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Question Paper Code: R3802S

B.E./B.Tech. DEGREE EXAMINATION, NOV 2025

Third Semester

Information Technology

R21UIT302 – DATA STRUCTURES

(Common to CSE, CSD, AI&DS, AIML, CYBER and IOT Engineering Branches)

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Illustrate, how a node can be inserted to the beginning of a singly linked list? CO1-U
2. Develop an algorithm and construct the coding for deleting a node in the singly linked list where the position to be deleted is given. CO2-App
3. Write the routine to insert an element onto a queue. CO2-App
4. Consider the following sequence of operations on an empty stack. CO2-App
Push(54);push(52);pop();push(55);push(62);s=pop();
Consider the following sequence of operations on an empty queue.
enqueue(21);enqueue(24);dequeue();enqueue(28);enqueue(32);q=dequeue();
The value of s+q is _____.
5. Construct a binary search tree for the given elements 16, 7, 18, 30, 11, 17 and find the in-order tree traversal. CO2-App
6. How many nodes will a complete binary tree with 27 nodes have in the last level? What will be the height of the tree? CO2-App
7. Apply Depth First Search starting from vertex 1 on the graph with edges: 1-2, 1-3, 2-4, 3-4. List the order of visited vertices. CO2-App
8. Suppose you have a directed graph representing all the flights that an airline flies. What algorithm might be used to find the best sequence of connections from one city to another? CO3-Ana
9. Which sorting algorithm is best if the list is already sorted? Justify your Answer. CO3-Ana

10. Analyze the space complexity of merge sort and why it requires additional CO3-Ana memory compared to insertion sort.

PART – B (5 x 16= 80 Marks)

11. (a) You are working on a train reservation application. Design a CO2 – (16)
singly linked list to manage passenger bookings. Implement App
functions to:
1. Add a new passenger to the reservation list.
2. Remove a passenger's booking by their booking ID.
3. Display all the passengers in a specific coach.
Count the total number of passengers on the train.
Or
- (b) Construct an algorithm and develop the coding for Doubly linked CO2 – (16)
list for the following operations: a) Creation of a list b) Insertion App
of a node c) Deletion of a node c) Display the inserted data d) Find
the length of the data and also explain the performance of the
operation with neat diagrammatic representation.
12. (a) A circular Queue has a size of 5 and has 3 elements 10, 20 and 40 CO2- App (16)
where $F=2$ and $R=4$. After inserting 50 and 60, what is the value of
 F and R . Trying to insert 30 at this stage what happens? Delete 2
elements from the queue and insert 70, 80, 90. Assess the sequence
of steps with necessary diagrams with the value of F .
Or
- (b) Develop an algorithm and illustrate the various operations that can CO2- App (16)
be performed on a Queue ADT using linked list.
13. (a) Construct an AVL tree with detailed rotation, check balance factor CO2- App (16)
for each node insertion and also write the Routine for all the
rotations: 150, 155, 160, 115, 110, 140, 120, 145, 130, 147, 170,
180.
Or
- (b) Write a routine to insert the following keys into an empty B-tree of CO2- App (16)
order 4. Show the structure of the B-tree after each insertion. 5, 3,
21, 9, 13, 22, 7, 10, 11, 14, 8, 16.
14. (a) Explain the Kruskal's algorithm for computing the minimal CO1-U (16)
spanning tree weighted undirected graph with example.
Or
- (b) Explain about Graph and their terminologies in detail with neat CO1-U (16)
diagrammatical representation.

15. (a) Write a C program to perform binary search for the number 40 in the sorted array: 18, 21, 23, 34, 42, 67, 75, 78, 90. Show each comparison and final result indicating if 40 is found or not. CO2- App (16)

Or

- (b) Given the input {4371, 1323, 6173, 4199, 4344, 9679, 1989} and a hash function of $h(X) = X \pmod{10}$ show the resulting (i) Separate Chaining hash table (ii) Open Addressing hash table using linear probing (iii) Open Addressing hash table using quadratic probing (iv) Open addressing hash table with second hash function $h_2(X) = 7 - (X \pmod{7})$. CO2- App (16)

