2315

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 - 641043, Tamil Nadu, India

Bachelor's Degree Examination - May 2025
II Semester

Class : I UG **Time : 3 Hours**
Major : Computer Science **Max. Marks : 100**

23BCSC04 Discrete Structures

Course Outcomes :

CO1: Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.
CO2: Understand the basics of combinatorics, and be able to apply the methods from these subjects in problem solving.
CO3: Be able to use effectively algebraic techniques to analyse basic discrete structures and algorithms.
CO4: Understand asymptotic notation, its significance, and be able to use it to analyse asymptotic performance for some basic algorithmic examples.
CO5: Understand some basic properties of graphs and trees and related discrete structures, and be able to relate these to practical examples.

Part A **10 x 1 = 10**
Choose the Correct Answer

1. The number of relations on a set A with n elements is _____. CO1K1
   a. 2^n b. 2^{n^2}
   c. 2^{2n} d. $(2^n)^2$

2. If n and r are non-negative integers with n ≤ r, then _____. CO1K1
   a. $c(n,r) = c(n,n-r)$ b. $c(n,r) = n!/r!$
   c. $c(n,r) = n!/r!\,(n-r)!$ d. $c(n,r) = n!\,r!$

3. The sum of cube of first n even natural numbers is _____. CO1K1
   a. $n^2(2n^2-1)$ b. $2(n(n+1))^2$
   c. $(n+1)^2$ d. $(2n^2+1)$

4. The sum of the geometric series $1+2+3+\cdots+2^n$ is _____. CO1K1
   a. $2^{n+1}+1$ b. $2^{n-1}+1$
   c. $2^{n+1}-1$ d. $2^{n-1}-1$

5. If $G(x) = \frac{1}{1+5x}$ then a_r=_____. CO1K1
   a. $(5)^r$ b. $(-5)^r$
   c. $(5)^{-r}$ d. $(-5)^{-r}$

6. The time complexity of the recurrence relation $T(n) = a + T(n/2) + n^2$ is _____. CO1K1
   a. $\theta(n/2)$ b. $\theta(1/2)$
   c. $\theta(n)$ d. $\theta(n^2)$

7. If n is the number of vertices in the graph, then _____. CO1K1
   a. $\deg(v) \le n-1$ b. $\deg(v) \le n+1$
   c. $\deg(v) < n-1$ d. $\deg(v) < n+1$

8. In any bipartite graph, the chromatic number is always _____. CO1K1
   a. 1 b. 2
   c. 3 d. 4

9. A complete graph with 5 vertices can have _____ number of Spanning trees. CO1K1
   a. 125 b. 150
   c. 175 d. 200

10. The relation $\sim[(P \vee Q) \wedge \sim P] \Rightarrow Q$ is a _____. CO1K1
   a. Tautology b. Contradiction
   c. Neither a nor b d. None

Part B — 5 x 6 = 30

Answer ALL questions

Each answer should not exceed 400 words or two pages

11.a. Define function F: Z→Z and G: Z→Z by the rules F(a)=a^2 and G(a)=a mod 5 for all integers i) Find (F o G) (12), (G o F) (12), (F o G) (6) and (G o F) (6). CO1K1

(or)

11.b. How many ways are there to select 3 males and 2 females out of 7 males and 5 females? CO1K1

12.a. Explain Big Theta Notation with example. CO2K2

(or)

12.b. Find the sum of first 10 natural numbers greater than 5, using the summation formula. CO2K2

13.a. Explain types of Recurrence relation using example. CO3K3

(or)

13.b. What is the generating function for the sequence (1, 6, 36, 216, ...)? CO3K3

14.a. Explain the concept of Adjacency Matrix with example. CO4K4

(or)

14.b. Discuss Planar graph with example. CO4K4

15.a. List out the properties of Spanning trees. CO5K5

(or)

15.b. Prove that $\sim[(P \vee Q) \wedge \sim P] \Longrightarrow Q$ is a contradiction. CO5K5

Part C — 5 x 12 = 60

Answer ALL questions

Each answer should not exceed 800 words or four pages

16.a. Define function. Explain the types of function with suitable examples. CO1K1

(or)

16.b. Discuss the method of Mathematical induction and show that CO1K1

$1^2 + 2^2 + 3^2 + \cdots + n^2 = \frac{n(n+1)(2n+1)}{6}$

17.a. Explain Big Oh Notation and Big Omega Notation with example. CO2K2

(or)

17.b. Explain any 12 techniques for Bounding summations. CO2K2

18.a. Solve the following recurrence relation:$a_n = -3a_{n-1} - 3a_{n-2} - a_{n-3}$, where $a_1 = 3$, $a_2 = 3$, $a_3 = 7$. CO3K3

(or)

18.b. Solve the following Recurrence relation using substitution method: CO3K3

$T(n) = 1$ if $n = 1$ and $T(n) = 2 * T(n/2) + n$ if n >1.

19.a. Discuss the types of graphs with suitable examples? CO4K4

(or)

19.b. Explain Cut Vertex and Cut Edge with example. CO4K4

20.a. Explain Prim's Algorithm with example. CO5K5

(or)

20.b. Using Rule CP, show that $R \rightarrow S$ is a valid conclusion for the given premises $P \rightarrow (Q \rightarrow S)$, $\neg R \vee P$, Q. CO5K5

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