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[5152]-161

S.E. (Computer Engg.) EXAMINATION, 2017

DISCRETE STRUCTURES

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Solve Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

1. (a) Use mathematical induction to show that : [4]

$$P(n) = 1 + 4 + 7 + \dots + (3n - 2) = \frac{n(3n - 1)}{2}.$$

(b) Let [3]

$$A = \{a, b, \{a, c\}, \phi\}$$

determine the following sets :

(i) $A - \{a\}$

(ii) $A - \phi$

(iii) $A - \{a, c\}$.

P.T.O.

- (c) Find the transitive closure of the relation R on : [5]

$A = \{1, 2, 3, 4\}$ defined by

$R = \{(1, 2), (1, 3), (1, 4), (2, 1), (2, 3), (3, 4), (3, 2),$
 $(4, 2), (4, 3)\}$

Or

2. (a) Consider a set of integers from 1 to 250. Find how many of these numbers are divisible by 3 or 5 or 7 ? Also indicate how many are divisible by 3 or 5 but not by 7. [6]

- (b) Prove that : [2]

$$P \leftrightarrow Q = (P \rightarrow Q) \wedge (Q \rightarrow P) = (\sim P \vee Q) \wedge (\sim Q \vee P).$$

- (c) Draw the Hasse diagram of the following sets under the partial ordering relation 'divides' and indicate those which are chains. [4]

(i) $\{2, 4, 12, 24\}$

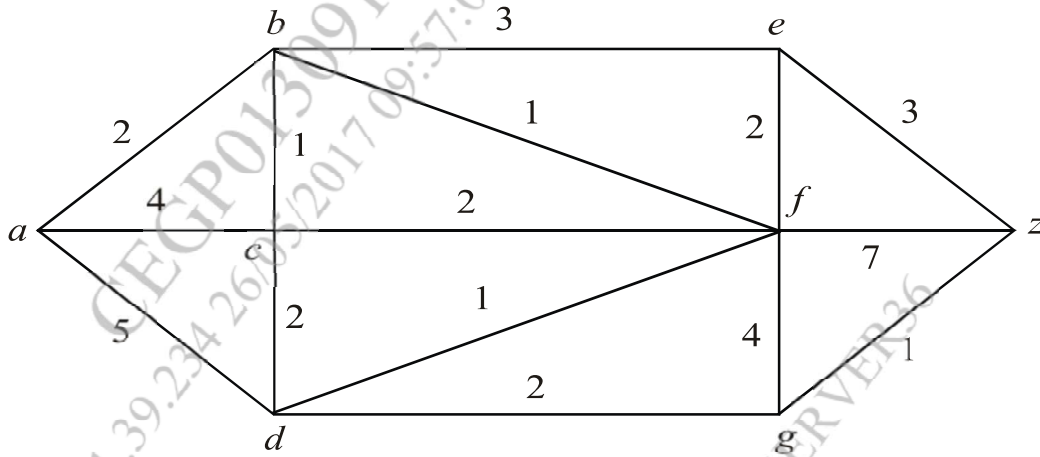
(ii) $\{1, 3, 5, 15, 30\}$.

3. (a) Consider the binary operation * on Q, the set of rational numbers other than 1 with operation * defined by : [6]

