Nirma University

Institute Of Techology

B. Tech in Computer Science and Engineering, Semester-III

2CS301 Data Structures

Roll/Exam no. :-_____ Supervisor's initial: _____

Time: 3 Hours Max. Marks: 270

Answer the following easy questions:- (Each 5 marks)

1. Describe the LIFO property of a stack.
2. Explain the concept of a circular queue.
3. What is a balanced tree?
4. Define a spanning tree in a graph.
5. What is a node's height in a binary tree?
6. What is the difference between a tree and a graph?

Answer the following medium questions:- (Each 8 marks)

7. Describe the concept of a self-balancing binary search tree and its importance in maintaining balance.
8. Explain the concept of a splay tree and its applications in data structures.
9. Explain how a linked list can be reversed using iterative and recursive methods.
10. Describe the purpose of a linked list node and its role in various data structures.
11. How can you implement a queue using two stacks, and why would you do so?
12. Describe the use of binary search trees in dictionary implementations.
13. What is the difference between an array and a linked list, and when would you choose one over the other?
14. How does a breadth-first search algorithm work in traversing a graph?
15. How do you efficiently find the lowest common ancestor of two nodes in a binary tree?
16. What is a red-black tree, and how does it maintain balance in a binary search tree?

Answer the following hard questions:- (Each 10 marks)

17. How does a depth-first search algorithm work in finding connected components in a graph?
18. What is the importance of a red-black tree in maintaining balanced data?
19. State applications of minimum spanning tree (MST)?
20. Write an algorithm to find that given tree is BST or not?

21. Justify the need of hashing. Discuss any two techniques with a proper example?
22. What is the time complexity of the most efficient algorithm for finding the shortest path in a graph?
23. Write an algorithm to perform to insertion and deletion middle of linked list?
24. Describe the concept of a B-tree and its use in database systems.
25. Describe the use of stacks in expression evaluation.
26. Write an algorithm to solve the Tower to Hanoi problem?
27. Convert the following Postfix expression to the Prefix expression using stack?
28. What is Binary Search Tree (BST)? Construct a BST by inserting the following elements in given order. Show all the intermediate steps. {5, 9, 1, 10, 15, 12, 2, 6, 20, 4, 14, 24}.
29. Write a recursive algorithm for binary search technique to search an element in a given sorted list. Also show the tracing of your algorithm to search an element 9 in the following data. {3, 5, 9,12, 17, 23, 36, 53, 65, 78}.
30. Write a algorithm for a Binary Search and discuss it time and space complexity?
31. Consider a 3-dimensional array A[2:8, -3:6, 5:10]. The base address of the array is 1000 and the memory required by each element is 2 bytes. Find the address of A[3, 1, 61] using row major representation.Show all the intermediate steps.
32. Explain the concept of a linked list’s applications in managing large datasets.