

St. Claret College

Autonomous, Bengaluru

UG END SEMESTER EXAMINATION-DECEMBER 2024

BCA - I SEMESTER

CA 1324: DISCRETE STRUCTURES

Roll No:
Date:

TIME: 3 hours.

10

MAX. MARKS: 80

This paper contains THREE printed pages and FOUR parts

Instructions:

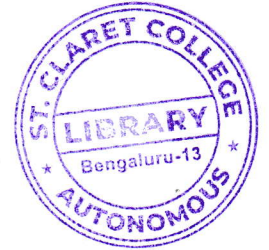
1. Verify and ensure that the question paper is completely printed.
2. Any discrepancies or questions about the exam paper must be reported to the COE within 1 hour after the examination.
3. Students must check the course title and course code before answering the questions.

PART-A

Answer ALL questions. Each answer carries ONE mark.

[10 x 1 = 10]

1. If $A = \{1, 2, 3\}$ and $B = \{3, 4, 5\}$, what is $A \cap B$?
a) $\{1, 2, 3, 4, 5\}$ b) $\{3\}$ c) $\{1, 2\}$ d) $\{1, 5\}$
2. The number of subsets of a set with n elements is
a) n^2 b) $2n$ c) 2^n d) $n!$
3. If $f(x) = 2x + 3$ and $g(x) = x^2$, what is the composition $f(g(x))$?
a) $2x^2 + 3$ b) $2x + 3$ c) $x^2 + 2x + 3$ d) $2(x + 3)^2$
4. What is a tautology?
a) A statement that is always false b) A statement that is sometimes true
c) A statement that is always true d) A statement that has no truth value
5. How many ways can 4 students be arranged in a row?
a) 16 b) 24 c) 120 d) 256
6. The inverse of a matrix A exists if and only if
a) The matrix is square b) The matrix is singular
c) The determinant of A is non-zero d) All elements of A are non-negative
7. For a square matrix A , the matrix is said to be symmetric if
a) $A = A^T$ b) $A = -A^T$ c) $A^2 = I$ d) $A \times A^T = I$
8. Which of the following is NOT a way to represent a graph?
a) Adjacency matrix b) Adjacency list
c) Incidence matrix d) Binary search tree



9. The height of a binary tree is the length of the path from
- The root to the deepest node
 - The leftmost node to the rightmost node
 - The root of any leaf
 - The root of a random node
10. A graph is called an Euler graph if
- It has no cycles
 - It contains a Hamiltonian cycle
 - It contains an Eulerian circuit
 - It is bipartite

PART-B

Answer any FIVE questions. Each answer carries TWO marks.

[5 x 2 = 10]

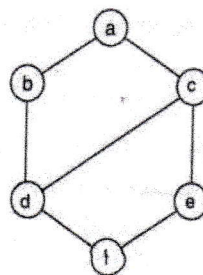
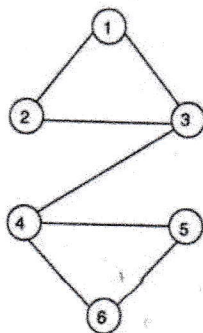
- If $A = \{x | x^2 - 5x + 6 = 0, x \in N\}$ and $B = \{1, 2, 3\}$ find $B - A$
- Define onto function.
- Write the negation of $p \rightarrow q$
- Find the value of 8P_2
- Find the characteristic equation of the matrix $\begin{bmatrix} 3 & 0 \\ 2 & 5 \end{bmatrix}$
- Define the Bipartite graph. Give an example.
- Define Binary tree.

PART-C

Answer any FOUR questions. Each answer carries FIVE marks.

[4 x 5 = 20]

- Show that the relation $R = \{(a, b) : a, b \in Z^+, a + b \text{ is even}\}$ is an equivalence relation, where Z^+ is a set of non zero integers.
- In a class of 45 students, 29 like to play Cricket and 21 like to play Hockey. Each student likes to play at least one of the two games. How many students like to play both Cricket and Hockey?
- If ${}^{2n}C_3 : {}^nC_2 = 44:3$, find n .
- Prove that $[p \wedge (q \vee r)] \equiv [(p \wedge q) \vee (p \wedge r)]$
- Solve by Cramer's rule, $5x + 3y = 12, 2x + y = 5$
- Define Isomorphism of graphs. Verify that the two graphs shown below are isomorphic or not.



PART-D

Answer any FOUR questions. Each answer carries TEN marks.

[4 x 10 = 40]

24. a) Using Mathematical Induction prove that

$$1^3 + 2^3 + 3^3 + \dots + n^3 = \frac{n^2(n+1)^2}{4}$$

b) If $f: R \rightarrow R$ is defined by $f(x) = 7x - 8$ prove that 'f' is Bijective and also find f^{-1} . (5+5)

25. a) Show that $\sim (p \rightarrow q) \leftrightarrow (p \wedge \sim q)$ is a tautology

b) How many words with or without meaning can be made from the letter of the word "MONDAY" assuming that no letter is repeated if

(i) 4 letters are used at a time (ii) All letters are used at a time. (5+5)

26. a) Write the inverse, converse, and contrapositive of the given conditional "If two triangles are congruent, then they are similar".

b) Construct a Binary search tree 56, 38, 10, 65, 72, 44, 50 (5+5)

27. a) Find the eigenvalues and the eigenvectors of the matrix $\begin{bmatrix} 4 & 1 \\ -1 & 2 \end{bmatrix}$

b) If $A = \begin{bmatrix} 2 & 3 \\ 1 & -4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$ Verify $(AB)' = B' A'$ (5+5)

28. Find the inverse of the matrix $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & -1 & 3 \\ -3 & -2 & 4 \end{bmatrix}$

29. Find the minimum weighted spanning tree by Prim's algorithm.

