RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

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Academic year 2024-2025 (Odd Sem)

Date	21/10/2024	Maximum Marks	50+10
Course Code	IS233AI	Duration	90+30
Sem	III	CIE 1	
UG/~~PG~~	UG	Faculty: *BMS,RBS,ARA,DN,CRM,VP,KCG,SB,SMS*	

Data Structure And Applications

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

Note: - Students need to add comments to their answers wherever required.

Q. No.	Questions	M	BT	CO
1.	Implement functions to demonstrate the following operations on stack - Push, Pop and Display.	10	2	1
2.	Design a Recursive function to implement Binary Search. Explain the role of stack during its execution.	7+3	3	2
3.	Write a function to perform infix to prefix conversion. convert the given infix expression to prefix and show the contents of the stack at each step of execution to - **K+L-M*N+(O^P)*W/U/V*T+Q**	5+5	3	2
4. a	Write a recursive program to solve the Tower of Hanoi problem.	6	2	2
b	Define Recursion. How does recursion differ from iteration?	4	1	1
5. a	Write an algorithm to evaluate given postfix expression Evaluate the given postfix expression showing the contents of the stack- **3, 4, *, 2, 5, *, +**	5	3	2
b	Write a program to perform the following operations on Ordinary Queue - Enqueue and Dequeue.	5	2	1

QUIZ

Q. No.	Questions	M	BT	CO
1.	Pushing an element into a stack with five elements, when its size limit is 5, will make the stack _____.	1	1	1

2.	What is the output of the following recursion when n = 2?
	int fun(int n)
	{
	if (n == 4)
	return n;
	else return 2*fun(n+1);
	}
		1	2	2

3.	The minimum number of stacks needed to implement a queue is:--------	1	2	2
4.	If the elements "A", "B", "C" and "D" are placed in a queue and are deleted one at a time, in what order will they be removed?	1	1	1
5.	What condition makes a normal queue, implemented with an array of size MAX_SIZE, full?	1	1	1

Academic year 2024-2025 (Odd Sem)

6.	The result of evaluating the postfix expression 5, 4, 6, +, *, 4, 9, 3, /, +, * is? ----------	1	2	2
7.	Consider the following operation performed on a stack of size 5. Push(1); Pop(); Push(2); Push(3); Pop(); Push(4); Pop(); Pop(); Push(5); After the completion of all operation, the number of elements present in stack is?	1	2	2
8.	Minimum number of moves required to solve a tower of Hanoi problem with 3 disks is _____. Also provide the moves from Tower 'A' (source) to Tower 'C' (destination) making use of Tower 'B' (the temporary tower).	2	2	2

9.	Consider the following algorithm: What is output for input **"Bengaluru"**?
	
	declare a stack of characters
	while (there are more characters in the word to read)
	{
	read a character
	push the character on the stack
	}
	while (the stack is not empty)
	{
	pop a character off the stack
	write the character to the screen
	}
		1	1	1

****

Blooms Taxonomy, CO-Course Outcomes

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	CO5	L1	L2	L3	L4	L5	L6
	Test	Max Marks	23	37	-	-	-	08	27	25	-	-	-

Course Outcomes:	
CO1:	Apply the knowledge of computing to define the various data structures and its operations
CO2:	Analyse a problem and identify the suitable data structure to develop solution
CO3:	Investigate & Design solution to a given problem using modern tools and appropriate data structure
CO4:	Implement solutions for real-time applications
CO5:	Demonstrate Good Coding Practices engaging in lifelong learning

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Academic year 2024-2025 (Odd Sem)

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

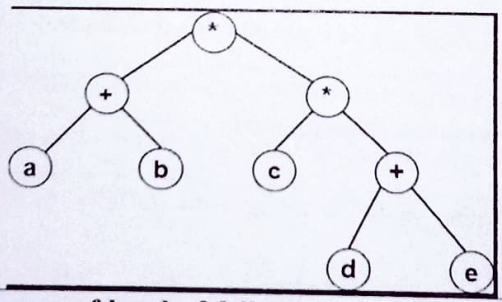
Date	02/12/2024	Maximum Marks	50+10
Course Code	IS233AI	Duration	90+30
Sem	III	CIE II	
UG/~~PG~~	UG	Faculty: *MS,RBS,ARA,DN,CRM,VP,KCG,SB,MSS*	

Data Structure And Applications
(Common to AIML/CSE/CD/CY/ISE)

Note: - Students need to add comments to their answers wherever required.

