

SET: 2


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AN INITIATIVE OF RV EDUCATIONAL INSTITUTIONS

School of Computer Science and Engineering

B.Tech (Hons.)

Midterm Question Paper

Academic Year 2024-2025

USN

Course: Discrete Mathematics and Graph Theory

Course Code: CS1803

Semester: I

Time: 9:15 AM - 11:30 AM

Duration: 90 minutes

Date : 4/12/2024

Max Marks: 25

Notes/ Instructions:

a) Answer all questions

b) Write necessary Steps as required.

Sl. No.	PART A – (MCQs) Max Marks(5)	Marks	L1-L6	CO
1.	<p>A library wants to catalog the collection of books borrowed by two different groups of members. Let $C = \{2, 4, 6, 8\}$ be the set of books borrowed by Group 1 and $D = \{4, 5, 7, 9\}$ be the set of books borrowed by Group 2. Identify the set of books borrowed by either group and also find the set of books borrowed only by Group 1.</p> <p>(a) $C \cap D = \{4\}$ & $C - D = \{2, 6, 8\}$ (b) $C \cap D = \{5\}$ & $C - D = \{2, 6, 8, 10\}$ (c) $C \cap D = \{2, 4\}$ & $C \cup D = \{2, 4, 5, 6, 7, 8, 9\}$ (d) $C \cup D = \{2, 4, 5, 6, 7, 8, 9\}$ & $C - D = \{2, 6\}$</p>	1	L3	CO1
2.	<p>A social media platform wants to analyze user interactions. Identify a relation R on the set $E = \{\text{Vinit, Suman, Ankit}\}$, where Vinit, Suman, and Ankit are users. Let R "follow" relationships: $\{(\text{Vinit, Vinit}), (\text{Suman, Suman}), (\text{Vinit, Ankit}), (\text{Vinit, Suman}), (\text{Suman, Ankit})\}$. Determine whether it follows</p> <p>a) Reflexive relation b) Transitive relation c) Symmetric d) None of the above</p>	1	L3	CO1
3.	<p>A study group has different topics to prepare. Outline the power set of $T = \{\text{Math, Science, History, English}\}$ to represent all possible combinations of topics the group could study.</p> <p>a) $P(T) = \{\emptyset, \{\text{Math}\}, \{\text{Science}\}, \{\text{History}\}, \{\text{English}\}, \{\text{Math, Science}\}, \{\text{Math, History}\}, \{\text{Math, English}\}, \{\text{Science, History}\}, \{\text{Science, English}\}, \{\text{History, English}\}, \{\text{Math, Science, History}\}, \{\text{Math, Science, English}\}, \{\text{Math, History, English}\}, \{\text{Science, History, English}\}\}$ b) $P(T) = \{\emptyset, \{\text{Math}\}, \{\text{Science}\}, \{\text{History}\}, \{\text{English}\}, \{\text{Math, Science}\}, \{\text{Math, History}\}, \{\text{Math, English}\}, \{\text{Science, History}\}, \{\text{Science, English}\}, \{\text{History, English}\}, \{\text{Math, Science, History}\}, \{\text{Math, Science, English}\}, \{\text{Math, History, English}\}, \{\text{Science, History, English}\}, \{\text{Math, Science, History, English}\}\}$</p>	1	L2	CO1

	c) $P(T) = \{\emptyset\}$ d) $P(T) = \{\emptyset, \{\text{Math}\}, \{\text{Science}\}, \{\text{History}\}, \{\text{English}\}\}$			
4.	A school attendance record shows "Present" for Math and Science classes for John, but "Absent" for History class. Interpret the scenario: a. John attended the History class only. b. John attended the Math and Science classes but not the History class. c. John attended all three classes. d. John did not attend any classes.	1	L2	CO1
5.	If there are 30 students in a classroom and each student has one of 6 favorite sports, calculate the minimum number of students who must share the same favorite sport. a) 3 b) 4 c) 5 d) 6	1	L3	CO2

Sl. No.	PART B – Max Marks (20)	Marks	L1-L6	CO
6.	a. Identify, if the expression $Q \vee \neg Q$ is a tautology, and explains your reasoning. [2 Marks] b. Consider the universal set $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, and let $A = \{1, 3, 5, 7, 9\}, B = \{2, 4, 5, 6, 8, 10\}$, express and verify the truth value of the statement: "There exists an element in A is also in B ". [1 Mark] c. In a distributed database system, two servers store data as multisets of key-value: Server A: $\{3x, 2y, 4z\}$ Server B: $\{4x, y, 3z, w\}$ Compute the maximum number of replicas and the minimum number of replicas for each key present on both servers. [2 Marks]	5	L3	CO1
7.	a. Identify the relation S on the set R of real numbers, $S = \{(a, b): a, b \in \mathbb{N} \text{ and } a \leq b^2\}$ is reflexive, symmetric and transitive. [3 Marks] b. If $f, g: R \rightarrow R$ is defined by $f(x) = \sin(x)$, $g(x) = \frac{1}{x}$, Calculate $f \circ g(x)$. Is $f \circ g(x)$ defined for all x ? [2 Marks]	5	L3	CO1

8.	a. A committee of 5 members is to be formed from a A team of 4 members to be selected from a group of 10 people.		L3	CO2
	I. Identify the number of ways can the team be formed? [1 mark] II. If one member is to be the team leader and the remaining three are regular members, identify the number of ways the team can be organized? [2 marks]	5	L3	CO1
9.	b. A college assigns unique roll numbers to its students, where each student is numbered from 1 to 50. A function $f: S \rightarrow R$, defined by $f(s) = s^2$ for $s \in S$, maps the students S to a set of roll numbers R . Examine if this function f is one-one and onto. [2 marks]			
	a. A sports club offers two categories of activities: indoor games and outdoor games. There are 7 indoor games and 5 outdoor games. Each member can participate in only one activity. I. Calculate the number of choices a member has if they can participate in either an indoor or outdoor game. [1.5 Marks] 1.5 II. Calculate the number of ways a member can participate in two activities, one indoor game and one outdoor game. [1.5 Marks] 3.5 b. Calculate the coefficient of x^5 in the expansion of $(3x + 4y)^7$. Determine the 5th Catalan number C_5 . [2 marks]	5	L3	CO2

Course Outcomes

CO1: Apply the principles of discrete mathematical structures for efficient computation and problem-solving in computer science

CO2: Analyze and solve problems in game theory, decision making and cryptography using the concepts of combinatorics

CO3: Design solutions for complex real-life problems using Graph Theory.

CO4: Implement discrete mathematical concepts through Computer Programming using open source tools.

Marks Distribution

L1	L2	L3	L4	L5	L6	CO1	CO2	CO3	CO4
	2	23				16	9		