INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, NAGPUR

Department of Computer Science and Engineering

CSL 204: **Discrete Mathematics and Graph Theory**

Sessional Exam I

Semester -IV

Date: 10/02/2023 (Friday)
Time: 09:00 AM to 10:00 AM

n: 1 Hours

Max. Marks: **15 Marks**

portant Instructions:

- All the questions are compulsory.
- Maximum marks that can be obtained for a particular question are indicated in the brackets [] on the extreme right of the corresponding question
- Write all the subparts of each question together.

Q. 1 Using Warshall's algorithm to find transitive closure of given relation R

$$R = \{(1,1), (1,4), (2,1), (2,3), (3,1), (3,2), (3,4), (4,2)\}$$

3 Marks
[CO - 3]

Q. 2 Let X = {a, b, c} and P(X) be the power set of X. A relation R is defined on P(X) as follows: For all A,B belongs to P(X), (A,B) belongs to R iff the number of elements in A is less than the number of elements in B. Mention the elements of relation R and check whether the given relation is reflexive, symmetric, antisymmetric, transitive or not.

2 Marks
[CO - 3]

Q. 3 Given set P = {{1}, {2}, {4}, {1,2}, {1,4}, {2,4}, {3,4}, {1,3,4}, {2,3,4}}. A relation R is defined over given P such that (A, B) belongs to P if A is subset of B.

A. Draw Hasse diagram for relation R — **1 Mark**
B. Find maximum element from R — **0.5 Mark**
C. Find minimum element from R — **0.5 Mark**
D. Find least upper bounds of {{2}, {4}} — **0.5 Mark**
E. Find Greatest Lower Bound of {{1,3,4}, {2,3,4}} — **0.5 Mark**

[CO – 4]

Q. 4 Given below set G and a binary operator * defined as matrix-matrix multiplication.

$$G = \left\{ g_1=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix},\quad g_2=\begin{bmatrix}0 & -1\\ 1 & 0\end{bmatrix},\quad g_3=\begin{bmatrix}-1 & 0\\ 0 & -1\end{bmatrix},\right.$$
$$g_4=\begin{bmatrix}0 & 1\\ -1 & 0\end{bmatrix},\quad g_5=\begin{bmatrix}1 & 0\\ 0 & -1\end{bmatrix},\quad g_6=\begin{bmatrix}-1 & 0\\ 0 & 1\end{bmatrix},$$
$$\left. g_7=\begin{bmatrix}0 & 1\\ 1 & 0\end{bmatrix},\quad g_8=\begin{bmatrix}0 & -1\\ -1 & 0\end{bmatrix} \right\}$$

Prove/disprove that G is a group over operation *.

3 Marks
[CO - 4]

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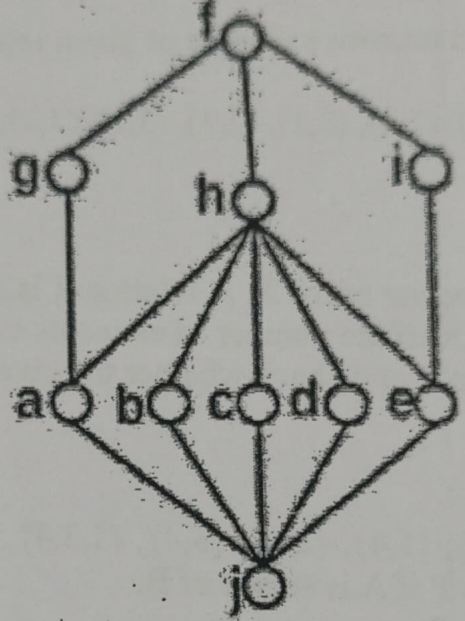
Q. 5 Let S1 = {1, 2, 3, 4, 5, 6, 7, 8, 9,10} and S2 = {1,2,3,4,5…}. Define a relation R1 on
R2 on set B = S2 X S2

1. (a, b)R1(c, d) if and only if a + d = b + c
2. (a, b)R2(c, d) if and only if ad = cb

Check relations R1 and R2 are reflexive, symmetric, antisymmetric, transitive or not.

Q. 6 Given a Lattice as shown below, determine if it is a complemented lattice or distributed lattice.



Moderator

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