**18CS43**

**USN** | | | | | | | | | | |

# RV COLLEGE OF ENGINEERING®

**(An Autonomous Institution Affiliated to VTU)**

**IVSemester B. E. Grade Improvement ExaminationsOctober 2021**

## Common to CS / IS

## DESIGN AND ANALYSIS OF ALGORITHMS

***Time: 03 Hours*** ***Maximum Marks: 100***

***Instructions to candidates:***

Answer any FIVE full questions out of TEN. Each carries 20 marks

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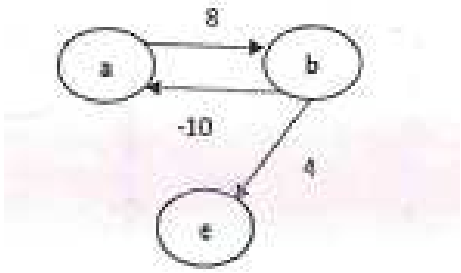
|---|---|---|---|
| 1 | 1.1 | What type of problems can be solved using Dynamic Programming Strategy. | 02 |
| | 1.2 | How many times the basic operation gets executed while finding the value of binomial coefficient$C(6,5)$ using dynamic programming approach? Show tracing. | 02 |
| | 1.3 | Load shedding is necessary to maintain the system reliability in a decentralization grid system, which is vulnerable to power supply shortage. A proposed model considers the customer values and load characteristics to meet the electricity requirement and aims to maximize the customer values within given supply capacity. Which is the best-known algorithm and the algorithm design strategy to that can be used to solve this puzzle to find the best optimized solution capturing the customer values and discrete characteristics of load? | 02 |
| | 1.4 | X company has the largest decentralized communication protocol P2P for sharing files and data of large size over the Internet. P2P communication protocol has the world's highest Internet traffic each day. It offers clients to download files for windows , Mac and Android OS. It offers feature rich, safe programs for desktop, a browser based streaming and downloading product, and a mobile downloader for android is available. Which known algorithm and the design strategy best suits to solve the above puzzle? | 02 |
| | 1.5 | What is the worst and average time complexity of Boyer-Moore algorithm for a pattern of length m and a text of length n? | 02 |
| | 1.6 | A person wants to visit different places in India. He wants to visit from North to South part and list the places. But there are some places which he wants to visit before some other places. How can this problem be solved as an application of graph? | 02 |
| | 1.7 | How many swaps are made by insertion sort to sort(20,10,30,15,16,25) in ascending order? Show tracing. | 02 |
| | 1.8 | Given the graph find the shortest path using Dijkstra's algorithm from source'a'.   | 02 |
| | 1.9 | Using Huffman encoding technique, the average length of each character is found to be 2.25bits. What is the number of bits used to represent 50 characters? Show the calculations. | 02 |

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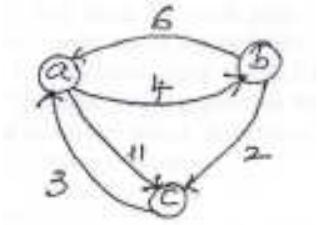
| | 1.10 | Find the total number of changes(Change in element value) to graph given below after 2 iterations of Floyd's algorithm. Show the iterations.<br>  <br> | 02 |
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| 2 | a | Analyze the algorithm for time complexity.<br>ALGORITHM findme(A[0..n-1])<br>//Input: Array a[0..n-1] of numbers<br>temp←∞<br>for i←0 to n-1 do<br>for j←0 to n-1 do<br>if i≠ $j$ and $\|A[i] - A[j]\| < temp$<br>temp←$\|A[i] - A[j]\|$<br>return temp<br>can the efficiency be improved? If so, propose an algorithm and find its time complexity. | 12 |
| | b | Apply bubble sort on the following input and count the number of comparisons done. Show complete passes and comparisons: 21,10,15,88,95,5. | 08 |
| | | | |
| 3 | a | Write a recursive function to solve the tower of Hanoi pruzzle. Analyze its running time efficiency. Show all the steps in analysis. | 12 |
| | b | Apply selection sort on the following input and count the number of comparison done<br>A L G O R I T H M S | 08 |
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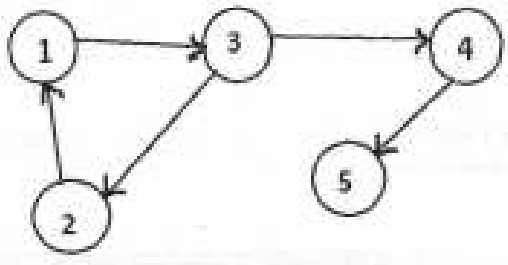
| 4 | a | Write the algorithm to traverse a graph using depth-first search traversal. What is its time efficiency. ? | 08 |
| | b | A digraph is called strongly connected if for any part of two distinct vertices u and v there exists a directed path from u to v and a directed path from v to u . Design a DFS-based algorithm for identifying strongly connected components in a given graph. Apply the same to the following digraph to determine its strongly connected components.<br>  <br> | 12 |
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| 5 | a | Write the pseudo code of merge sort algorithm(along with the merge) and analyses for worst case time efficiency. | 10 |
| | b | Compare the standard Brute force algorithm and the divide and conquer algorithm for matrix multiplication. | 10 |

