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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution Affiliated to VTU)

III Semester B. E. Examinations April/May -2024

DATA STRUCTURES AND APPLICATIONS

Common to ISE/CSE/CD/CY

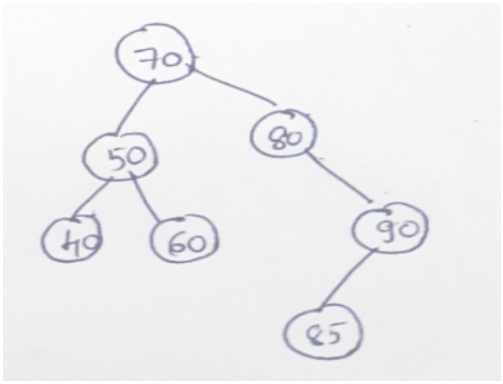
Time: 03 Hours ***Maximum Marks: 100***

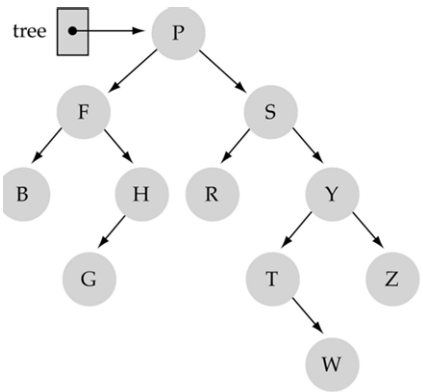
Instructions to candidates:

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	Write a C function to convert a decimal number to binary using recursion.	02	2	4
	1.2	Evaluate the expression $-/*2*5+3652$ using stack	02	3	1
	1.3	The following postfix expression with single digit operands is evaluated using a stack: $8\ 2\ 3\ \hat{}\ /\ 2\ 3\ *\ +\ 5\ 1\ *\ -$ Note that ^ is the exponentiation operator.	02	3	1
	1.4	Let the following circular queue can accommodate maximum eight elements with the following data front = 3 rear = 6 queue = __, __, X, Y, Z, W, __ What will be the value of front and rear after 'insert (P)' operation takes place?	02	2	1
	1.5	What does the function "llist" return for a given singly linked list with contents as $(1, 4, 3, 5, and\ 11)$ and with first node pointed by external pointer "head"? $struct\ node\{$ $int\ data;$ $struct\ node * next;$ $\};$ $int\ llist(struct\ node * head)$ $\{$ $if(head == NULL)$ $return\ 1;$ $return(llist(head \rightarrow next) + head \rightarrow data);$ $\}$	02	3	2
	1.6	The height of a tree is the length of the longest root-to-leaf path in it. The maximum and minimum number of nodes in a strict binary tree of height 5 are _____ and _____.	02	2	2
	1.7	A priority queue is implemented as MAX –heap. Initially, it has five elements. The level order traversal of the heap is: 20,16,14,4,7. Two elements 13 and 15 are inserted in to the heap in that order. The level order traversal of the heap after the insertion of the element is _____.	02	3	1
	1.8	Consider a hash table with 9 slots. The hash function is $h(k) = k$ mod 9. The collisions are resolved by chaining. The following 9 keys are inserted in the order: 5,28,19,15,20,33,12,17,10. The maximum and average lengths in the hash table, respectively, are _____ and _____	02	2	2

