

Total No. of Questions—8]

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**[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 :

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

**(b)** The converse of statements is given. Write inverse and contrapositive 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  $B \not\subseteq A$ . 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 digraphs are shown in fig 2.1, Compute : [4]
- (i)  $R^{-1}$
- (ii)  $R \cap S$
- (iii)  $R \cup S$
- (iv)  $S^{-1}$ .

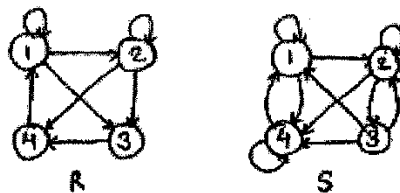
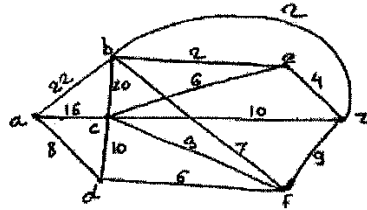


Fig. 2.1

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

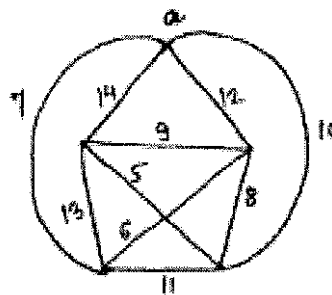
- (b) Use Dijkstra's algorithm to find the shortest path between  $a$  and  $z$  for Fig. 3.1. [6]



**Fig. 3.1.**

Or

4. (a) Show that  $(F, +, \cdot)$  is a field where  $F$  is set of all rational numbers and  $+$  and  $\cdot$  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]

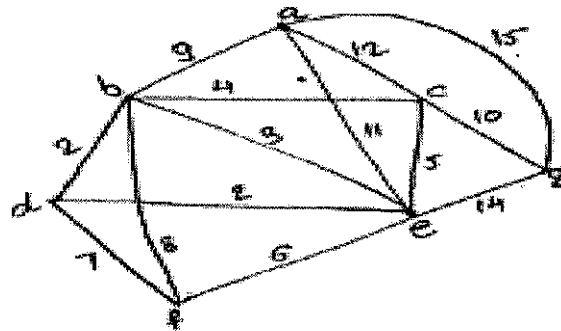
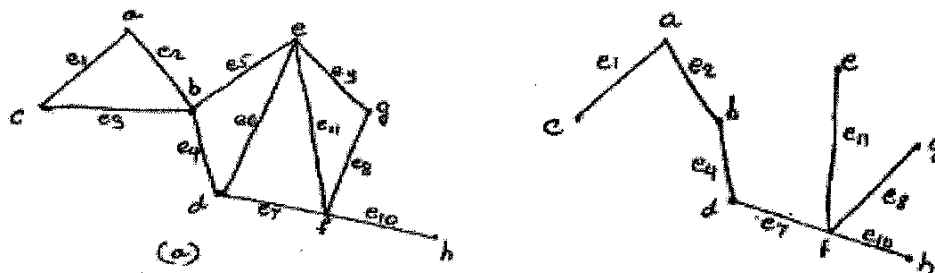


Fig. 6.1.

- (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 arranged 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 ?

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*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]