Avinashilingam Institute for Home Science and Higher Education for Women

Deemed to be University Estd. u/s 3 of UGC Act 1956, Category A by MHRD (now MoE)
Re-accredited with A++ Grade by NAAC. CGPA 3.65/4, Category I by UGC
Coimbatore - 641 043, Tamil Nadu, India

Continuous Internal Assessment Test I – February 2026
II Semester

Class : I UG **Time: 2 hours**
Major : B.Sc. Computer Science **Maximum Marks: 60**

23BCSC04 Discrete Structures

Course Outcomes:
At the end of the course, students will:

1. Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.
2. Understand the basics of combinatorics, and be able to apply the methods from these subjects in problem solving.
3. Be able to use effectively algebraic techniques to analyse basic discrete structures and algorithms.
4. Understand asymptotic notation, its significance, and be able to use it to analyse asymptotic performance for some basic algorithmic examples.
5. Understand some basic properties of graphs and trees and related discrete structures, and be able to relate these to practical examples.

Part - A 6 x 1 = 6
Choose the Correct Answer

1. What is the main characteristic that distinguishes a finite set from an infinite set? CO1 K1
   a. Size b. Elements c. Countability d. Membership
2. In a group of 5 people, how many different ways can they arrange themselves in a line? CO1 K2
   a. 5 b. 10 c. 20 d. 120
3. What is the first step in a typical mathematical induction proof? CO1 K1
   a. Proving the base case
   b. Assuming the statement holds for some arbitrary value (inductive hypothesis)
   c. Proving the statement for a general case d. Concluding the induction step
4. Which asymptotic notation represents an upper bound on an algorithm's running time? CO2 K1
   a. Θ (Theta) notation b. O (Big O) notation c. Ω (Omega) notation d. o (Little O) notation
5. What is the sum of the first n natural numbers using the summation notation? CO2 K2
   a. n(n+1)/2 b. n^2 c. n/2 d. 2n
6. What is the solution to the recurrence relation T(n) = T(n-1) + 3 with the base case T(1) = 2? CO3 K2
   a. T(n) = 3n-1 b. T(n) = 3n-2 c. T(n) = 3n+1 d. T(n) = 3n

Part - B 3 x 6 = 18
Answer ALL Questions
Each answer should not exceed 400 words or two pages

7. a. Define the properties of relations with examples. CO1 K1

(or)

7. b. (i) Define Partial ordering. (ii) Show that the relation R = { (a, b) | a is a subset of b} defined on the power set of set S = {1, 2, 3} is a partial order relation. (iii) Show that the relation R = { (a, b) | a divides b} defined on the set S = {1, 2, 3, 4, 6} is a partial order relation. CO1 K3

8. a. (i) Among 100 people, how many of them are guaranteed to born in the same month? (ii) How many cards must be selected from a standard deck of 52 cards to guarantee that at atleast three cards of the same suit are chosen? (iii) How many cards must be selected from a standard deck of 52 cards to guarantee that at least three hearts are selected? CO1 K3

(or)

8. b. Explain the concept of Asymptotic notations with suitable examples. CO2 K2

9. a. Write notes on Bounding summations. CO2 K3

(or)

9. b. Find the generating functions for the below sequences. (i) 1,1,1,... (ii) 1,1,1,1,1,1,0,0 (iii) 1,3,3,1,0,0 (iv) 1, a, a^2, a^3 , ... (v) 1,3,9,27,... (vi) 1,2,3,4,... (vii) 0,1,2,3,... (viii) 0,0,0,1,2,3,... (ix)0,0,0,1,1,1,... (x)1,1,0,1,1,1,... (xi)1,0,-1,0,1,0,-1,... (xii) 2,-2, 2,-2, CO3 K3

Part - C **3 x 12 = 36**

Answer ALL questions

Each answer should not exceed 800 words or four pages

10. a. Explain the different types of functions with examples CO1 K3

(or)

10. b. (i) Define Mathematical Induction. What are the steps in Mathematical Induction.
(ii) Show by mathematical induction $1^2 + 2^2 + 3^2 + \ldots + n^2 = n(n+1)(2n+1)/6$, for all $n >= 1$
(iii) Show by mathematical induction $1^3 + 2^3 + \ldots + n^3 = n^2 (n+1)^2 / 4$ for all $n >= 1$ CO1 K3

11. a. (i) Define a function S: Z --> Z as follows: For each positive integer n, S(n) = the sum of positive divisors of n. Find a) S(1) b) S(15) c) S(17) d) S(5) e) S(18) f) S(21)
(ii) Determine if each of these functions {a, b, c, d} to itself is one to one. a)f(a) = b, f(b) = a, f(c) = d b)f(a) = b, f(b) = b, f(d) = c c)f(a) = d, f(b) = b, f(c) = d
(iii) Let A = {a, b}and S = {00, 01, 10, 11}. A function f is defined from set P(A) to S where P(A) denotes the power set of A = {ϕ, {a}, {b}, {a, b}} as follows: Given any subset X of A. If element a is in x, then write 1 in first position of string f(x). If not, then write 0 in the first position of string f(x). If element b is in x, then write 1 in the second position of string f(x). If not then write 0 in the second position of string f(x). Is f a one to one correspondence.
(iv) Define function f: Z --> Z and g: Z--> Z by the rules f(a) = 7a and g(a) = a mod 5 for all integers a. Find (g o f)(1), (g o f)(2), (g o f)(3), (g o f)(4) CO1 K4

(or)

11. b. Write notes on Approximation by Integrals CO2 K4

12. a. (i) List the summation formulas and properties.
(ii) Find the sum of 10 first natural numbers greater than 5, using the summation formula.
(iii) Find the sum of all even numbers from 1 to 100
(iv) Simplify and evaluate $\sum_{x=1}^{n} (4+x)$.
(v) Find the value of $\sum_{i=1}^{n} (3 - 2i)$ using the summation formulas. CO2 K3

(or)

12. b. Solve the following recurrence relations. (i) $a_n = 4a_{n-1} + 5a_{n-2} + 7n$ where $a_1 = 2$ and $a_2 = 6$,
(ii) $a_n = 6a_{n-1} - 11a_{n-2} + 6\, a_{n-3}$ where $a_0 = 2$, $a_1 = 5$, $a_2 = 15$ CO3 K4

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