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 :

$$1^2 - 2^2 + 3^2 - 4^2 + \ldots + (-1)^{n-1} n^2 = (-1)^{n-1} \cdot \frac{n(n-1)}{2}.$$ 　[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 ∪ S for the relations R and S defined on A = {1,2,3,4} described as : 　[6]

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

2. (*a*) Let A and B be sets such that (A ∪ B) ⊆ B and B ⊄ 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 ∩ S
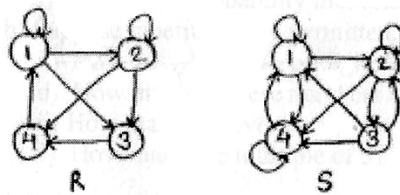
   (*iii*) R ∪ S

   (*iv*) S⁻¹.

Fig. 2.1

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

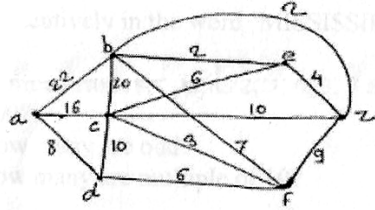(*b*) Use Dijkstra's algorithm to find the shortest path between *a* and *z* for Fig. 3.1. [6]

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]
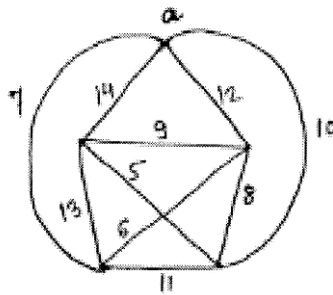

Fig. 4.1

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]
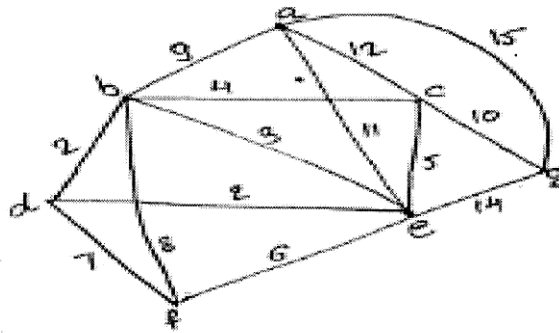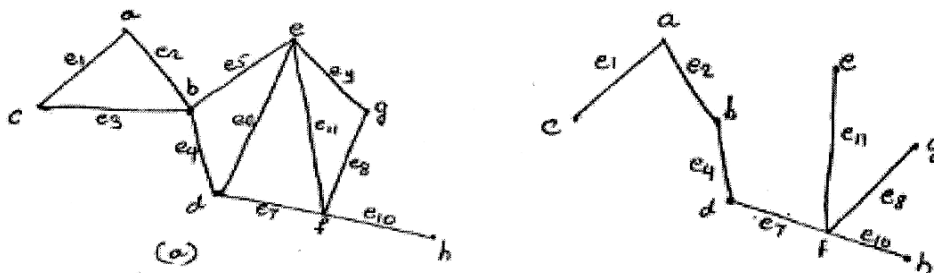

Fig. 6.1.

(*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 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 ?

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]