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# RV COLLEGE OF ENGINEERING®

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

**III Semester B. E. Regular / Supplementary Examinations Jan / Feb-2025**

**Artificial Intelligence and Machine Learning**

## FUNDAMENTALS OF DATA STRUCTURES AND DATA ANALYSIS

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

***Instructions to candidates:***

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.

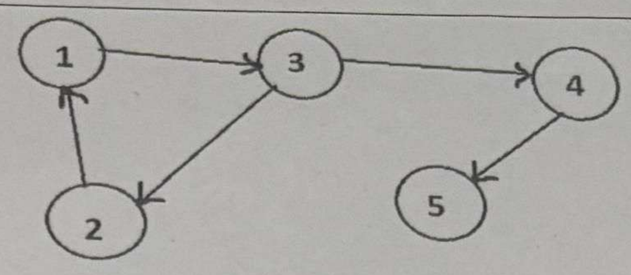
**PART-A**

| | | | M | BT | CO |
|---|---|---|---|---|---|
| 1 | 1.1 | What does the function "sllprint" return for a given linked list with contents as (2,4,6,8 *and* 10) and with first node pointed by external pointer "head"?<br>*struct node{*<br>*int data;*<br>*struct node * next;*<br>*};*<br>*int sllprint (struct node * head){*<br>*if(head == NULL)*<br>*return 1;*<br>*if(head → next ! = NULL)*<br>*sllpring(head → next → next);*<br>*return(head → data);*<br>*}* | 02 | 2 | 1 |
| | 1.2 | Write the C code to allocate memory dynamically to the array *'A'* using *malloc()*. Assume *a* $1-D$ array, named 'exArray', which contains 30 integers. | 01 | 2 | 1 |
| | 1.3 | Write a C iterative function to print the contents of a doubly linked list in reverse order. | 01 | 2 | 2 |
| | 1.4 | Consider the stack-based infix to postfix conversion algorithm. What is the maximum number of tokens that appear on the stack at any one time during the tracing for $4\$2\$6 * 3 + 5 - 6 * 3 + 2 * 4$? | 01 | 2 | 2 |
| | 1.5 | Write any two applications of queue data structure from operating system perspective. | 01 | 3 | 2 |
| | 1.6 | The keys $10, 40, 20, 30, 100, 200$ are inserted into the empty hash table of length 10 with hash function $H(i) = i2\ mod\ 10$. What is the maximum probe value for the resultant hash table? | 01 | 2 | 1 |
| | 1.7 | In almost complete binary search tree every internal node has exactly two children. If there are 100 leaf nodes in the tree, how many internal nodes are there in the tree? | 01 | 2 | 2 |
| | 1.8 | A binary search tree is generated by inserting in order the following integers: 50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24. What is the number of the node in the left sub-tree and right sub-tree of the root, respectively? | 01 | 2 | 1 |
| | 1.9 | Suppose the numbers $7, 5, 1, 8, 3, 6, 0, 9, 4, 2$ are inserted in that order into an initially empty binary search tree. The binary search tree used the usual ordering on natural numbers. What is the in-order traversal sequence of the resultant tree? | 01 | 2 | 2 |

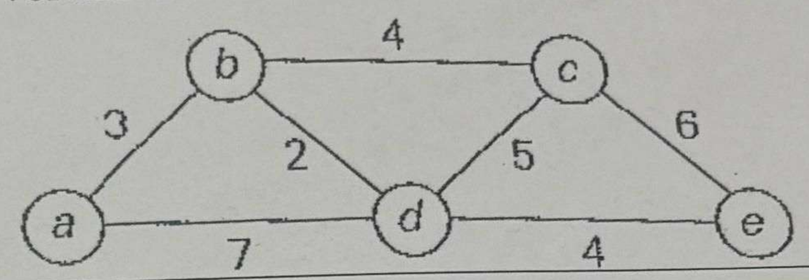
| | | | | | |
|---|---|---|---|---|---|
| 1.10 | | Postorder traversal of a given binary search tree T produces following sequence of keys: 3, 5, 7, 9, 4, 17, 16, 20, 18, 15, 14. Write an in-order traversal of the tree T. | 01 | 3 | 2 |
| 1.11 | | Why Dijkstra's Algorithm cannot be applied on "Graphs having negative weight function"? | 01 | 2 | 2 |
| 1.12 | | How many solution/solutions are available for a graph having negative weight function? | 01 | 2 | 1 |
| 1.13 | | What is Unsupervised learning? | 01 | 2 | 1 |
| 1.14 | | For what purpose, the analysis tools pre-compute the summaries of the huge amount of data? | 01 | 2 | 1 |
| 1.15 | | Write the 6-phases of CRISP-DM methodology. | 01 | 2 | 3 |
| 1.16 | | Which data mining task is the most suitable for the following scenario? 'Identify an unexpected / unusual amount of spending'. | 01 | 2 | 3 |
| 1.17 | | What does the 3*Vs* of the Big data refer to? | 01 | 2 | 3 |
| 1.18 | | What is the term used for the process of extracting valuable insights from Big data? | 01 | 2 | 3 |
| 1.19 | | What is the primary goal of Big data analytics? | 01 | 2 | 3 |

