K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109
DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SESSION: 2022-2023 (EVEN SEMESTER)

I INTERNAL TEST QUESTION PAPER
SET-A

| USN | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

Degree : B.E
Branch : AI & DS
Course Title : Design and Analysis of Algorithms
Duration : 60 Minutes

Semester : IV
Course Code : 21CS42
Date : 26/06/2023
Max Marks : 20

**Note: Answer ONE full question from each part.**

| Q No. | Questions | Marks | K-Level | CO mapping |
|---|---|---|---|---|
| | **PART-A** | | | |
| 1(a) | **Outline** algorithm. What are the criteria that an algorithm must satisfy? | 5 | Understanding K2 | CO1 |
| (b) | i. **List** Asymptotic notations in detail with example.<br>ii. **Show** the general plan for analyzing the efficiency of a recursive algorithm. Write the algorithm to find a factorial of a given number. Derive its efficiency. | 5 | Applying K3 | CO1 |
| | **OR** | | | |
| 2(a) | **Explain** Tower of Hanoi Recursive algorithm and its complexity. | 5 | Understanding K2 | CO1 |
| (b) | i. **Solve** and Prove the following Theorem<br>a. If $f1(n) \in O(g1(n))$ and $f2(n) \in O(g2(n))$ then $f1(n) + f2(n) \in O(\max(g1(n), g2(n)))$<br>ii. **List** the following functions according to their order of growth from the lowest to the highest. State proper reasons.<br>a. $(n-2)!, 5\log(n+100)^{10}, 2^{2n}, 0.001n^4+3n^3+1, 1n^2n, \sqrt[3]{n}, 3^n$. | 5 | Applying K3 | CO1 |
| | **PART-B** | | | |
| 3(a) | **Demonstrate** an algorithm to find uniqueness of elements in an array and give the mathematical analysis of this non recursive algorithm with steps. | 5 | Applying K3 | CO1 |

| | | | | |
|---|---|---|---|---|
| (b) | **Express** how quick-sort works to sort an array and trace for the following data set. Draw the tree of recursive calls made. 65 70 75 80 85 60 55 50 45. **Derive** the best case complexity of quick sort algorithm | 5 | Applying K3 | CO2 |
| | **OR** | | | |
| 4(a) | **Illustrate** the following problem types. a)Selection Sort b) Sequential Search | 5 | Applying K3 | CO1 |
| (b) | **Develop** merge sort algorithm and discuss the best-case ,worse complexity and average case efficiency. | 5 | Applying K3 | CO2 |

5

Course In charge

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AI & DS

IQAC- Coordinator

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Dr. K. RAMA NARASIMHA
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## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

**SESSION: 2022-2023 (EVEN SEMESTER)**

**I INTERNAL TEST QUESTION PAPER**
**SET-B**

| | | | | |
|---|---|---|---|---|
| Degree | : | B.E | USN | |
| Branch | : | AI & DS | Semester | : IV |
| Course Title | : | Design and Analysis of Algorithms | Course Code | : 21CS42 |
| Duration | : | 60 Minutes | Date | : 26/06/2023 |
| | | | Max Marks | : 20 |

**Note: Answer ONE full question from each part.**

| Q No. | Questions | Marks | K-Level | CO mapping |
|---|---|---|---|---|
| | **PART-A** | | | |
| 1(a) | **Give an example** how a new variable count introduced in a program can be used to find the number of steps needed by a program to solve a problem instance | 5 | Applying K3 | CO1 |
| (b) | i. **Outline** Asymptotic notations in detail with example.<br>ii. **Build** the general plan for analyzing time efficiency of recursive algorithms. Model the recursive algorithm to find the factorial of a number. Develop its efficiency.. | 5 | Applying K3 | CO1 |
| | **OR** | | | |
| 2(a) | i. **Solve** and Prove the Theorem<br>a. If $f1(n) \in O(g1(n))$ and $f2(n) \in O(g2(n))$ then $f1(n) + f2(n) \in O(\max(g1(n), g2(n)))$<br>ii. **Demonstrate** the algorithm<br>Algorithm S(n)<br>{<br>if(n==1)<br>return 1<br>else<br>return (S(n-1)+n*n* n)<br>}<br>a) **Identify** what does this algorithm?<br>b) **Identify** the basic operation.<br>c) **Identify** how many times the basic operation executed? | 5 | Applying K3 | CO1 |