Sl. No.	QUIZ –II	M	BT	CO

1.1	**What will be the output of the following code snippet for the list 1→2→3→4→5→6?**
	
	void FUN(struct node* start)
	{
	if(start == NULL)
	return;
	printf("%d ", start->data);
	if(start->next != NULL)
	FUN(start->next->next);
	printf("%d ", start->data);
	}
		2	3	2

1.2	**Write the inorder and preorder of the following expression tree:** 	1	2	1

1.3.	**Assume that reference of head of following doubly linked list is passed to above function 1 <--> 2 <--> 3 <--> 4 <--> 5 <-->6.**
	What should be the modified linked list after the function call?
	void fun(struct node **head_ref)
	{
	struct node *temp = NULL;
	struct node *current = *head_ref;
	while (current != NULL)
	{
	temp = current->prev;
	current->prev = current->next;
	current->next = temp;
	current = current->prev;
		2	3	1

	}
	if(temp != NULL)
	*head_ref = temp->prev;
	}			

1.4.	The maximum height of a binary tree with 'n' nodes is_____.	1	1	1

1.5.	**What does the following code snippet do?**
	
	ListNode* fun(ListNode* head, int x)
	{
	ListNode* front = head;
	int count = 1;
	while(front != NULL)
	{
	printf("%d %d\n", front -> data , head -> data);
	if(count <= x) {
	front = front -> next;
	}
	else {
	head = head -> next;
	front = front -> next;
	}
	count++;
	}
	return head;
	}
		2	3	2

1.6.	**What will be the value of "sum" after the following code snippet terminates?**
	
	void solve(ListNode* root) {
	/*
	The LinkedList is defined as:
	root-> val = value of the node
	root-> next = address of next element from the node
	The List is 1 -> 2 -> 3 -> 4 -> 5
	*/
	int sum = 0;
	while (root != NULL)
	{
	sum += root -> val;
	root = root -> next;
	}
	printf("%d\n",sum);
	}
		2	3	2

	CIE-II			
1a.	With example explain the difference between single linked double linked list and circular linked list.	6	1	1
1b.	Differentiate between arrays and dynamic memeory allocation.	4	1	1

2a.	You are given two non-empty linked lists, each representing a non-negative integer. The digits of the integers are stored in reverse order, with each node containing a single digit. Write a program to add the two numbers and return the result as a linked list. Input :(2→4→5) + (5→7→2) Output: (7→1→8)	10	3	4,5
3a.	Construct the BT from the following data: **Postorder: A C E D B H I G F** **Inorder: A B C D EF G H I**	6	3	1
3b.	Construct the expression tree for the Postfix expression **2 3*2 1-/5 4 1-*+**	4	2	1
4a.	Write a program to search a node with value '***K***' in a single linked list, if it is not found then insert value as a last node	6	3	5
4b.	With example explain: i) Degree ii) Complete binary Tree iii)Height of a tree iv)Depth of Tree	4	1	1
5a.	Write a program to delete a node in double linked list at the specified position	6	3	5
5b.	Write a code snippet to display the contents of circular queue	4	2	3

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	CO5	L1	L2	L3	L4	L5	L6
	Test	Max Marks	28	6	4	10	12	15	9	36	--	-	-

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Apply the knowledge of computing to define the various data structures and its operations
CO 2	Analyse a problem and identify the suitable data structure to develop solution
CO 3	Investigate &Design solution to a given problem using modern tools and appropriate data structure
CO 4	Implement solutions for real-time applications.
CO 5	Demonstrate Good Coding Practices engaging in lifelong learning

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Academic year 2024-2025 (Odd Sem)