$$a * b = a + b - ab, \forall a, b \in Q$$

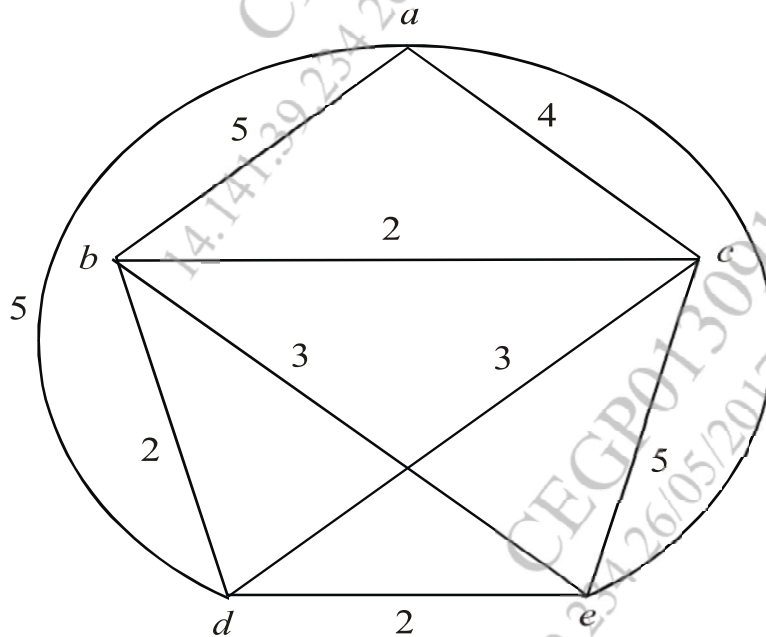
is an abelian group.

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



Or

4. (a) Prove that $(R, +, *)$ is a ring with zero divisors, where R is 2×2 matrix and $+$ and $*$ are usual addition and multiplication operations. [6]
- (b) Use nearest neighbour method to find the Hamiltonian circuit starting from ' a ' in the following graph, find its weight. [6]



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

(i) Level and Height of a Tree

(ii) Eccentricity of Vertex

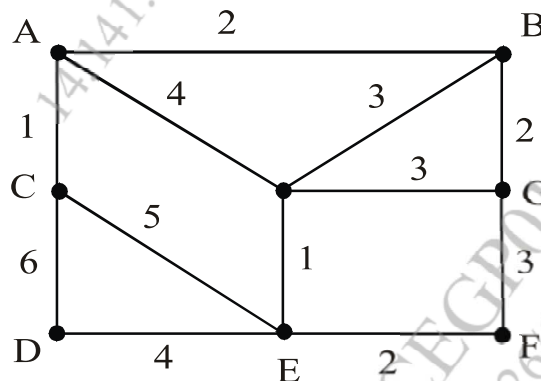
(iii) Rooted Tree and Binary Tree.

(b) For the following sets of weights, construct an optimal binary prefix code for each weight in the set, give the corresponding code word : [7]

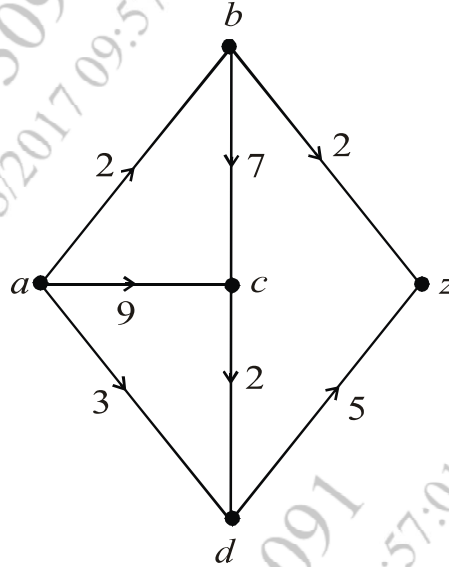
20, 75, 20, 85, 51, 32, 26, 19, 25, 30, 24, 29, 35, 37

Or

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



- (b) Determine the maximal flow in the following transport network. [7]



7. (a) (i) In how many different ways can letters of the word 'SIGNATURE' be arranged so that vowels always come together.
- (ii) In how many ways can 21 books on English and 19 books on Hindi be placed in a row on a shelf so that two books on hindi many not be together. [6]
- (b) One card is drawn from a pack of 52 cards :
- (i) What is the probability that the card drawn is either a red card or a king ?

(ii) What is the probability that will be a diamond or a king ?

(iii) What is the probability that the card drawn is a face card ? [7]

Or

8. (a) If two dice are thrown, what is the probability of getting : [6]

(i) a doublet ?

(ii) total of 10 or 11 ?

(b) In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there ? [7]