| | | | | |
|---|---|---|---|---|
| (b) | Write the Tower of Hanoi Recursive algorithm and show its analysis. | 5 | Applying K3 | CO1 |
| | **PART-B** | | | |
| 3(a) | **Express** an algorithm to find uniqueness of elements in an array and give the mathematical analysis of this non recursive algorithm with steps. | 5 | Applying K3 | CO1 |
| (b) | **Give an example** of a suitable sorting algorithm that uses divide and conquer a technique which divides problem size by considering values in the list. Analyse it for best and worst case efficiencies. | 5 | Applying K3 | CO2 |
| | **OR** | | | |
| 4(a) | **Develop** an algorithm to search an element in an array using Linear (sequential) search. Identify the worst case, best case and average case efficiency of this algorithm. | 5 | Applying K3 | CO1 |
| (b) | **Use** the following list of elements<br><br>-15,-6,0,7,9,23,54,82, 101, 112,125,131,131,142,151<br><br>**Apply** Binary search on the elements. Identify average number of comparisons required for successful and unsuccessful search | 5 | Applying K3 | CO2 |

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# K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109
## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SESSION: 2022-2023 (EVEN SEMESTER)

II INTERNAL TEST QUESTION PAPER
SET-A

| USN | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

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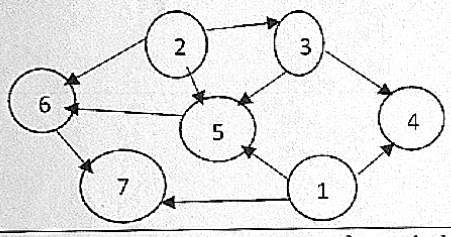
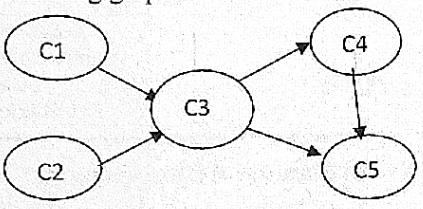
|---|---|---|---|---|
| Degree | : | B.E | Semester : | IV |
| Branch | : | AI & DS | Course Code : | 21CS42 |
| Course Title | : | Design and Analysis of Algorithms | Date : | 10/08/2023 |
| Duration | : | 60 Minutes | Max Marks : | 20 |

**Note: Answer ONE full question from each part.**

| Q No. | Questions | Marks | K-Level | CO mapping |
|---|---|---|---|---|
| | **PART-A** | | | |
| 1(a) | **Develop** algorithm for BFS and DFS and apply it on the following graph.   | 5 | Applying K3 | CO2 |
| (b) | **Solve** the following instance of greedy knapsack problem where n=4, m=10, p = (40, 42, 25, 12) and w = (4, 7, 5, 3) | 5 | Applying K3 | CO3 |
| | **OR** | | | |
| 2(a) | **List** the three major variation of Decrease and conquer technique? Explain with a example for each. | 5 | Applying K3 | CO2 |
| (b) | **Implement** Greedy approach to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm. | 5 | Applying K3 | CO3 |
| | **PART-B** | | | |
| 3(a) | **Develop** the algorithm for Insertion Sort and apply it on the following data. 25 15 30 9 99 20 26 | 5 | Applying K3 | CO2 |

| | | | | |
|---|---|---|---|---|
| (b) | **Construct** a Huffman code for the following data.<br><br>Characters: A, B, C, D, _<br>Frequency: 0.4, 0.1, 0.2, 0.15, 0.15<br><br>Encode the text ABACABAD and decode 100010111001010 | 5 | Applying K3 | CO3 |
| | **OR** | | | |
| 4(a) | **List** out the advantages and disadvantages of divide and conquer method and **illustrate** the topological sorting for the following graph.<br><br>  <br> | 5 | Applying K3 | CO2 |
| (b) | i. **Use** Dijkstra algorithm to generate java code to find single source shortest path for a graph G whose edge weights are positive.<br>ii. Sort the given list of numbers using heap sort: 2, 9, 7, 6, 5, 8. | 5 | Applying K3 | CO3 |

