Total No. of Questions—**8**]

[Total No. of Printed Pages—**5**

Seat
No.

[5152]-561

S.E. (Computer)(I Sem.) EXAMINATION, 2017

DISCRETE MATHEMATICS

(2015 PATTERN)

Time : Two Hours　　　　　　　　　　**Maximum Marks : 50**

N.B. :—
　(*i*) Figures to the right indicate full marks.

　(*ii*) Assume suitable data, if necessary.

1. (*a*) Explain the concept of countably infinite set with example. **[3]**

　(*b*) Use mathematical induction to show that, for all $n \geq 1$.

$$1 + 2 + 3 + \ldots + n = \frac{n(n+1)}{2}.$$

[3]

　(*c*) Let A = {1, 2, 3, 4} consider partition

$$P = \{\{1, 2, 3\}, \{4\}\},$$

of A. Find the equivalence relation R on A determined by P. **[3]**

　(*d*) Let A = {1, 2, 3} R is the relation on A whose matrix is :

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

show that R is transitive.

Or

[3]

P.T.O.

2. (*a*) (*i*) Find DNF of :

$$(p \rightarrow q) \cap (q \rightarrow p)) \vee p .$$

(*ii*) Find CNF of :

$$p \leftrightarrow (\sim p \vee \sim q) .$$

[3]

(*b*) In the survey of 260 college students, the following data were obtained :

64 had taken a maths course,

94 had taken a cs course,

58 had taken a business course,

28 had taken both a maths and a business course,

26 had taken both a maths and a cs course,

22 had taken both a cs and a business course,

14 had taken all types of courses.

How many students were surveyed who had taken none of the three types of courses. [3]

(*c*) Let A = Z$^+$ the set of positive integers, and let

$$R = \{(a, b) \in A \times A \mid a \text{ divides } b\}$$

Is R symmetric, asymmetric *or* antisymmetric. [3]

(*d*) Find transitive clousure using Warshall algorithm :

$$M_R = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}.$$

[3]

**3.** (*a*) How many words of three distinct letters can be formed from the letters of the word MAST ? [3]

(b) How many different seven-person committees can be formed each containing three women from an available set of 20 women and four men from an available set of 30 women. [3]

(c) Check whether the graph has an Euler circuit, Euler path, justify : [3]

(d) How many colours required to colour $k_{m,n}$, why ? [3]

(Graph G_1) *Or* (Graph G_2)

4. (a) How many distinguishable words that can be formed from the letters of MISSISSIPPI ? [3]

(b) Compute the number of distinct five-card hands that can be dealt from a deck of 52 cards. [3]

(c) Determine whether the following graph has a Hamiltonian circuit or Hamiltonian path. [3]
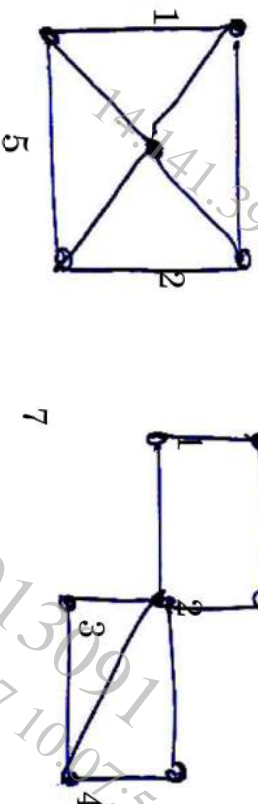
(d) Write 45 applications of graph theory in the field of data analytics. (Graph G_1) [3]

5. (a) Use labeling procedure to find a maximum flow in the transport network given in the following figure. Determine the corresponding
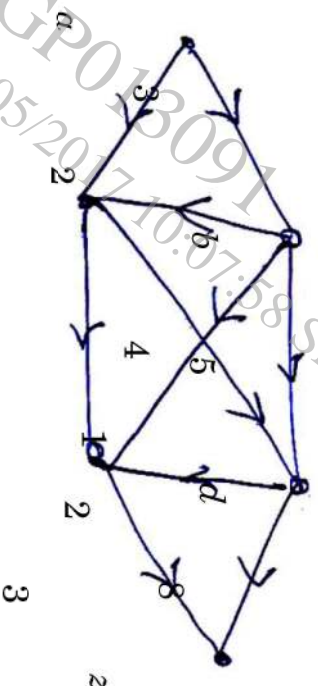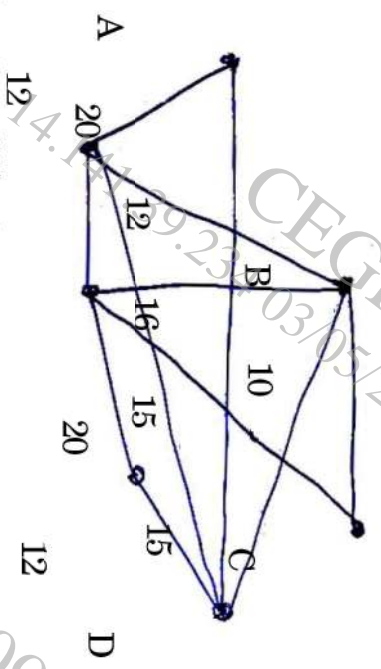
minimum cut. [7]

(b) Explain the following : [6]
(1) Difference between binary tree and binary search tree.
(2) Rooted tree
(3) Cut-sets.

Or

6. (a) Find minimum spanning tree for given graph using Krustkal's algorithm. [6]

(b) Explain the following terms : [7]
(i) Application of cut-set in computer engineering domain
(ii) Prefix code construction using Huffman coding.
(iii) Properties of trees.

7. (a) Prove that :

$$(a+b\sqrt{2}, +, \times)$$

where $a, b \in R$ is integral domain. [6]

(b) Explain isomorphism ahnd homomorphism of two semigroups. [3]

(c) Prove that every cyclic group is an abelian group. [4]

Or

8. (a) Let G be set of all non-zero real numbers and let :

$$a * b = \frac{ab}{2},$$

show that (G, *) is an abelian group. [6]

(b) Explain Galois theory. [3]

(c) Explain properties of binary operations. [4]