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| 6 | a | Consider a university endowment that needs to invest $100 million. This sum must be split between three types of investments: stocks, bonds, and cash. The endowment managers expect an annual return of 10%,7% and 3% for their stock, bond and cash investments , respectively. Since stocks are riskier than bonds, the endowment rules require the amount invested in stocks to be no more than one third of the money is invested in bonds. In addition, at least 25% of the total amount invested in stocks and bonds must be invested in cash.<br>Design a transform and conquer based solution to the above problem to find how the mangers can invest the money to maximize the return. | 10 |
| | b | Apply Horspool's algorithm to find the pattern "BARBER" in the string.<br>"JIM_SAW_ME_IN_THE_BARBERSHOP" | 10 |
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| 7 | a | Jealous husbands: There are n($n \geq 2$) married couples who need to cross river. They have a boat that can hold no more than two people at a time. To complicated matters , all the husbands are jealous and will not agree on any crossing procedure that would put a wife on the same bank of the river with another woman's husband without the wife's husband being there too, even if there are other people on the same bank. Can they cross the river under such constraints?<br>Design transform and conquer based solution to the above problem to find solution when n=2. Draw the state space tree for the solution. | 10 |
| | b | Apply Boyer Moore's Algorithm to find the pattern "BAOBAB" in the string.<br>"BESS_KNEW_ABOUT_BAOBABS". | 10 |
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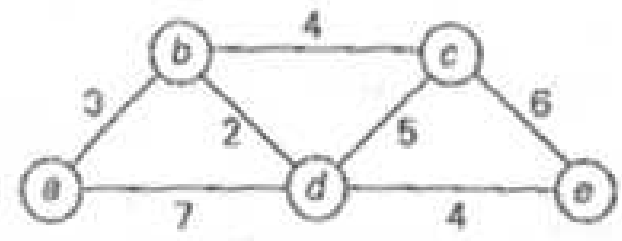
| 8 | a | Write the algorithm for computing binomial coefficient C(n,k) using dynamic programming approach. Draw the binomial coefficient table for C(8,3). | 10 |
| | b | Apply Dijkstra's algorithm to find single source shortest paths from source vertex 'a'.<br>  | 10 |
| | | | |
| 9 | a | There are n houses build in a line, each of which contains some value in it. A theif is going to steal the maximal values of these houses, but he can't steal in two adjacent houses because the owner of the stolen houses will tell his two neighbours left and right side.<br>Given the number of houses (n) and a list of n values, write a recurrence relation to sove the given problem. Write an Algorithm for the identifiedrecurrence relation to find the maximum stolen value. Trace your algorithm for input: val [ ]={6,7,1,3,8,2,4} | 12 |
| | b | What are the advantages of memory function? Write a memory function method to solve the knapsack problem. | 08 |

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| 10 | a | What are the conditions in Branch and Bound technique to terminate a search path in state space tree? Apply Branch and Bound approach to solve the 0/1 Knapsack problem with the instance:<br>Knapsack capacity=10kg<br><br>| Item | Weight (Kg) | Value ($) |<br>|---|---|---|<br>| 1 | 4 | 40 |<br>| 2 | 7 | 42 |<br>| 3 | 5 | 25 |<br>| 4 | 3 | 12 | | 12 |
| | b | What are NP,P,NP-complete and NP-Hard problems? Give examples for each. | 08 |