RV Educational Institutions
RV College of Engineering
Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi
Approved by AICTE, New Delhi

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Academic year 2023-2024 (ODD Sem)

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

Date	9th Jan 2024	Maximum Marks	50
Course Code	IS233AI	Duration	90 Min
Sem	III Semester	Test-I	

DATA STRUCTURES AND APPLICATIONS
(Common to CS, IS, CD &CY)

Sl. No.		M	BT	CO
1a	Design an algorithm to convert infix expression to its prefix Trace the algorithm for the input **((A + (B – C) * D) ^ E) + F** **Note : ^ is the exponential symbol**	6	3	3
1b	Differentiate between linear and non-linear data structures.	4	1	1
2a	What is a Linear queue? Discuss the enqueue and dequeue operations of integers on it.	6	3	1
2b	Write a C function to check the parenthesis balancing using a stack **Examples :** **{ ( ) [ ] } is valid** **{ ([ ]) } is valid** **{ ([ )] } is not valid**	4	2	2
3a	Write recursive functions to perform the following i) To check whether the array elements are sorted or not (In descending order) ii) To find GCD or two numbers.	6	3	2
3b	Trace the algorithm for evaluating a postfix expression for the input. Show the stack contents at each step. **10 5 + 60 6 / * 8 -**	4	3	3
4a	Discuss the functions used to perform dynamic memory allocation along with syntax.	6	2	1

4b	Consider the following C function
	`int fun(int n,int r)`
	`{`
	`  if(n > 0)`
	`  return (n % r + fun(n/r,r);`
	`  else`
	`  return 0;`
	`}`
	What is the return value when it is called as fun(345,10)
		4	3	2

5a	Discuss the push and pop operation of integers with necessary functions on a Singly Linked list.	6	2	2
5b	Write a C function to Create an Ordered Singly linked list (**Note:** List should be created in ascending order).	4	3	3

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Academic year 2023-2024 (ODD Sem)

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

Date	22nd Feb 2024	Maximum Marks	50
Course Code	IS233AI	Duration	90 Min
Sem	III Semester	Test-II	

DATA STRUCTURES AND APPLICATIONS
(Common to CS, IS, CD &CY)

Sl. No.		M	BT	CO
1	Write C functions for a doubly linked list: a. To count the number of nodes in the list b. To insert a new node at the end of the list c. To delete the first node from the list d. To search for a key element in the list	10	3	3
2	Imagine that **N** people have decided to elect a leader by arranging themselves in a circle and eliminating every **K**th person around the circle, till one person remains, who becomes the leader. Note that the count should begin from 1st person. Given the values for N and K, write recursive/non-recursive solution using circular singly linked list data structure to determine the order in which people are eliminated from the circle and which person becomes the leader. Mention are the supplementary functions used and assumptions made. Trace the code with an example.	10	3	2
3	Define binary search tree. Construct a binary Search tree by inserting the keys **18, 4, 1, 0, 47, 65, 90, 21, 7, 12.** Traverse the constructed tree in preorder, inorder and postorder.	10	3	1
4	Write recursive C functions for a binary tree a. To visit the tree in preorder b. To find the height of the tree c. To find the total number of nodes in the tree d. To find the total number of leaf nodes in the tree	10	3	3
5	Define binary heap. With a pseudocode illustrate the heapsort strategy as an application of binary heap.	10	2	2

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Academic year 2023-2024 (Odd Sem)

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

Date	23rd March 2024	Maximum Marks	50
Course Code	IS233AI	Duration	90Min
Sem	III	Re-CIE-1	
UG/PG	UG	Faculty:SWS/GRS/CRM/SB/SDV/ARA	

DATA STRUCTURES AND APPLICATIONS
(Common to CS, IS, CD &CY)

SL No.	Test Questions	M	BT	CO
	PART A			
1.1	Paheli is using the usual algorithm to determine if a given sequence of parentheses is balanced or not. Write the maximum number of parentheses that can appear on the stack AT ANY ONE TIME when she is applying the algorithm: ({}<(<>)><([])>)	2	L3	CO1
1.2	what will be the value returned by the following function, when it is called with a value 11? *Fun(int num)* *if ((num/2) !=0)* *return (Fun(num/2) * 10 + num%2);* *else return 1;*	2	L3	CO5
1.3	Let the following circular queue can accommodate maximum seven elements with the following data :front = 3 rear = 5, queue = ___, __, X, Y, Z, ___ What will the value of front and rear pointer after 'insert (A)' operation takes place?	2	L2	CO3

