K-25/2110

Discrete Mathematics

BCA-213

7625/N

M.M. =75 **Time: 3 hrs**

Note: Candidates are required to attempt **Five** questions in all by selecting at least **Two** questions each from the section A and B. Section C is compulsory. Non-Prog. Scientific Calculator is allowed.

Section-A

Q1: (a) If S and T have n elements in common. Show that $S \times T$ and $T \times S$ have n^2 elements in common.

(b) How many subsets can be formed from a set of n elements? How many of these will be proper and how many improper?

Q2: (a) Prove that disjunction distributes over conjunction.

(b) Prove by the principle of induction: $1 + 3 + 5 + \ldots + (2n - 1) = n^2$.

Q3: (a) Test the validity: If I will select in IFS examination, then I will not be able to go to America. Since, I am going to America, I will not select in IFS examination.

(b) Find the domain and range of the relation given by R:

$$\left\{(x, y): y = x + \frac{6}{x}, where\ x, y \in N\ and\ x < 6\right\}.$$

Q4: (a) Let R be the relation on the set $\{0,1,2,3\}$ containing the ordered pairs (0,1), (1,1), (1,2), (2,0), (2,2), and (3,0). What is the reflexive closure, symmetric closure and transitive closure of R?

(b) Partition $A = \{2,4,6,8,10,12\}$ with the minsets generated by $B_1 = \{2,4\}$ and $B_2 = \{8,10\}$ and also find out how many different subsets of A can you generate from B_1 and B_2?

15×2=30

Section-B

Q5: (a) Explain in detail the Adjacency matrix representation of graphs and also give one example.

(b) State and prove Euler theorem.

Q6: (a) Define function and explain different types of functions.

(b) If $f: A \to B$ and $g: B \to C$ are two bijections, then show that $(gof)^{-1} = f^{-1}og^{-1}$.

Q7: (a) Define simple path and Circuit. Suppose a graph G contains two distinct paths from a vertex u to a vertex v. Show that G has a cycle.

(b) Define connected graph, cut-edge and cut-vertex. Let G be a connected with at least two vertices. If the edges in G is less than the number of vertices, then prove that G has a vertex of degree one.

Q8: (a) A finite connected graph is Eulerian iff each vertex has even degree.

(b) Let G be a graph with more than one vertex. Then following are equivalent: (i) G is tree. (ii) Each pair of vertices is connected by exactly one simple path. (iii) G is connected, but if any edge is deleted then resulting graph is not connected. (iv) G is cycle tree, but if any edge is added to the graph then the resulting graph has exactly one cycle.

15×2=30

Section-C

Q9: (i) Define Partition of sets, max-set and min-set. (3)

(ii) Prove that $A \cap (B \cap C) = (A \cap B) \cap C$. (3)

(iii) Define an equivalence relation and give an example. (1)

(iv) Define Big-O Notation. (1)

(v) Define Ceilings function. (1)

(vi) Explain the travelling salesman problem. (3)

(vii) Give the properties of minimum spanning tree. (3)

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