	1.9	_____ rotation is required to balance the following AVL tree. 	01	2	1
	1.10	On Creating a min heap using bottom up method for the following elements, what is the position of element 7(assume that the array index starts with 1) 84 68 23 43 1 20 −6 7 9	02	3	2
	1.11	Write an example graph to show that the number of vertices of odd degree in a graph is always even.	01	1	3
		PART-B			
2	a	Write an algorithm to convert infix expression to postfix form and convert the following infix expression to postfix form. Give the steps showing the content of stack, input array and output array. $((p + q * r - s - t/u) /(v * w))/x\$y\$z$ Note : Use the following Precedence and associativity Rules Parenthesis have highest precedence Precedence(+) = Precedence(-) Precedence(*) = Precedence(/) Precedence($) > Precedence(+,-) Precedence(+,-) > Precedence(*,/) Associativity($) is Right to Left Associativity(+,-) is Right to Left Associativity(*,/) is Left to Right	08	3	1
	b	Write a C program to do the following using stack i) Create stack with n elements. ii) Assign to a variable name Y the value of the third element from the top of the stack and keep the stack undisturbed. iii) Given an arbitrary integer n pop out the top n elements. A message should be displayed if an unusual condition is encountered. iv) Display the content of stack after each above operation	08	2	3
3	a	Write the C functions to perform insertion, deletion and display operations on circular queue. Note: Handle all exceptions while performing the operations.	06	2	5
	b	Discuss the push and pop operation of integers with necessary functions on a Singly Linked list.	05	2	5
	c	Explain with syntax example different dynamic memory allocation functions.	05	1	1
		OR			

4	a	Develop C functions to perform the following operations on a singly linked list i) Replacing all nodes which have the data 'x' by 'y'. ii) Create an ordered list. (Note : A list of n nodes such that $N_i <= N_{i+1}$ for all $1 < i < n-1$ is called an ordered list)	06	3	5
	b	Write C functions to perform the following operations on linked list with header node: i) Insert at beginning ii) Deletion at end	05	3	3
	c	Write a C function to delete alternate nodes of a Linked List.	05	3	5
5	a	Design a doubly linked list to represent sparse matrix. Each node in the list can have the row and column index of the matrix element and the value of the element. Print the complete matrix as the result.	08	3	4
	b	Define binary trees. Explain the following with an example: i) Skewed binary tree ii) Almost complete binary tree iii) Degree of a binary tree iv) Height of a node	08	2	1
		OR			
6	a	With necessary diagram explain the deletion operation in Binary Search tree.	08	2	1
	b	Write a $\boldsymbol{C}$ function to perform the following operations i) Insert a node in the middle of a Doubly Linked List. ii) Delete a node at the given position in circular Doubly linked list using only tail/end pointer.	08	3	3
7	a	Give a node structure and write iterative C solution functions to perform inorder, preorder and postorder traversal of a binary search tree.	08	2	3
	b	Design an algorithm to Generate Expression Tree from parentheses-free infix arithmetic expression and apply the same on the following input to show the stack content after processing each input character in the process. $A + B \,\%\, C \,\$\, E - F \,/\, E$	08	3	5
		OR			
8	a	Write a recursive C function to check whether the given tree is a strictly binary tree or not.	05	3	3
	b	Apply the Postorder, preorder and inorder traversal on the below tree and write the order in which the vertices are visited.  	06	3	1
	c	Write the pseudocode to build bottom-up Max-heap construction	05	3	3

9	a	Build an AVL tree with the following values: $15, 20, 24, 10, 13, 7, 30, 36, 25$	05	3	1
	b	Write a C function with node structure to perform preorder traversal of threaded binary search tree	05	3	4
	c	Construct trie for the following keys: {one, two, three, four, five, six, seven, eight}	06	3	1
		OR			
10	a	Show the steps of insertion operation on a splay tree for the following elements: $25, 20, 27, 17, 23, 26$	06	3	1
	b	Apply Quadratic probing to insert the keys $45, 5, 8, 31, 23, 16, 18, 17, 22, 11, 21, 13$ into the empty hash table of length 13, with hash function $H(K) = 3K + 3\%13$. Show the structure of the hash table and what is the probe sequence to search for the key element 21?	05	3	1
	c	For the given set of elements construct a $B+$ tree of order 3 by storing a copy on the left $R\ E\ T\ E\ S\ T\ A\ D\ D\ I\ T\ I\ O\ N\ A\ L$	05	3	1