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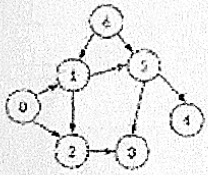
DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SESSION: 2022-2023 (EVEN SEMESTER)

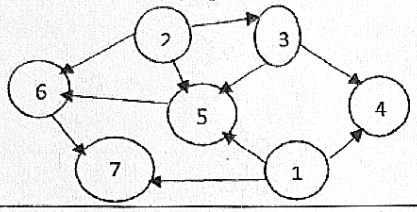
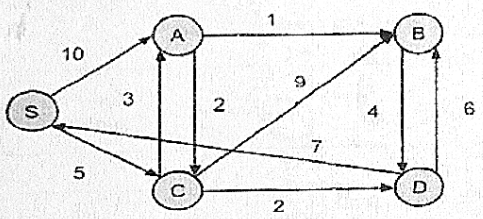
II INTERNAL TEST QUESTION PAPER
SET-B

| | | | | |
|---|---|---|---|---|
| Degree | : | B.E | USN | |
| Branch | : | AI & DS | Semester | : IV |
| Course Title | : | Design and Analysis of Algorithms | Course Code | : 21CS42 |
| Duration | : | 60 Minutes | Date | : 10/08/2023 |
| | | | Max Marks | : 20 |

**Note: Answer ONE full question from each part.**

| Q No. | Questions | Marks | K-Level | CO mapping |
|---|---|---|---|---|
| | **PART-A** | | | |
| 1(a) | Define topological sorting. **Illustrate** the topological sorting using DFS method for the following graph.  | 5 | Applying K3 | CO2 |
| (b) | **Implement** Greedy approach to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm. | 5 | Applying K3 | CO3 |
| | **OR** | | | |
| 2(a) | **List** the three major variation of Decrease and conquer technique? Explain with an example for each. | 5 | Applying K3 | CO2 |
| (b) | i. Write the problem statement for job sequencing with deadline? Let n=5, profits (10, 3, 33, 11, 40) and deadlines (3, 1, 1, 2, 2). **Find out** the optimal sequence of execution of job solution using greedy algorithm.<br>ii. **Construct** the Huffman tree and the code for the following data. | 5 | Applying K3 | CO3 |

| Characters | a | e | i | o | u | s | t |
|---|---|---|---|---|---|---|---|
| Frequency | 10 | 15 | 12 | 3 | 4 | 13 | 1 |

| | PART-B | | | |
|---|---|---|---|---|
| 3(a) | **Develop** the algorithm for BFS and DFS and apply it on the following graph.<br>  | 5 | Applying<br>K3 | CO2 |
| (b) | **Use** Dijkstra's Algorithm to **find out** shortest path on the following graph. Write the function for it.<br>  | 5 | Applying<br>K3 | CO3 |
| | **OR** | | | |
| 4(a) | **Develop** the algorithm for Insertion Sort and apply it on the following data.<br>4 3 2 10 12 1 5 6 | 5 | Applying<br>K3 | CO2 |
| (b) | **Solve** the following instance of greedy knapsack problem where n=5, m=6, p = (25, 20, 15,40,50) and w = (3, 2, 1, 4,5) | 5 | Applying<br>K3 | CO3 |

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# K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109
## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SESSION: 2022-2023 (EVEN SEMESTER)

III INTERNAL TEST QUESTION PAPER
SET-A

USN | | | | | | | | | | |

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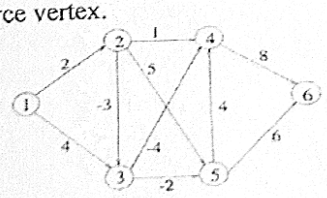
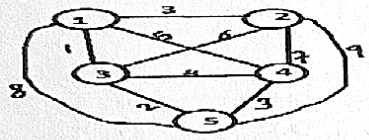
|---|---|---|---|---|
| Degree | : | B.E | Semester | : IV |
| Branch | : | AI & DS | Course Code | : 21CS42 |
| Course Title | : | Design and Analysis of Algorithms | Date | : 12/09/2023 |
| Duration | : | 60 Minutes | Max Marks | : 20 |

