# KAMARAJ COLLEGE (Autonomous)

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(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

**(4 Pages)** **Reg. No:……**

**Question Code: 26E01407** **Course Code : 24PMCA22/25PMCA22**

**PG Degree - End Semester Examinations, April 2026**

**Second Semester**

**M.C.A**

**Advanced Data Structures**

**(For those who joined in July 2024 and June 2025 onwards)**

**Time : 3Hours** **Maximum : 75 Marks**

**PART – A (10 × 1 = 10 Marks)**

**Answer ALL Questions**

**Choose the correct answer :**

CO:1 K:1 1. Which of the following is a Date ADT operation?

(a) push() (b) pop()

(c) addDays() (d) enqueue()

CO:1 K:2 2. A Map ADT stores data in the form of _____.

(a) Index–value pairs (b) Key–value pairs

(c) Node–pointer pairs (d) Row–column pairs

CO:2 K:1 3. What does asymptotic analysis measure?

(a) Exact running time

(b) Memory usage only

(c) Growth rate of algorithm with input size

(d) Compiler efficiency

CO:2 K:2 4. Recursion uses which data structure internally?

(a) Queue (b) Stack

(c) Array (d) Heap

CO:3 K:1 5. The stopping condition in recursion is called _____.

(a) Break point (b) Exit loop

(c) Base case (d) Return value

CO:3 K:2 6. Which linked list allows traversal in both directions?

(a) Singly linked list (b) Circular linked list

(c) Doubly linked list (d) Linear queue

CO:4 K:1 7. Which data structure is commonly used to implement a priority queue?

(a) Stack (b) Heap

(c) Linked List (d) Queue

CO:4 K:2 8. The time complexity of heap insertion is _____.

(a) O(1) (b) O(log n)

(c) O(n) (d) O(n log n)

CO:5 K:1 9. Breadth-First Search (BFS) uses _____.

(a) Stack (b) Queue

(c) Heap (d) Recursion only

CO:5 K:2 10. Kruskal's algorithm is based on _____.

(a) Dynamic programming (b) Greedy method

(c) Divide and conquer (d) Backtracking

**PART – B (5 X 5 = 25 Marks)**

**Answer ALL Questions choosing either (a) or (b).**

**Answer should not exceed 250 words.**

CO:1 K:3 11. (a) Make use of Abstract Data Type (ADT) with an example.

**(OR)**

(b) Utilize the Map ADT traversal using keys and values.

CO:2 K:4 12. (a) Analyze the difference between experimental analysis and asymptotic analysis of algorithms.

**(OR)**

(b) Compare linear recursion with binary recursion.

CO:3 K:3 13. (a) Apply stack operations to evaluate the postfix expression:

Expression: 5 2 3 * +

**(OR)**

(b) Build queue operations for the sequence:

Insert 10, 20, 30 → Delete one element.

CO:4 K:4 14. (a) Analyze how collisions affect hash table performance and how they are resolved?

**(OR)**

(b) Examine why priority queues are widely used in graph algorithms.

CO:5 15. (a) Apply merge sort to the list: 8, 3, 5, 2

K:3

**(OR)**

(b) Perform BFS traversal on the graph:

Edges: A-B, A-C, B-D, C-E

**PART – C (5 X 8 = 40 Marks)**

**Answer ALL Questions choosing either (a) or (b).**

**Answer should not exceed 600 words.**

CO:1 16. (a) A college stores department names in a set and department–HOD pairs in a map.

K:3

Design an algorithm to:

i) Check whether a department exists in the set.

ii) Retrieve the HOD using the map.

Apply the algorithm for department "MCA" using suitable example data.

**(OR)**

(b) A 3×3 matrix represents marks of 3 students in 3 subjects. Write an algorithm to:

i) Find total marks of each student

ii) Find average marks of each subject

Apply the algorithm using sample values and display the results in tabular form.

CO:2 17. (a) Write a recursive algorithm to compute the sum of elements in an array using:

K:3

i) Linear recursion.

ii) Binary recursion (divide array into two halves).

**(OR)**

(b) Two recursive algorithms process n elements:

Algorithm L**:** calls itself once with size n-1.

Algorithm B: calls itself twice with size n/2.

i) Form recurrence relations for both.

ii) Compute the number of recursive calls for n = 8.

CO:3 K:4 18. (a) A sequence of stack operations is given:

PUSH 10, PUSH 20, PUSH 30, POP, PUSH 40, POP, PUSH 50

i) Trace the stack contents after each operation.

ii) Identify the final top element and stack size.

**(OR)**

(b) From the Singly linked list: 5 → 15 → 25 → 35 → 45

i) Analyze the steps to delete the first node, a middle node (25) and the last node.

ii) Show the updated list after each deletion.

CO:4 K:5 19. (a) Examine and evaluate how priority queues and dictionaries can be combined to design an efficient task management system.

Discuss time complexity, memory usage and scalability.

**(OR)**

(b) Evaluate the advantages of using a priority queue over a normal queue in real-world applications such as task scheduling or hospital emergency systems.

Discuss efficiency, order of processing and practical suitability.

CO:5 K:6 20. (a) A weighted graph with vertices {A, B, C, D, E} has edges:

AB=2, AC=3, BC=1, BD=4, CD=5, CE=6, DE=7.

Construct the Minimum Spanning Tree using Kruskal's algorithm and compute total cost.

**(OR)**

(b) Develop an AVL tree by inserting

30, 20, 40, 10, 25, 35, 50, 5.

Show each rotation and justify balance factor calculations.