1.4	The following C function takes a single-linked list of integers as a parameter and rearranges the elements of the list. The function is called with the list containing the integers 3,4,5,6,7,8,9 in the given order. What will be the contents of the list after the function completes execution?
	
	struct node {
	int value;
	struct node *next;
	};
	
	void fun (struct node *list){
	struct node *p, * q;
	int temp;
	if(!list || !list-> next) return;
	p = list; q = list->next;
	while (q)
	{ temp = p->value;
		2	L3	CO4

DSA-III

	p-> value = q ->value;
	q-> value = temp;
	p = q-> next;
	q = p ? p->next : 0;
	}
	}			

1.5	Write the equivalent calloc statement for ptr = malloc(m * n);	2	L2	CO2
1.a	List the advantages of circular queue over linear queue, explain with a neat diagram	5	L1	CO2
1.b	Differentiate between static memory allocation and Dynamic Memory Allocation (DMA). Write the syntax for malloc and realloc DMA functions in C	5	L2	CO3
2.a	Write "C' functions to perform following operations on linked list with header node i) Insert at beginning ii) Deletion at end	5	L2	CO5
2.b	Write recursive algorithm to solve Tower of Hanoi puzzle. Draw the recursive call tree for number of disc is 3 and write the moves performed.	5	L2	CO1
3a	Evaluate the following expressions. Write the steps showing the content of stack and input array and output array. abc+$de-*fg*+h* Assume : a=2 ,b=3, c=1, d =2, e=3,f=7, g=1 ,h=2	5	L3	CO4
3b	Define data structure. Write any four applications of stack and queue data structures	5	L1	CO1
4	Write an algorithm to convert infix to postfix expression and convert the following infix expression to prefix form. Give the steps showing the content of stack , input array and output array. ((x+y*c-d+e/g) /(h*i))/jkn Note : Use the following Precedence and associativity Rules Precedence(+) = Precedence(-) Precedence(*) = Precedence(/) Precedence($) > Precedence(+,-) Precedence(+,-) > Precedence(*, /) Associativity($) is Right to Left Associativity(+,-) is Right to Left Associativity(*,/) is Left to Right	10	L3	CO4
5	Give a node structure to create a singly linked list of integers and write a C functions to perform the following: i) Create a three node list with data 500,700 and 800 ii) Insert a node with the data value 600 in between the nodes having data values 500 and 700. iii) Delete the node whose data is 700 iv) Display the resultant linked list	10	L2	CO5

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

DATA STRUCTURES AND APPLICATIONS

Common to ISE/CSE/CD/CY

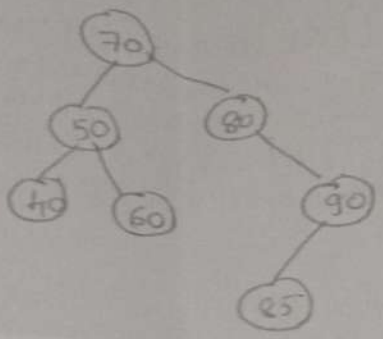
Time: 03 Hours *Maximum Marks: 100*

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

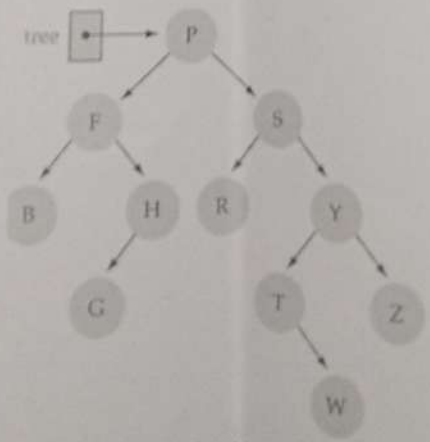
			M	BT	CO	
1	1.1	Write a C function to convert a decimal number to binary using recursion.	02	2	4	
	1.2	Evaluate the expression $-/*2*5+3652$ using stack	02	3	1	
	1.3	The following postfix expression with single digit operands is evaluated using a stack: $8\,2\,3\,\hat{}\,/\,2\,3\,*\,+\,5\,1\,*\,-$ Note 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 → next) + head → 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	05	3	3
		ii) Deletion at end	05	3	5
	c	Write a *C* function to delete alternate nodes of a Linked List.			
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 *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.  			
	c	Write the pseudocode to build bottom-up Max-heap construction	06 05	3 3	1 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 *RETESTADDITIONAL*	05	3	1