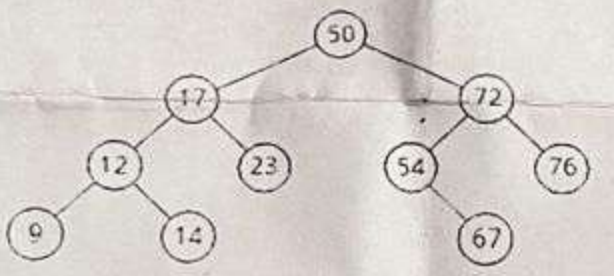
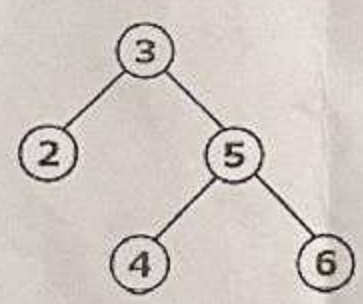
DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Date	07 Jan 2025	Maximum Marks	50+10
Course Code	IS233AI	Duration	90+30
Sem	III	CIE III	
UG	UG	Faculty: BMS,RBS,ARA,DN,CRM,VP,KCG,SB,SMS	

Data Structure and Applications
(Common to CSE/CD/CY/ISE)

Note: - Students need to add comments to their answers wherever required.

S.No	Part A	M	BT	CO
1.1	Construct a B+ tree of order 3 for the numbers (7, 2, 9, 11, 15, 5, 37).	02	1	2
1.2	Assume only preorder traversal of a BST is given and you are asked to reconstruct the tree. Is it possible to build BST? Justify.	02	2	3
1.3	Construct a Trie for: [out, one, me, my, men, mud, mug, wine, wife, wifi]	02	3	1
1.4	The hash function $h(x) = (5x^2 - 8)\ mod\ 12$ is used to store the keys $[10, 11, 15]$. Calculate the index for each key.	02	3	1
1.5	Construct the graph from the following matrix. $\begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix}$	01	1	2
1.6	Construct the graph from the following adjacency list. 1→ 2→ 3→ 5 2→ 1→ 3→ 1→ 4→ 5 4→ 3→ 5→ 1→ 3	01	1	2
	Part B			
1.a	An expression tree is already constructed but you need to obtain prefix, infix and postfix expressions. Write the suitable functions.	05	2	5
1.b	Construct the BST for the numbers (45, 32, 57, 37, 52, 67, 28, 30, 39, 63, 55). Apply tree sort.	05	3	2
2.a	Define heap and mention the properties. Write the pseudocode for the bottom-up heap construction.	05	3	5

2.b	Construct the min-heap for the instance (35, 67, 12, 89, 102, 42, 5, 19, 10). How can you leverage heap for sorting?	05	3	2
3.a	Define the following w.r.t graphs and give suitable examples. i. Euler graph ii. Complete graph iii. Degree of vertex iv. Disconnected graph.	05	2	4
3.b	Mention the types of rotations in AVL tree. Apply it suitably while constructing the tree for the instance (15, 9, 12, 19, 8, 17, 4). Show tree in each step with balance factor attached to nodes.	05	3	2
4.a	State the benefits of threaded binary tree as compared to regular binary tree. Mention the types.	04	2	4
4.b	Construct the single-threaded (right-in) and double-threaded binary tree for the tree shown in Fig 4b.  Fig 4b	06	3	3
5.a	What are splay trees? List the types of rotation. Perform $splay(4)$ on the tree shown in Fig 5a.  Fig 5a	04	3	3
5.b	Mention the properties of hash function. Given two hash functions, h_1 and h_2 defined by $h_1(x) = (3x + 11) mod\ 17$ and $h_2(x) = 5x\ mod\ 29$, identify which is better w.r.t collision resistance. Being cyber-forensic expert, original hard drive and image is handed over to you. How do you take decision and generate the report?	06	4	4

USN | 1 | R | V | 2 | 3 | C | D | 0 | 0 | 3 |

RV COLLEGE OF ENGINEERING®

(An Autonomous Institution Affiliated to VTU)

