BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE | SEMESTER : III
BRANCH: CSE | SESSION : MO/17

SUBJECT: CS4101 DISCRETE MATHEMATICAL STRUCTURES

TIME: 3HRS | FULL MARKS: 60

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

1(a) State Modus ponens law and Hypothetical syllogism law. [2]

(b) Let L(x,y) be the statement "x loves y" where the domain for both x and y consists of all people in the world. Use quantifiers to express the statement: "There is somebody whom no one loves". [4]

(c) Show that the following argument is valid: [6]
If x is human then x is omnivorous. Rohit is not omnivorous. Therefore, Rohit is not human.

2(a) Suppose that the relation R on a set A is represented by the matrix [2]

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

Is R possesses the reflexive and symmetric property?

(b) Prove that the transitive closure of a relation R equals the connectivity relation R*. [4]

(c) Find the zero-one matrix of the transitive closure of the relation R where [6]

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

3(a) What do you mean by the term Walk and Path in a graph. [2]

(b) The number of vertices of odd degree in a graph is always even. [4]

(c) Show that a simple graph with n vertices and k components can have at most $\frac{(n-k)(n-k+1)}{2}$. [6]

4(a). Define Euler circuit and Hamiltonian circuit. [2]

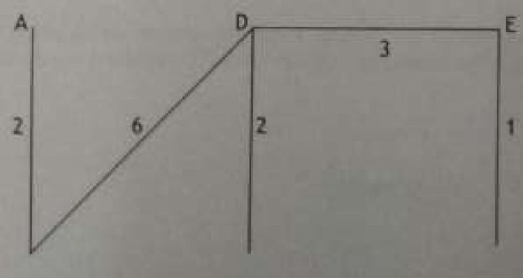
(b) Explain Konigsberg bridge problem using graph theory. [4]

(c) Prove that a given connected graph G is an Euler graph if and only if all vertices of G are of even degree. [6]

5(a) If in a graph G there is one and only one path between every pair of vertices, then prove that G is a tree. [2]

(b) Prove that a tree with n vertices have (n-1) edges. [4]

(c) Find a minimum spanning tree using Kruskal's algorithm of the labeled connected graph shown in the figure given below: [6]



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6(a) Define group. Give an example of a group. [2]

(b) If G is a group such that $(ab)^2 = a^2b^2$, $\forall a, b \in G$. Show that G must be abelian. [4]

(c) Define subgroup of a group G. Prove that a non-void subset H of a group G is a subgroup of G if and only if $a, b \in H \Rightarrow ab^{-1} \in H$. [6]

7(a) Consider the poset {1,2,3,4,5,6,7,8,9,10,11,12} with integer division as the partial order. Draw Hasse diagram for this poset. [2]

(b) Proof by contraposition that if $x^2(y+3)$ is even then either x is even or y is odd, for all $x, y \in Z$. [4]

(c) If R and S are relations from A to B, prove that [6]

(i) $R^{-1} \subseteq S^{-1}$ when $R \subseteq S$

(ii) $(R \cup S)^{-1} = R^{-1} \cup S^{-1}$

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