**Note: Answer ONE full question from each part.**

| Q No. | Questions | Marks | K-Level | CO mapping |
|---|---|---|---|---|
| | **PART-A** | | | |
| 1(a) | Outline Comparison Counting Sort algorithm and **apply** for following input.<br>62 \| 31 \| 84 \| 96 \| 19 \| 47 | 5 | Applying K3 | CO4 |
| (b) | Explain Backtracking method? **Draw** state space tree to generate solution to 4-Queens problem. | 5 | Applying K3 | CO5 |
| | **OR** | | | |
| 2(a) | Explain the algorithm to **solve** multistage graph using backward approach with an example. | 5 | Applying K3 | CO4 |
| (b) | **Solve** assignment problem for the following job assignment and obtain optimal solution.<br>Job 1 Job 2 Job 3 Job 4<br>A 9 2 7 8<br>B 6 4 3 7<br>C 5 8 1 8<br>D 7 6 9 4 | 5 | Applying K3 | CO5 |
| | **PART-B** | | | |
| 3(a) | Explain Bellman ford algorithm. **Solve** the following single source shortest problem assuming vertex 1 as the source vertex.<br>  | 5 | Applying K3 | CO4 |

| | | | | |
|---|---|---|---|---|
| (b) | What is Hamiltonian cycle? **Provide** a java code to find Hamiltonian cycle using backtracking technique with example. | 5 | Applying K3 | CO5 |
| | **OR** | | | |
| 4(a) | **Make** use of Dynamic programming for finding maximum profit in the knapsack problem and solve it. Item={1,2,3,4}, n =4, P = (40, 42, 25, 12), W = (2, 1, 2, 1). W=5 | 5 | Applying K3 | CO4 |
| (b) | **Apply** Branch and bound algorithm to solve the Travelling Salesperson problem for the following graph  | 5 | Applying K3 | CO5 |

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SET-B

USN

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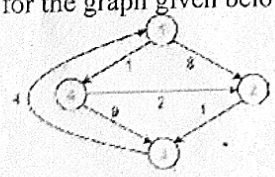
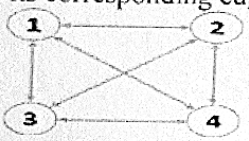
|---|---|---|---|---|---|
| Degree | : | B.E | Semester | : | IV |
| Branch | : | AI & DS | Course Code | : | 21CS42 |
| Course Title | : | Design and Analysis of Algorithms | Date | : | 12/09/2023 |
| Duration | : | 60 Minutes | Max Marks | : | 20 |

**Note: Answer ONE full question from each part.**

| Q No. | Questions | Marks | K-Level | CO mapping |
|---|---|---|---|---|
| | **PART-A** | | | |
| 1(a) | Outline Distribution Counting algorithm and **apply** it for the following input.<br>13 \| 11 \| 12 \| 13 \| 12 \| 12 | 5 | Applying K3 | CO4 |
| (b) | **Solve** assignment problem for the following job assignment and obtain optimal solution.<br>Job 1 Job 2 Job 3 Job 4<br>A 9 2 7 8<br>B 6 4 3 7<br>C 5 8 1 8<br>D 7 6 9 4 | 5 | Applying K3 | CO5 |
| | **OR** | | | |
| 2(a) | Explain the algorithm to **solve** multistage graph using forward approach with example. | 5 | Applying K3 | CO4 |
| (b) | Explain Backtracking method? **Draw** state space tree to generate solution to 4-Queens problem. | 5 | Applying K3 | CO5 |
| | **PART-B** | | | |
| 3(a) | **Apply** Floyd's algorithm to find all pair shortest path for the graph given below with java code.<br>  | 5 | Applying K3 | CO4 |
| (b) | **Apply** Backtracking to solve the instance of the sum of subset problem S={5,10,12,13,15,18} d=30 and outline the java code. | 5 | Applying | CO5 |

30/6 = 5

| | | | | |
|---|---|---|---|---|
| | | | K3 | |
| | **OR** | | | |
| 4(a) | **Solve** TSP - the optimal tour for sales person using dynamic programming technique for the given graph and its corresponding edge length matrix   $\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$ | 5 | Applying K3 | CO4 |
| (b) | **Use** Branch & Bound for Knapsack problem for the following and find the optimal solution, C=10 | 5 | Applying K3 | CO5 |

| Items | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Weights | 4 | 7 | 5 | 3 |
| Values | 40 | 42 | 25 | 12 |

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