RV College of Engineering
Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India
NBA Accredited
Tel: 080-68188199

Department of Computer Science and Engineering

Program: BE

| | | | |
|---|---|---|---|
| Date | 18 June 2024 | Maximum Marks | 50 |
| Course Code | **CD343AI** | Duration | 90 min |
| 4th Sem | IV Semester | CIE-I | |

**Design and Analysis of Algorithms**
(Common to AIML/CSE/CD/CY/ISE)

| Sl. No. | Test Questions | M | L | CO |
|---|---|---|---|---|
| 1a | Summarise the framework for analysis of algorithms. | 05 | L1 | CO2 |
| 1b | With suitable notations and graphs, explain the different asymptotic notations. Give two examples in each case. | 05 | L2 | CO1 |
| 2a | Design a recursive algorithm to find the sum of cubes of first '$n$' natural numbers. Set up a recurrence, solve and determine the time complexity of the algorithm. | 05 | L2 | CO1 |
| 2b | Write an algorithm to arrange the numbers in ascending order using Selection Sort. Evaluate the time complexity. Compare it with merge-sort algorithm. | 05 | L1 | CO3 |
| 3a | Sort the following functions in the increasing order of growth. $n^3$, $2^n$, $log_5 n$, $3n$, $log_2 n$, $\sqrt{n}$, $n \log n$ Indicate how much the functions value will change if its argument is increased four-fold. | 05 | L2 | CO2 |
| 3b | Write the pseudocode for merge sort and describe the process. Setup a recurrence and decide the time complexity. | 05 | L2 | CO1 |
| 4a | Apply Master's theorem to following recurrence and indicate the efficiency class. $i.\ T(n) = 2\,T\left(\frac{n}{2}\right) + n$ $ii.\ T(n) = 8\,T\left(\frac{n}{2}\right) + 5n^2$ | 04 | L3 | CO1 |
| 4b | Derive the worst-case efficiency class for the quick sort. Show the first split for the following array by considering the leftmost element as the pivot: 38, 81, 22, 48, 18, 50, 31, 58 | 06 | L3 | CO2 |
| 5a | Mention the 3 variations of decrease-and-conquer and give an example algorithm in each case. | 04 | L1 | CO3 |
| 5b | Consider the graph shown in Fig 5b.<br>i. Apply DFS algorithm by considering vertex '1' as the source and write the traversal sequence. Show the contents of stack during DFS and also draw the DFS forest. | 06 | L3 | CO3 |

ASUS VivoBook

ii. Apply BFS algorithm by considering vertex '0' as the source. Draw the BFS forest.

