SET-2

INDIRA UNIVERSITY, PUNE

SCHOOL OF INFORMATION TECHNOLOGY-BSC (AIML)

Term End Examination (2025 Pattern) December – 2025 - Semester – I

Subject Name: - Discrete Structures for Computer Science **Max. Marks: 25**
Subject Code: 25AML109T **Time: 1:30 Hrs.**

Instructions

- All questions are compulsory.
- Use of single memory non programmable calculator is allowed.

CO #	Cognitive Ability	Course Outcome
CO2	**Understand**	Understand and explain the properties of relations, including equivalence relations, partial orderings, and their applications in the context of functions and binary relations
CO3	**Apply**	Apply operations on sets, such as union, intersection, set difference, and complement, as well as use De-Morgan's Laws in various mathematical and practical contexts
CO5	**Evaluate**	Evaluate combinatorial problems using basic counting principles, including the addition and multiplication principles, as well as permutations and combinations

Q1.	**Attempt any 5 out of 7. (1 mark each)** **(5 Marks)** a) For sets A = {x | x < 5, x ∈ N} and B = {x | x is even, x < 7}, find A ∩ B. b) Explain how many elements are there in A × B if n(A) = 4 and n(B) = 5? c) Describe the composition of two functions f(x) = x^2 and g(x) = 2x+3. d) Explain the inverse of f(x) = 3x - 2. e) If you can choose any of 5 shirts and any of 3 trousers, how many outfits can you make? Explain. f) Let $a_n = 2a_{n-1} + a_{n-2}$, with $a_0 = 1, a_1 = 2$. Interpret a_2 and a_3. g) Explain when to use combinations vs. permutations.	**CO2**

Q2.	**Attempt any 2 out of 4. (5 marks each) (10 Marks)** **a)** Applying the inclusion–exclusion principle, find the number of integers from 1 to 100 that are divisible by 2 or 5. **b)** Use Hasse diagram to represent the poset D_{60} with divisibility relation. **c)** Apply the concepts of permutations to find the number of distinct ways to arrange the letters of the word **"MATHEMATICS".** How many of those arrangements have the two letters **C** and **S** adjacent (together)? **d)** The Tower of Hanoi puzzle consists of three pegs and n disks of different sizes, placed on the first peg in decreasing order of size with the largest at the bottom. Only one disk may be moved at a time, and a larger disk can never be placed on top of a smaller one. The objective is to transfer all disks from the first peg to another peg. Apply the concept of recurrence relations to derive the relation for the number of moves required to solve the puzzle with n disks.	**CO3**
Q.3.	**Attempt all questions. (5 marks each) (10 Marks)** **a)** Let A be a set. Show that the set inclusion (subset) relation on P(A) defined as $x\ R\ y$ if and only if $x \subseteq y$, is a partial order relation. **b)** **S**olve the recurrence relation $a_n = a_{n-1} + 2a_{n-2}$ with initial conditions $a_0 = 2\ and\ a_1 = 7$**.**	**CO5**
Q.3	**OR** Consider the relation R on set $A = \{a, b, c, d, e\}$ given by: **(10 marks)** $R = \{(a, b), (b, c), (c, d), (d, e), (a, e)\}$ Find its transitive closure using Warshall's algorithm. Also draw the digraph of R^*.	**CO5**

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