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

DATA STRUCTURES AND APPLICATIONS

Common to IS / CS / 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	List any four applications of the Queue data structure.	02	1	1
	1.2	Naveen got the postfix expression 5 3 + 6 2 / * 3 5 * + to evaluate. Help him with the answer.	02	2	2
	1.3	List the differences between Linear and Non-Linear data structures.	02	1	1

	1.4	Predict the output of the following C code?
		`#include < stdio.h >`
		`void foo(int *);`
		`void main()`
		`{`
		`int i = 10;`
		`foo((&i) + +);`
		`}`
		`void foo(int * p)`
		`{`
		`printf("%d\n",* p);`
		`}`
			02	2	2

	1.5	Write the postfix and prefix forms of the given expression. $A + B * (C - D)/(P - R)$.	02	2	1
	1.6	List any 4 differences between a Singly-linked list and Doubly linked list.	02	1	4
	1.7	A hash function h defined $h(key) = key \ mod \ 10$, with linear probing, is used to insert the keys 43, 135, 72, 23, 99, 19, 82 into a table indexed from 0 *to* 9. What will be the location (index) of key 82?	02	1	3
	1.8	Given In-order: 3, 12, 6, 4, 7, 10, 11, 5, 2, 8. Construct a binary search Tree.	02	1	2

	1.9	Predict the output of the following C code?
		`#include < stdio.h >`
		`#include < stdlib.h >`
		`void main()`
		`{`
		`char * p = calloc(100,1);`
		`p = "welcome";`
		`printf("%s\n",p);`
		`}`
			02	2	4

	1.10	Describe a balance factor in AVL trees?	02	1	5

PART-B

2	a	Write the recursive call tree to explain the recursion to solve Tower of Hanoi problem (number of disc= 3).	08	1	1
	b	Programmers might prefer to store the data in continuous memory locations to improve the efficiency of the program. Identify, define, and write the syntax and the instantiation of the data structure that can be used. Using the same, write a program to find the second largest and second smallest element of 'n' integer elements.	08	2	3
3	a	Write a C function for inserting and deleting an element in a sequential Stack.	08	1	2
	b	Develop a program to read a sparse matrix of integer values in the $2D$ array format convert the sparse matrix to <row, column, value> format, and search for an element specified by the user. Print the result of the search appropriately.	08	3	1
		OR			
4	a	Explain how the Stack and Queue can be used to check whether a string is palindrome or not. Also, write a program that does the same.	08	2	2
	b	Illustrate the Circular Singly Linked List. Develop a program to implement the following operation of Circular Singly Linked List i) addLast() ii) addAfterKey()	08	2	3
5	a	Write a program to implement Queue data structure using linked list.	08	1	3
	b	Write a program to implement the addition of two polynomials using linked list.	08	1	4
		OR			
6	a	Write a function to insert an element in to binary search tree.	10	1	5
	b	Construct a binary search tree for the sequence of numbers **12, 15, 5, 9, 1, 3, 20, 17, 19, 2, 4, 16.**	06	2	1
7	a	Consider the Railway passengers database. Build a Program to sort passengers' IDs using Heap Sort.	10	2	1
	b	Illustrate the following: (i) Binary Tree (ii) Binary Search Tree (iii) Complete Binary Tree with examples.	06	2	4
		OR			
8	a	Write a function to print the number of leaves in a binary tree.	08	1	4
	b	Write a program to Implement Threaded Binary Tree.	08	1	5
9	a	Construct the hash table for the keys: $58, 21, 93, 17, 88, 30$ that are inserted one after the other into the empty hash table of length 7 using linear probing with hash function $(h(key) = key2\ \%7)$.	08	2	2
	b	Write a program to count leaf nodes in a binary tree.	08	1	1
		OR			
10	a	The keys $10, 6, 12, 4, 25, 6, 18, 20, 8$ are inserted into the empty hash table of length 10 using linear probing with hash function $H(i) = i\ mod\ 10$. What is the resultant hash table and find the maximum probe value?	08	2	4
	b	Explain the following collision resolution techniques with an example. (i) Linear Probing (ii) Double Hashing.	08	2	2