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[5352]-561

S.E. (Computer) (First Semester) EXAMINATION, 2018

DISCRETE MATHEMATICS

(2015 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) Prove : [4]

$$1^3 + 2^3 + 3^3 + \dots + n^3 = \left[ \frac{n(n+1)}{2} \right]^2.$$

(b) Prove that the set of rational numbers is countably infinite. [4]

(c) Let  $A = \{1, 2, 3\}$  and  $f_1$  and  $f_2$  are functions from  $A$  to  $B$  given by : [4]

$$f_1 = \{(1, 2), (2, 3), (3, 1)\} \text{ and}$$

$$f_2 = \{(1, 2), (2, 1), (3, 3)\}$$

Compute  $f_1 \circ f_2$  and  $f_2 \circ f_1$

P.T.O.

Or

2. (a) Compute the transitive closure of given digraph using Warshall's algorithm : [4]

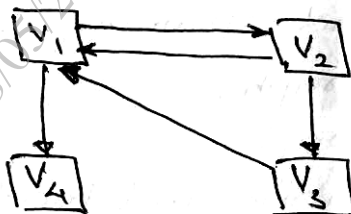


Fig. 2(a) Graph  $G(V, E)$

- (b) Show that the relation  $R$  is "Less than" from  $A$  to  $B$  where : [4]

$$A = \{1, 2, 8\} \text{ and}$$

$$B = \{1, 2, 3, 5\}$$

Find :

- (i)  $R$  in Roster form
  - (ii) Domain and Range of  $R$ .
- (c) Explain with example, notation used and mathematical expression to describe the following terms : [4]
- (i) Membership
  - (ii) Subset
  - (iii) Equality between sets
  - (iv) Union of sets.

3. (a) Write an algorithm for generating permutation of  $\{1, 2, \dots, n\}$ . Apply it for  $n = 3$  case. [4]
- (b) Solve the following :
- (i) How many different car number plates are possible with 2 letters followed by 3 digits. [4]
- (ii) How many of these number plates begin with 'MH'.
- (c) Consider a graph  $G(V, E)$  where  $V = \{v_1, v_2, v_3\}$  &  $\deg(v_2) = 4$  : [4]
- (i) Does such simple graph exist? If not, why?
- (ii) Does such a multigraph exist? If yes, give example.

Or

4. (a) Explain the following in brief : [4]
- (i) Subgraphs and spanning subgraph
- (ii) Isomorphic graph
- (iii) Bipartite graph
- (iv) Adjacency matrix and incidence matrix of undirected graph.
- (b) Apply Dijkstra's Algorithm to find the shortest path from vertex  $v_1$  to  $v_5$  in the graph shown below in Fig. 4.(b). [4]

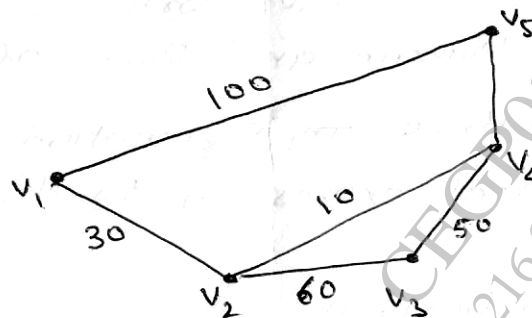


Fig. 4(b). Weighted Graph

(c) In how many ways can a cricket team of eleven players be chosen out of a batch of 14 players. How many of them will : [4]

(i) Include a particular player.

(ii) Exclude a particular player.

5. (a) Determine the maximum flow in the transport network shown in Fig. 5. (a) using Labelling procedure. Determine the corresponding min. cut. [7]

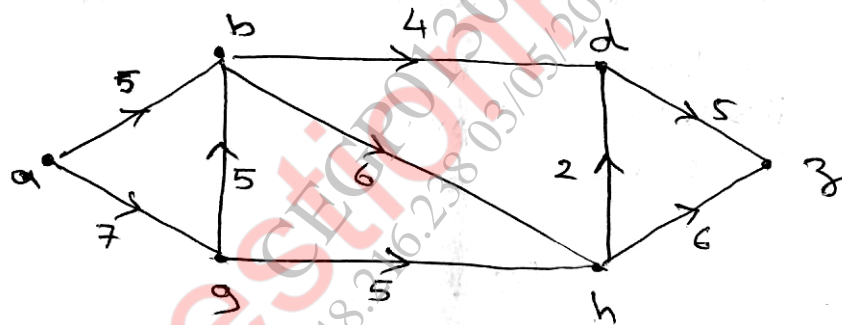


Fig. 5.(a) Graph Transport network.

(b) Explain the following terms : [6]

(i) Spanning trees

(ii) Properties of trees

(iii) M-ary tree.

Or

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

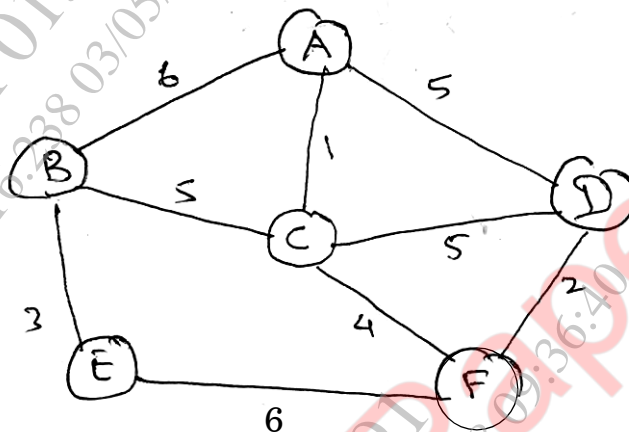


Fig. 6.(a) Graph G.

- (b) Explain the following : [6]
- (i) Game tree
  - (ii) Kruskal's Algorithm.
7. (a) Let  $R = \{0, 60, 120, 180, 240, 300\}$  and  $*$  = binary operation so that for  $a$  and  $b$  in  $R$ ,  $a * b$  is overall angular rotation corresponding to successive rotation by  $a$  and by  $b$ . Show  $(R, *)$  is a group. [7]
- (b) Explain the following terms with examples : [6]
- (i) Ring
  - (ii) Integral Domain
  - (iii) Field.

Or

8. (a) Show that  $(\mathbb{I}, \oplus, \odot)$  is a commutative ring with identity where  $\oplus$  and  $\odot$  are defined as : [7]

$$a \oplus b = a + b - 1 \text{ and}$$

$$a \odot b = a + b$$

- (b) Explain the following terms : [6]

(i) Monoids

(ii) Sub-group

(iii) Group codes.