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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
Major : Computer Science

Time : 3 Hours
Max. Marks : 100

23BCSC03 Data Structures

Course Outcomes:

CO1: To uunderstand the basic ideas of algorithms and data structures.
CO2: Apply linear and non linear data structures to programming solutions.
CO3: Understand and apply tree and graph structures.
CO4: Ability to choose and implement appropriate data structures in real-time problems.
CO5: Obtain knowledge of advanced data structures.

10 x 1 = 10

Part A
Choose the Correct Answer

CO1K1

1. A binary tree is a tree in which:
   a. Each node has at most two children
   b. Each node has exactly two children
   c. Each node has one child
   d. Nodes are connected in a circular manner

CO2K1

2. Which of the following is a linear data structure?
   a. Tree
   b. Graph
   c. Stack
   d. Hash Table

CO1K1

3. In a queue, the insertion operation is performed at the:
   a. Front
   b. Rear
   c. Middle
   d. Both front and rear

CO2K1

4. Which operator has the highest precedence?
   a. +
   b. *
   c.^
   d.–

CO1K1

5. A threaded binary tree is used to:
   a. Optimize in-order traversal
   b. Reduce memory consumption
   c. Make post-order traversal easier
   d. Increase the size of a tree

CO1K1

6. In a graph, if there is an edge between two vertices, it is called:
   a. A directed graph
   b. A weighted edge
   c. An undirected edge
   d. A self-loop

CO1K1

7. A direct access file allows:
   a. Only sequential reading
   b. Random access to records
   c. Only indexed searching
   d. Files to be read in blocks

CO1K1

8. Which of the following is used to handle overflow in hashing?
   a. Linear Probing
   b. Sequential Searching
   c. Binary Search
   d. Direct Access

CO1K2

9. Which of the following is a characteristic of a heap data structure?
   a. It is always a complete binary tree
   b. It is used for indexing
   c. It stores elements in sorted order
   d. It does not support priority-based operations

CO1K1

10. In a balanced search tree, the height of the tree is kept:
    a. Constant
    b. Logarithmic
    c. Linear
    d. Exponential

Part B — 5 x 6 = 30

Answer ALL questions

Each answer should not exceed 400 words or two pages

11.a. Explain the differences between linear and non-linear data structures with examples.	CO3K2
(or)	
11.b. Describe the concept of data abstraction with an example of an Abstract Data Type (ADT).	CO1K2
12.a. Explain the difference between singly linked lists and doubly linked lists with an example of their structure.	CO3K2
(or)	
12.b. Discuss the advantages of circular linked lists over singly and doubly linked lists.	CO2K4
13.a. Write an algorithm for in-order traversal of a binary tree and explain its application.	CO2K3
(or)	
13.b. Describe the process of converting a binary tree into a threaded binary tree and explain how it improves traversal efficiency.	CO3K2
14.a. Explain the difference between sequential, indexed, and direct access files. Provide examples where each type would be preferred.	CO2K2
(or)	
14.b. Implement a simple hashing mechanism with separate chaining and demonstrate how it handles collisions.	CO4K3
15.a. Compare the B-tree and B+ tree in terms of structure, indexing, and use cases. Which one is more efficient for range queries?	CO4K4
(or)	
15.b. Demonstrate with an example the process of insertion in a B-tree. Show how the tree maintains its balance after insertion.	CO5K3

Part C — 5 x 12 = 60

Answer ALL questions

Each answer should not exceed 800 words or four pages

16.a. Give algorithm for insertion and deletion of nodes in a singly linked list.	CO5K4
(or)	
16.b. Evaluate the performance of stack and queue operations for different scenarios such as insertion, deletion, and searching.	CO4K4
17.a. Compare and contrast stack and queue implementations using arrays and linked lists in terms of memory usage, speed, and complexity.	CO5K5
(or)	
17.b. Evaluate the performance of infix-to-postfix conversion and postfix evaluation using stacks for a large set of expressions. Discuss the limitations of the approach.	CO4K5
18.a. Design an algorithm to find the shortest path in a weighted graph using Dijkstra's algorithm and analyse its time complexity.	CO5K6
(or)	
18.b. Create a graph traversal algorithm that combines both BFS and DFS. Discuss its applications in solving problems like shortest path or cycle detection in graphs.	CO5K6
19.a. Evaluate the impact of overflow handling on the performance of a hash table in terms of time complexity for search, insert, and delete operations. Discuss the scenarios in which open addressing or chaining is preferred.	CO3K5
(or)	
19.b. Design a file structure for a database system that uses sequential files for bulk storage and indexed files for fast search queries. Evaluate the benefits and trade-offs of this approach.	CO5K6
20.a. Design a heap data structure that supports both min-heap and max-heap operations. Discuss how each operation (insert, delete) maintains the heap property.	CO5K6
(or)	
20.b. Analyse the time complexity of search, insert, and delete operations in B-trees and B+ trees. Which tree is more suitable for real-time data processing and why?	CO3K4

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