4-6

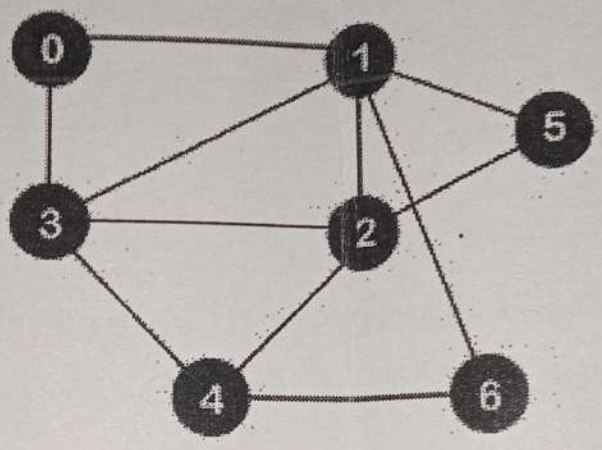



Fig 5b

**Course Outcomes**

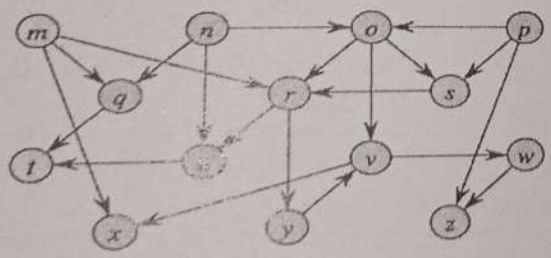
| | |
|---|---|
| CO1 | Apply knowledge of computing and mathematics to algorithm analysis |
| CO2 | Analyze a problem and identify the computing requirements appro solution |
| CO3 | Apply mathematical foundations, algorithmic principles, and comp theory to the modeling, and evaluation of computer-based solutions demonstrates comprehension of the trade-offs involved in design choi |
| CO4 | Investigate and apply optimal design, development principles, skills ar construction of software solutions of varying complexity. |
| CO5 | Demonstrate critical, innovative thinking, and display competence in and visual communication. |
| CO6 | Exhibits positive group communication exchanges in order to accomp goal and engage in continuing professional development. |

**Blooms' taxonomy**

| Date | July 2024 | | |
|---|---|---|---|
| Course Code | CD343AI | Duration | 120 min |
| Sem | IV | CIE-II | |

**Design and Analysis of Algorithms**

(Common to AIML/CSE/CD/CY/ISE)

| Sl. No. | Questions | M | L | C |
|---|---|---|---|---|
| | **PART A** | | | |
| 1.1 | Is it possible to find transitive closure of a digraph using Depth First Search (DFS) or Breadth-first search (BFS)? Justify the answer | 2 | L3 | CO |
| 1.2 | Given a text of length n=30 and a pattern of length m=4, how many shifts will the Horspool algorithm perform in the worst case? | 2 | L3 | CO |
| 1.3 | In a max heap containing n elements, the smallest element can be found in _____ worst time | 2 | L1 | CO |
| 1.4 | Why Floyd-Warshall Algorithm better for Dense Graphs and not for Sparse Graphs? | 2 | L3 | CO |
| 1.5 | List any four limitations of Distribution Counting Sort | 2 | L2 | CO |
| | **PART B** | | | |
| 1a | Apply DFS traversal to find the topological order of the graph shown in figure 1a from the vertex p (break the ties by the alphabetical order of the vertices)<br>  <br><br>figure 1a | 06 | L3 | |
| 1b | Compare the brute force approach and Instance simplification variant of transform and conquer approach to solve checking element uniqueness in an array. | 04 | L1 | |

| | | | | |
|---|---|---|---|---|
| 2a | Show the state of each pass and final array after applying comparison counting sort for the list: 94, 73, 26, 11, 05, 77, 31 to sort the elements in non-decreasing order. | **06** | L2 | CO2 |
| 2b | Write the pseudocode of Warshall's algorithm and prove that the time efficiency of warshall's algorithm is cubic. | **04** | L2 | CO2 |
| 3a | Apply heapsort to arrange the list 8, 12, 15, 3, 5, 1, 43, -7 in ascending order by using array representation of heap. | **06** | L3 | CO3 |
| 3b | Compute binomial coefficient of $^5C_3$ using dynamic programming | **04** | L2 | CO1 |
| 4 | Apply floyd's algorithm to find all pairs shortest path for the digraph shown in with the weight matrix $\begin{pmatrix} 0 & 2 & \infty & 1 & 8 \\ 6 & 0 & 3 & 2 & \infty \\ \infty & \infty & 0 & 4 & \infty \\ \infty & \infty & 2 & 0 & 3 \\ 3 & \infty & \infty & \infty & 0 \end{pmatrix}$ | **10** | L3 | CO3 |
| 5 | Use input enhancement technique for the pattern ***RNARNAKARNA*** and apply Boyer Moore algorithm to find the occurrence of this pattern in the text ***RAVANAKARNA_RAMAYANA_EPIC _SEETHA_ _ _ _NNARNA_ RNARNAKARNA*** | **10** | L3 | CO |

