Total No. of Questions—**8**] [Total No. of Printed Pages—**6**

| Seat No. | |
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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]

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

(*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}

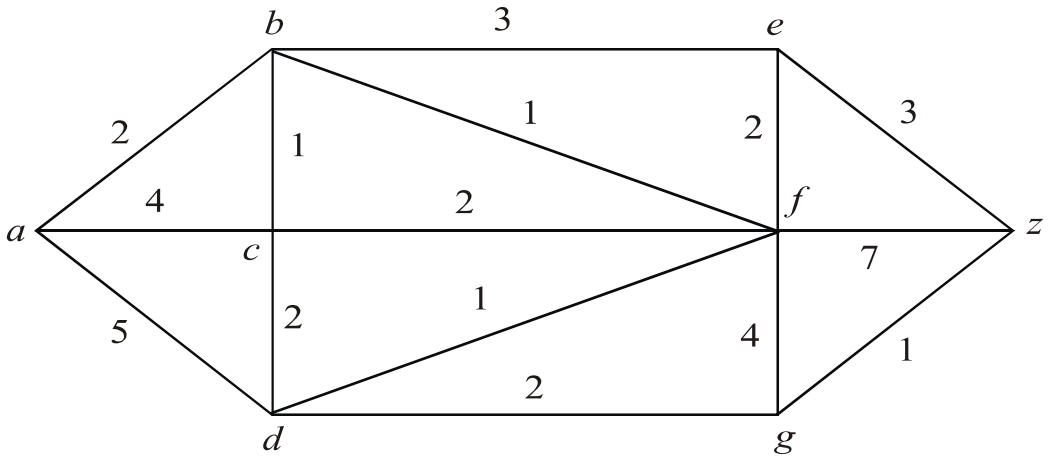
(*ii*) {1, 3, 5, 15, 30}.

**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.

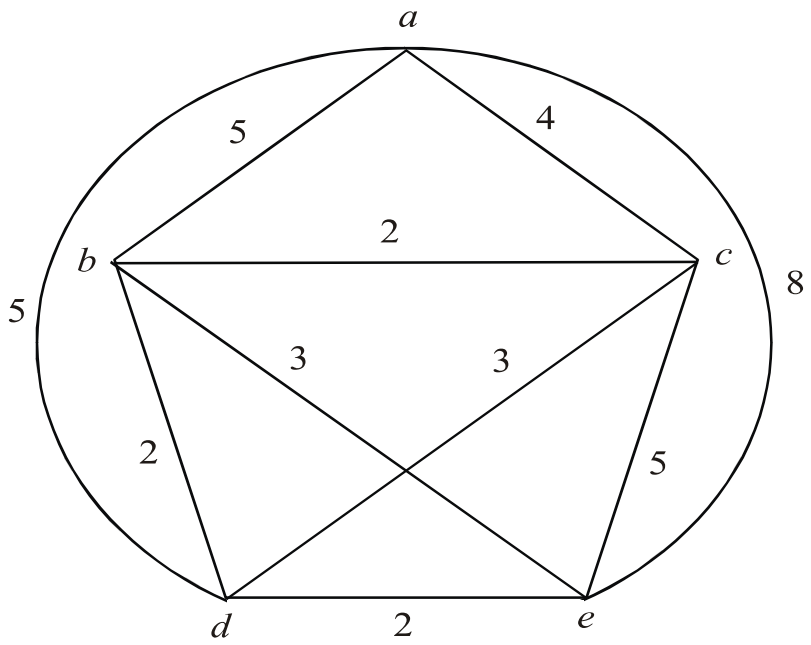
(*b*) Use Dijkstra's algorithm to find the shortest path between *a* and *z*. [6]




*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

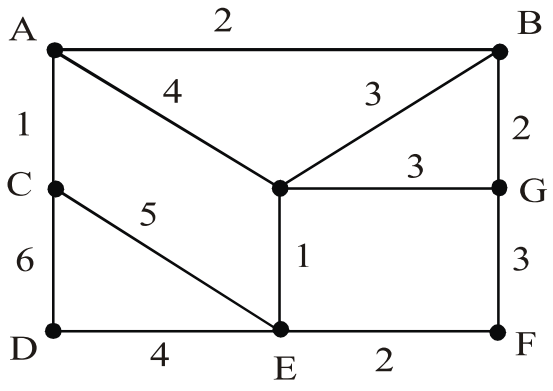
(*iii*) Rooted Tree and Binary Tree.

(*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]

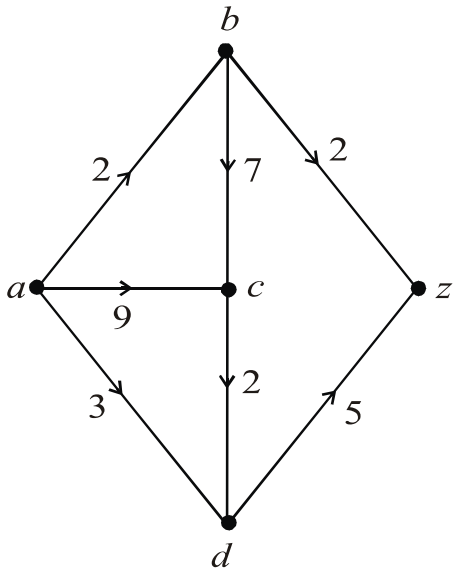
20, 75, 20, 85, 51, 32, 26, 19, 25, 30, 24, 29, 35, 37

*Or*

**6.** (*a*) Give the stepwise construction of minimum spanning tree using Prims 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]