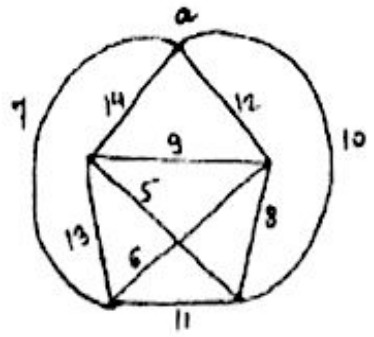


Fig. 4.1

5. (*a*) Define the following terms with example : [6]

(*i*) Binary search tree

(*ii*) Bipartite graph

(*iii*) M-ary tree.

(*b*) For the following sets of weights, construct an optimal binary prefix code for each weight in the set, give the corresponding code word : 8, 9, 10, 11, 13, 15, 22. [7]

Or

6. (*a*) Give the stepwise construction of minimum spanning tree using Prim's algorithm for the graph in Fig. 6.1. Obtain the total cost of minimum spanning tree. [7]

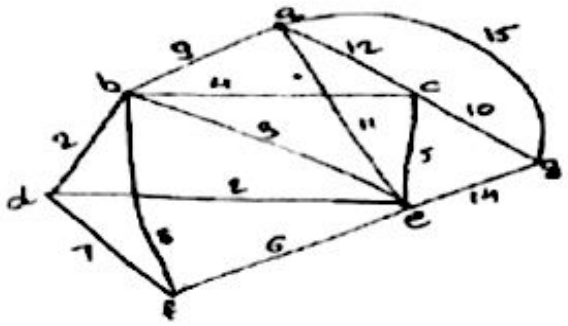
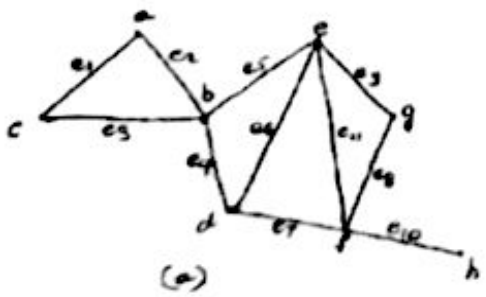
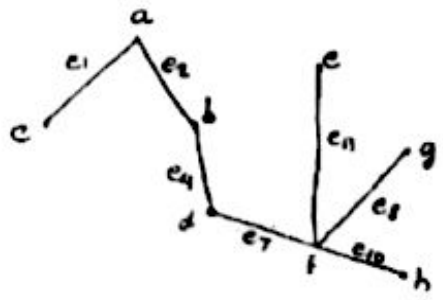


Fig. 6.1.

(*b*) Find the fundamental system of cut-set for the graph G shown below with respect to the spanning tree T. [6]





7. (*a*) (*i*) If the letters of the word 'REGULATIONS' be arranaged at random. What is the chance that there will be exactly 4 letters between R and E ?

(*ii*) What is the probability that four S's come consecutively in the word 'MISSISSIPPI' ? [6]

(*b*) Suppose repetitions are permitted : [6]

(*i*) How many ways three digit number can be formed six digits 2,3,4,5,7 and 9 ?

(*ii*) How many of these numbers are less than 400 ?

(*iii*) How many are even ?

(*iv*) How many are odd ?

(*v*) How many are multiple of 5 ?

(*vi*) How many are multiple of 10 ?

Or

8. (*a*) If two dice are thrown, what is the probability that the sum is : [6]

(*i*) Greater than 8 ?

(*ii*) Neither 7 nor 11 ?

(*b*) Four persons are chosen at random from a group containing 3 men, 2 women and 4 children. Find the chance that exactly two of them will be children. [6]