Total No. of Questions—**8**] [Total No. of Printed Pages—**5**

Seat No.	

[5252]-161

S.E. (Com. Engg.) (First Semester) EXAMINATION, 2017

DISCRETE STRUCTURES

(2012 COURSE)

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

N.B. : (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **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*) Show that $n^3 + 2n$ is divisible by 3, for all $n >= 1$ using mathematical induction. [4]

(*b*) Prove whether the following statements are logically equivalent or not ?

(*i*) $p \rightarrow q$ and $\sim p \wedge \sim q$

(*ii*) $\sim(p \wedge q)$ and $\sim p \wedge \sim q$. [4]

(*c*) Define cardinality. What is the cardinality of the following sets : [4]

(*i*) I = {.....–4, –3, –2, –1, 0, 1, 2, 3, 4 .....}

(*ii*) N X N, N is a set of natural numbers.

(*iii*) Union of finite numbers of countable sets.

Or

2. (*a*) $f(x) = ax + b$ and $g(x) = cx + d$ where a, b, c, d are constants. Determine for which constant a, b, c, d it is true that $fog = gof$. [4]

P.T.O.

(*b*) Show that the relation $y = 2x + 3$ from $R \rightarrow R$ is a function. [4]

(*c*) In a school, 2000 students were asked whether they like science or maths. It was found that 1200 like science and 900 like maths and 400 like both. How many like at least one subject and how many none ? [4]

3. (*a*) Define : [5]

(*i*) Ring

(*ii*) Ring Homomorphism

(*iii*) Ring Isomorphism

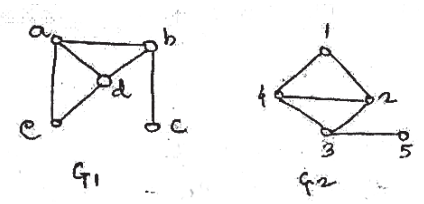
(*iv*) Integral domain

(*v*) Semi-Group

(*b*) Discuss about permutation groups and coding theory. [4]

(*c*) State whether the following graphs in Fig. 3. (*c*) are isomorphic or not. [4]

(*i*)



(*ii*)

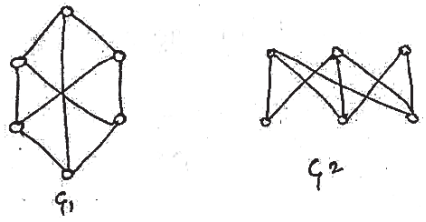


Fig. 3 (*c*)

Or

4. (*a*) Apply Dijkstra's shortest path algorithm to find the shortest path between vertices and *z* in the Fig. 4. (*a*) below : [6]

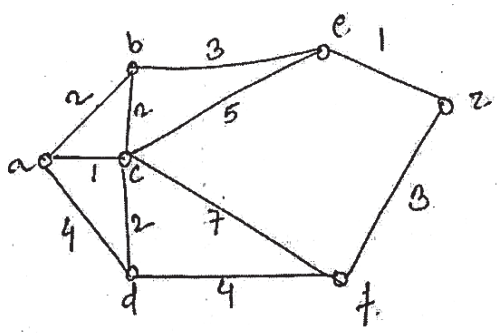


Fig. 4 (*a*)

(*b*) Determine the number of edges in a graph with 6 nodes, 2 of degree 4 and 4 of degree 2. Draw two such graphs. [4]

(*c*) Let G be the set of all non-zero real numbers and let a*b = ab/2. Show that (G, *) is an Abelian group. [3]

5. (*a*) Find the maximum flow in the transport network shown in Fig. 5. (*a*) using labeling procedure. Determine the corresponding minimum cut. [6]

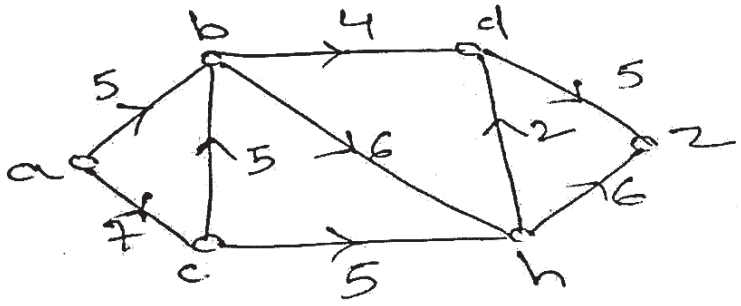


Fig. 5 (*a*)

(*b*) For each of the following sets of weights construct an optimal binary prefix code. For each weight in the set give the corresponding code word 10, 11, 14, 16, 18, 21. [6]

Or

6. (*a*) Define and explain the following terms with reference to tree with example : [6]

(*i*) Level and height of the tree

(*ii*) M-ary tree

(*iii*) Eccentricity of the tree.

(*b*) Define Spanning sub-graph and minimum spanning tree. Use Kruskal's Algorithm to find minimum spanning tree for the graph. [6]

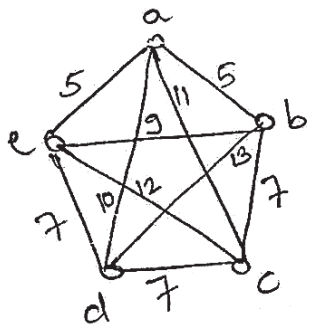


Fig. 6 (*b*)

7. (*a*) A bag contain 3 red and 4 black pebbles and second bag contains 6 red and 4 black pebbles. A pebble is thrown from each bag. Find the probability that : [7]

(*i*) Both are red

(*ii*) Both are black

(*iii*) One is red and one is black.

(*b*) A, B, C throw a fair coin in that order one who throws a head first wins. Find the probabilities of their winning. [6]

Or

8. (*a*) There is a pack of 52 cards : [7]

(*i*) If one card is drawn at random from each of two decks, then what is the probability that at least one is the ace of hearts ?

(*ii*) If cards are drawn one by one without replacement, then what is the probability that the first ace will be drawn in the 10th draw ?

(*b*) If P(A) = 3/8, P(B) = 1/3 and P(A $\cup$ B) = 1/4, then find :

(*i*) P(A') and P(B')

(*ii*) P(A $\cup$ B)

(*iii*) P(A' $\cup$ B')

(*iv*) P(A' $\cap$ B'). [6]