Register Number:……..

KUMARAGURU college of technology
character is life

**MCA DEGREE EXAMINATIONS: NOV/ DEC 2024**

(Regulation 2024)

First Semester

**MASTER OF COMPUTER APPLICATIONS**

24CAI501: Data Structures and Algorithms

**COURSE OUTCOMES**

CO1: Understand the fundamental concepts and the implementation of algorithms in problem-solving contexts.

CO2: Apply linear and non-linear data structures in various practical applications.

CO3: Analyze the representation of different types of data structures and implement them in hierarchical data management.

CO4: Analyze the efficiency of various algorithms and evaluate their performance for efficient memory usage and algorithmic performance in solving problems.

CO5: Develop programs by applying various techniques to optimize data organization and retrieval.

**Time: Three Hours** **Maximum Marks: 100**

**PART A (4*20 = 80 Marks)**

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|---|---|---|---|---|---|
| 1. | a) | What are the characteristics of an algorithm? | 2 | CO1 | [$K_1$] |
| | b) | What is the running time for the following program fragment:<br>for(i=0;i<n;i++)<br>A[i] = 0;<br>for(i=0;i<n;i++)<br>for(j=0;j<n;j++)<br>A[i] = A[i] + 10; | 2 | CO1 | [$K_1$] |
| | c) | Write an algorithm for searching for an element among the list of elements. Show how element 10 is searched for among 24, 3, 14, 10, 8, 12, 14. | 4 | CO1 | [$K_2$] |
| | d) | Write short notes on how the asymptotic notations are used to compare and rank orders of growth with respect to various algorithms. | 4 | CO1 | [$K_2$] |

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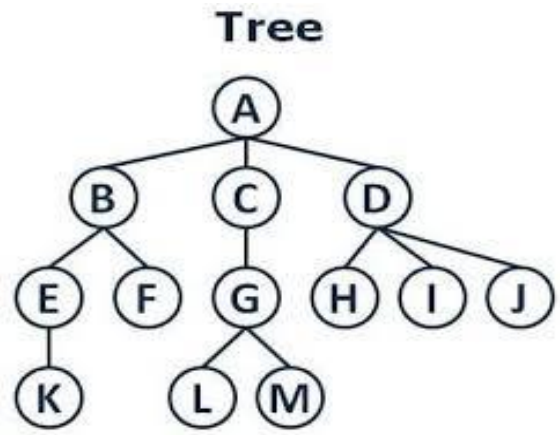
| | e) | Enumerate the steps to be followed for Mathematical Analysis of non-recursive algorithms. Show how the mathematical analysis is done for an algorithm that finds a maximum element among the list of 10 elements. | 8 | CO1 | [$K_3$] |
| 2. | a) | Are linked lists more efficient than arrays? Justify your answer. | 2 | CO2 | [$K_2$] |
| | b) | Give the structure of a doubly linked list that may be used for storing roll number and name of the student. [Treat roll number and name of the student as separate members] | 2 | CO2 | [$K_2$] |
| | c) | Write routines for the Enqueue and Dequeue functions of a Queue using Arrays. | 6 | CO2 | [$K_3$] |
| | d) | Write a C program to convert an infix expression to postfix expression. Show how the infix expression, (a + b) * c is converted to postfix expression. | 10 | CO2 | [$K_3$] |
| 3. | a) | Find the height of node G and depth of node H for the tree: | 2 | CO3 | [$K_2$] |

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| | b) | What data structure is used by the depth first search algorithm and breadth first search algorithm? | 2 | CO3 | [$K_2$] |
| | c) | Write a C program to insert a node into a Binary Search Tree. Analyze the program for its efficiency. | 8 | CO4 | [$K_3$] |
| | d) | Write a C program to find a given element from a Binary Search Tree. Analyze the program for its efficiency. | 8 | CO4 | [$K_3$] |
| 4. | a) | What is a collision in hashing, and what are the techniques used to resolve it? | 2 | CO1 | [$K_1$] |
| | b) | Compare linear search and binary search techniques. Which one is more efficient, and under what conditions? | 2 | CO4 | [$K_2$] |

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| | c) | Given input {371, 323, 173, 199, 344, 679, 989} and a hash function h(X) = X (mod 10), show the separate chaining hash table. | 6 | CO2 | [K3] |
| | d) | Write a C program to implement Quick Sort. Show how the elements 18, 11, 14, 19, 10, 13, 15, 12, 17, 16 are sorted using Quick Sort algorithm. | 10 | CO5 | [K3] |

**Answer any ONE Question**
**PART B (1*20 = 20 Marks)**

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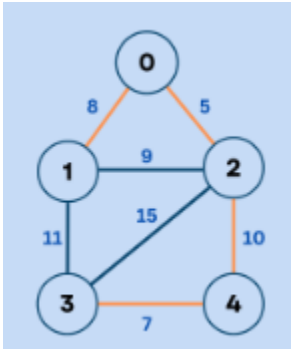
| 5. | a) | Describe depth-first and breadth-first traversal of Graphs with simple diagrams. | 8 | CO2 | [K2] |
| | b) | Find the Minimum Spanning Tree for the Graph given below using Prim's and Kruskal's algorithm: | 12 | CO2 | [K3] |




[Consider node 1 as the start node for Prim's algorithm]

OR

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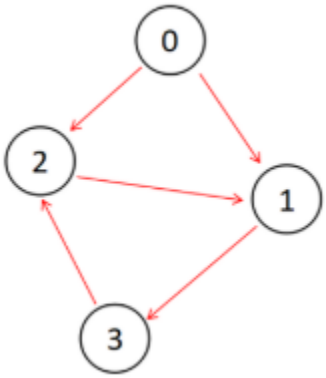
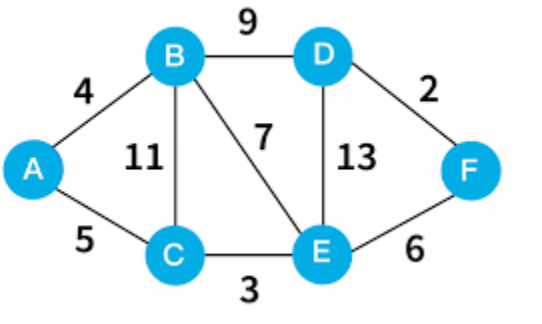
|---|---|---|---|---|---|
| 6. | a) | Explain Warshall's algorithm and find the Transitive Closure for the following Graph: | 8 | CO2 | [K3] |



b) Find the Shortest Path using the Dijkstra's algorithm for the Graph given below: 12 CO2 [$K_3$]




[Note: Consider node A as the source node]

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