

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

B.E (Bachelor of Engineering)

Semester End /Backlog Examination, January/February-2024

Department: CSE

Semester: 3rd

Course Title: Data Structures and Applications

Course Code: 22UCSC300

Duration : 3 Hours

Max. Marks: 100

Note: Answer any one full question from each unit

Unit - I

Q1

- Write a c function `int is_palindrome(char str[])` to check whether given string is a palindrome or not using stacks. 4 Marks
- Evaluate the given postfix expression using stack: $3\ 4\ +\ 1\ *\ 7\ 5\ -\ 6\ 2\ +\ *\ -$. Also represent how evaluation is done using stack representation. 6 Marks
- Write C functions for the following operations of stack.

i. Push()	ii. Pop()
iii. Peek()	iv. Display()

4*2.5=10Marks

OR

Q2

- Define Stack. List the different applications of stack. 2+2=4 Marks
- The Greatest Common Divisor of two integers x and y is defined as follows,

$\text{gcd}(x,y) = y$	if $(y \leq x \ \&\& \ x \% y = 0)$
$\text{gcd}(x,y) = \text{gcd}(y,x)$	if $(x < y)$
$\text{gcd}(x,y) = \text{gcd}(y, x \% y)$	otherwise

Write a recursive C function to compute gcd (x, y). Also find for how many times the recursive function is called for the values of gcd (20,75). 6 Marks
- Convert the following given infix expressions to postfix expressions respectively.
 - $A\ \$\ B\ * \ C - D + E / F / (G + H)$
 - $((A + B) * C - (D - E)) \$ (F + G)$

Also write a c function `char conversion_infix_to_postfix(struct stack *s, char infix[])`, to convert infix expression to postfix expression. 4+6=10 Marks

Unit - II

Q3

- Compare and contrast between Stacks and Queues of linear data structure. 4 Marks
- Discuss the limitations of linear queues. Write an algorithm, how the insertion of elements and deletion are done in circular queues. 6 Marks

- c Write a C routines for the implementation of a Descending Priority Queue with following given operations:
- pqinsert ()
 - pqmaxdelete ()
 - pqempty ()

10 Marks

OR

Q4

- a Discuss the advantages of circular queues over linear queues. Explain the different scenarios of priority queues.

2+2=4 Marks

- b Implement a queue of integers using an array q[10], where q[0] is used to indicate the front of the queue, q[1] is used to indicate its rear and q[2] through q[9] are used to contain queue elements. Also, show how to initialize such an array to represent empty queue and write routines dequeue() and enqueue() operations for such an implementation.

6 Marks

- c Explain with the pseudocode to implement queue operations using Output Restricted Deque (double ended queue) works.
Insertqfront (), insertqqrear (), remvleft (), display()

2.5*4=10
Marks

Unit - III

Q5

- a Mention the different uses of header nodes in linked lists.
- b Write a C function **NODE Insert_pos_dll ()** to insert an element before the specified key element of the list using doubly linked list.
- c Write necessary C functions needed to simulate stack operations using singly linked list.

4 Marks

6 Marks

10 Marks

OR

Q6

- a Compare and contrast between;
- i. Arrays and linked list
 - ii. Circular linked list and Doubly linked list
- b Write a C functions to implement the following operations using doubly linked list:
- i. Insert an element from the front of the list.
 - ii. Delete an element from the front of the list.

4 Marks

3*2=6 Marks

- c Write a c function **search(l,x)** that accepts a pointer 'l' to a list of integers and an integer x and returns a pointer to a node containing x, if it exists and the null pointer otherwise. Write another function **srchinsrt(l, x)**, that adds 'x' to 'l' if it is not found and returns a pointer to a node containing 'x'.

10 Marks

Unit – IV

Q7

- a Define the following with examples each.
- Complete Binary tree
 - Strictly binary tree
- b Write a C function **BST_search(struct node *, int)** to search an element in binary search tree.
- c Construct a binary expression tree for the given postfix expression. Write the steps involved in constructing the binary expression tree using stack representation.

4 Marks

6 Marks

$$a\ b +\ c\ d * e / -\ f\ g / h * +$$

Also write the preorder traversal of the constructed expression tree and evaluate with a=3,b=9,c=8,d=2,e=7,f=4,g=6,h=1

10 Marks

OR

Q8

- a Discuss with an example how array representation and linked list representations are carried out in binary trees.
- b Illustrate and discuss all the cases of deleting an element from the Binary Search Tree for the constructed BST given in the question 8c.
- c Construct a Binary Search Tree for the following elements.

4 Marks

6 Marks

65,45,80,30,49,75,100,20,38,49,69,78,85,110

Also write the Inorder traversal and Preorder traversal for the constructed binary tree. Write the recursive call function **Inorder(struct node *)** for the inorder traversal and **Preorder(struct node *)** for the preorder traversal of a tree.

10 Marks

Unit - V

Q9

- a Define AVL tree. Discuss the different rotations of AVL tree. Also construct an AVL tree for the following data given.

63, 9, 19, 27, 18, 108, 99, 81

10 Marks

- b Construct 2-3 tree of the order $m = 3$ for the elements given below.

55, 30, 15, 75, 65, 45, 5

10 Marks

OR

Q10

- a Define B-tree. Write the properties of B-trees. Construct 2-3-4 tree of the order $m = 4$ for the elements given below.

10 Marks

3, 7, 4, 9, 10, 0, 5, 6, 8, 2, 1

- b Construct BST for the given set of data and check whether it is height balanced tree (AVL) or not. If not convert and reconstruct the balanced AVL tree.

10 Marks

20, 11, 5, 32, 40, 2, 4, 27, 23

Q. No.	1a	1b	1c	3a	3b	3c	5a	5b	5c	7a	7b	7c	9a	9b
CO	1	1	1	2	2	2	3	3	3	4	4	4	5	5
Q. No.	2a	2b	2c	4a	4b	4c	6a	6b	6c	8a	8b	8c	10a	10b
CO	1	1	1	2	2	2	3	3	3	4	4	4	5	5