

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, December 2025

B. Tech., Odd Semester, 2025-26

Roll No.....

CS1142: DISCRETE MATHEMATICS

Time: 3 hours

Max. Marks: 40

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Mention all the assumptions for your answers clearly.
3. Non-programmable calculator is allowed.

- Q. 1.1 Check whether the following are posets or not? Give proper reason. 1
(CO3)
- a. $(\mathbb{Z}, \neq), aRb$ if $a \neq b$.
 - b. $(\mathbb{Z}, |), aRb$ if $|a| = |b|$.

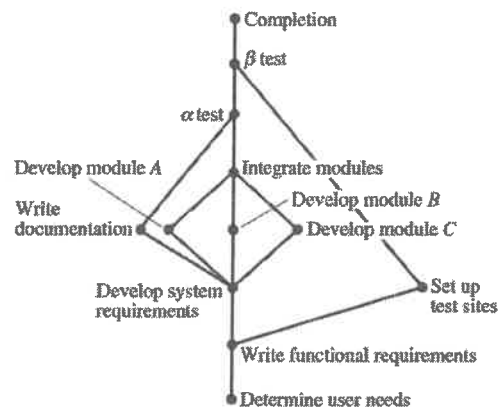
- Q. 1.2 In a group of 10 friends, every pair of friends take selfies together. No one takes a selfie alone or with 2 or more other friends. How many total such selfies were clicked in the group? 1
(CO5)

- Q. 2.1 The number of 4 digit numbers having their digits in non-decreasing order (from left to right) constructed by using the digits belonging to the set $\{1, 2, 3\}$ is _____. 2
(CO4)

- Q. 2.2 Determine the maximum length of trail in the following graphs: 2
(CO4)
- a. K_8
 - b. $K_{2,5}$
- Justify your answer.

- Q. 2.3 Each of the following sets is partially ordered with respect to the "less than or equal to" relation, $\leq$, for real numbers. In each case, determine whether the set has a greatest or least element. 2
(CO3)
- a. $\{x \in \mathbb{R} \mid 0 < x < 1\}$
 - b. $\{x \in \mathbb{R} \mid 0 \leq x < 2\}$

- Q. 2.4 Find an ordering of the tasks of a software project if the Hasse diagram for the tasks of the project is as shown on the right.

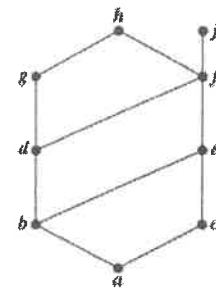


- Q. 2.5 Draw the Hasse diagram illustrating the superset partial ordering $(\supseteq)$ on the power set $P(S)$ where $S = \{a, b, c\}$. Also, check whether this poset is complemented lattice or not. 2
(CO3)

- Q. 2.6 A book publisher has 3000 copies of a discrete mathematics book. How many ways are there to store these books in their three warehouses if the copies of the book are indistinguishable? 2
(CO5)

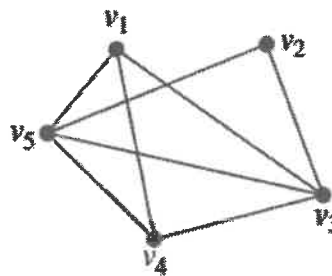
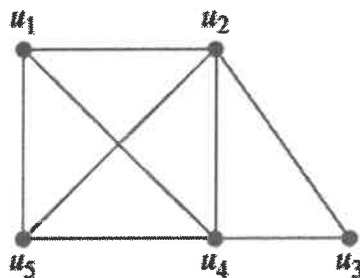
- Q. 3.1 For the Hasse diagram of a poset is given on the right, answer the following:

- Find the lower and upper bounds of the subsets $\{a, b, c\}$ and $\{i, h\}$.
- Determine whether the poset is lattice or not.



3
(CO5)

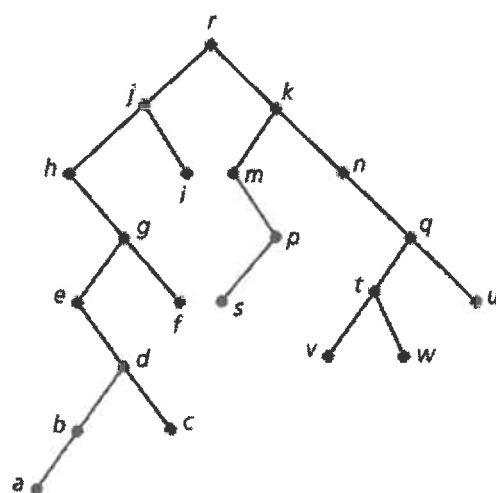
- Q. 3.2 Determine whether the given pairs of graphs are isomorphic or not. Give proper justification for your answer. 3
(CO5)



- Q. 3.3 A model for the number of lobsters caught per year is based on the assumption that the number of lobsters caught in a year is the average of the number caught in the two previous years. 3
(CO5)
- Find a recurrence relation for $\{L_n\}$, where L_n is the number of lobsters caught in year n , under the assumption for this model.
 - Find the solution (L_n) of the recurrence relation obtained in part (a) if 100,000 lobsters were caught in year 1 and 300,000 were caught in year 2.

- Q. 3.4 Answer the following questions for the tree shown below-

- Is it a rooted tree? If yes determine the root of the tree if not justify your answer.
- Is it a full binary tree? Justify your answer.
- What is the height of this tree?
- Write the descendants of 'h'.
- How many leaves are there in this tree.
- Write the vertices with no siblings.



3.0
(CO5)

- Q. 3.5 Using generating functions, determine the number of ways Douglas can select 24 jellybeans from red, green, white, and black colors, assuming that there is an unlimited supply (or at least 24 of each color). The selection must satisfy the following conditions: 3.0
(CO5)
- the number of white jellybeans is even,
 - the number of black jellybeans is at least six, and
 - no more than four green jellybeans are selected.
- Q. 3.6 Let $G = \{q \in \mathbb{Q} \mid q \neq 0\}$. Define the binary operation ' $\odot$ ' on G by $x \odot y = \frac{xy}{4}$. Prove that $(G, \odot)$ is an abelian group. 3.0
(CO4)
- Q. 3.7 Determine whether the group, $(\mathbb{Z}_{16}, +)$ is cyclic or not. If yes, find all of its generators. 3.0
(CO4)

- Q. 4 The PWD Department (Public Works Department) has one inspection depot at intersection D . The PWD inspector wants to inspect all streets of the city. He starts his inspection at depot D , walks along city streets and inspects every street exactly once, and finishes back at the depot. Model this problem using a graph. 5.0
(CO5)
- The city block map (relevant portion) can be modelled using the following information:
- *two parallel streets between D, A .*
 - *two parallel streets between A, B .*
 - *one street between B, C .*
 - *one street between C, E .*
 - *two parallel streets between E, D .*
 - *one street between D, B .*
 - *one street between E, F .*
 - *one street between D, F .*
- Model the street network as a graph.
 - Can the inspector start his inspection at the depot D , traverse each street exactly once, and return to D ? Justify your answer. If possible, give one such solution.
 - Using the street-network graph obtained in part (a), decide whether the graph is Eulerian, Hamiltonian, both, or neither. Justify your classification.

All the best!