**PART-B**

| | | | | | |
|---|---|---|---|---|---|
| 2 | a | What is a data structure? How do you classify data structure? List any four data structures along with their application. | 04 | 2 | 1 |
| | b | Compare linked list data structure with an array. | 04 | 2 | 2 |
| | c | Write C functions for a singly linked list for the following:<br>i) To count the number of nodes<br>ii) To insert a new node at the end of the list<br>iii) To delete a node from the beginning of the list<br>iv) To join list2 at the end of list1.<br>Mention any assumption/s made. | 08 | 3 | 2 |
| 3 | a | Design an algorithm to convert a given infix expression (with parenthesis) into a prefix expression using stack. Using the same convert the following infix to prefix. Show each step of the conversion: $(A+B)/C*(D-A)\wedge F\wedge H$ | 08 | 3 | 2 |
| | b | Write C function for a binary search tree of the following:<br>i) To traverse the tree in preorder<br>ii) To find the height of the tree<br>iii) To find the number of leaf nodes | 08 | 3 | 2 |
| | | **OR** | | | |
| 4 | a | Write a C program to simulate the working of a linear queue that contains integer elements. Implement all the primitive operations of the linear queue. | 08 | 3 | 1 |
| | b | Write an algorithm to create an expression tree from a given postfix expression. Trace the same for $AB+CD-/EF*-$ | 08 | 3 | 1 |
| 5 | a | Write the algorithm to traverse a graph using depth-first search traversal. What is its time efficiency? | 06 | 3 | 2 |
| | b | A digraph is called strongly connected if for any pair 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 the given graph. Apply the same to the following digraph to determine its strongly connected components. | | | |




**OR**

| | | | | | |
|---|---|---|---|---|---|
| 6 | a | Define hashing. Explain the separate chaining technique. Using the hash function 'key mod 11', construct a hash table using separate chaining technique for the following list: {50, 700, 76, 85, 92, 73, 101} | 10 | 3 | 2 |
| | b | Apply Dijkstra's algorithm to find single source shortest paths from source vertex 'a'.   | 06 | 3 | 3 |
| | | | 10 | 3 | 3 |
| 7 | a | What is Data-Driven Decision-Making (DDDM)? Explain the importance of DDDM. | 08 | 2 | 3 |
| | b | What is Data Analytics Thinking? Taking the example of 'Hurricane Frances' case study, explain analyzing data to extract predictive patterns. | 08 | 3 | 3 |
| | | **OR** | | | |
| 8 | a | Compare and contrast supervised with unsupervised methods. | 08 | 2 | 4 |
| | b | Explain the six steps in data mining process. | 08 | 2 | 4 |
| 9 | a | Explain Prediction and Prediction Models. Give suitable examples for the same. | 08 | 2 | 3 |
| | b | Explain the supervised segmentation with Tree-structured models. Give examples. | 08 | 2 | 4 |
| | | **OR** | | | |
| 10 | a | Explain Selecting informative attributed and Attributes selection with information gain. Give examples. | 08 | 2 | 4 |
| | b | What is the rule for probability tree? Explain Trees as sets of rules and probability estimation. | 08 | 2 | 3 |