**Course Outcomes**

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|---|---|
| CO1 | Apply knowledge of computing and mathematics to algorithm analysis and design |
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| CO3 | Apply mathematical foundations, algorithmic principles, and computer science theory to the modeling, and evaluation of computer-based solutions in a way that demonstrates comprehension of the trade-offs involved in design choices. |
| CO4 | Investigate and apply optimal design, development principles, skills and tools in the construction of software solutions of varying complexity. |
| CO5 | Demonstrate critical, innovative thinking, and display competence in oral, written, and visual communication. |
| CO6 | Exhibits positive group communication exchanges in order to accomplish a common goal and engage in continuing professional development. |

**Blooms' taxonomy**

DAA-II

| L1 | L2 | L3 | L4 | L5 | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | | | | | | | | | - | - |

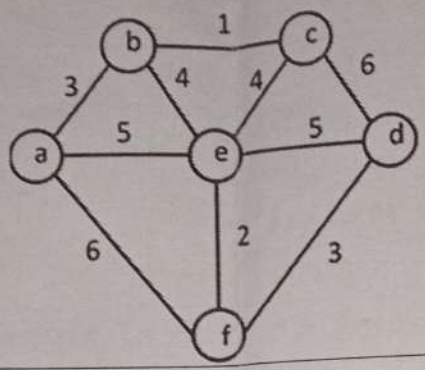
| Course Code | CD343AI | Duration | 90 min |
|---|---|---|---|
| 4th Sem | IV Semester | CIE-I | |

# Design and Analysis of Algorithms

(Common to AIML/CSE/CD/CY/ISE)

| Sl. No. | Improvement Quiz Questions | M | L |
|---|---|---|---|
| 1 | Define spanning tree. | 2 | 1 |
| 2 | Find the compression ratio for the given data<br>A = 8 = 40%, B = 2 = 10%, C = 4 = 20%, D = 3 = 15%, _ = 3 = 15%<br>Using Huffman coding the characters are coded as<br>A 0<br>B 100<br>C 110<br>D 101<br>_ 111 | 2 | 2 |
| 3 | Explain how Dijkrasta's algorithm differ from Prim's algorithm | 2 | 2 |
| 4 | Define a state-space tree in the context of the backtracking algorithm | 2 | 1 |
| 5 | What is NP hard problems? | 2 | 1 |

| Sl. No. | Improvement Test Questions | M | L |
|---|---|---|---|
| 1 | Apply 0/1 Knapsack, find the maximum profit for the given data<br>C= 5 Wi 2 1 3 2<br>Pi 8 6 16 11 | 10 | 3 |
| 2 | Apply Prim's algorithm to find the Minimum Spanning Tree (MST) for the given graph. Write the spanning tree after finding the MST | 10 | |




| | | | | |
|---|---|---|---|---|
| 3 a | Compare Backtracking and Branch & bound. | **4** | 2 | 2 |
| 3 b | Write the decision tree for finding minimum of three numbers. | **6** | 2 | 1 |
| 4 | Consider an assignment problem where you have to assign n people to n jobs in such a way that the total cost of the assignment is minimized. The cost matrix for assigning each person to each job is given below: | **10** | 3 | 3 |

| Job/Person | Job 1 | Job 2 | Job 3 | Job 4 |
|---|---|---|---|---|
| Person 1 | 9 | 2 | 7 | 8 |
| Person 2 | 6 | 4 | 3 | 7 |
| Person 3 | 5 | 8 | 1 | 8 |
| Person 4 | 7 | 6 | 9 | 4 |

*(a) Calculate the lower bound for this assignment problem.*
*(b) Find the solution using branch and bound*

| | | | | |
|---|---|---|---|---|
| 5 a | Briefly discuss P and NP problems used in problem solving | **6** | 2 | |
| 5 b | Define greedy technique, how it differs from dynamic programming? | **4** | 2 | |

DAA-III ~~DMSC-III~~

**Course Outcomes**

| | |
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| CO1 | Apply knowledge of computing and mathematics to algorithm analysis and design |
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**Blooms' taxonomy test**