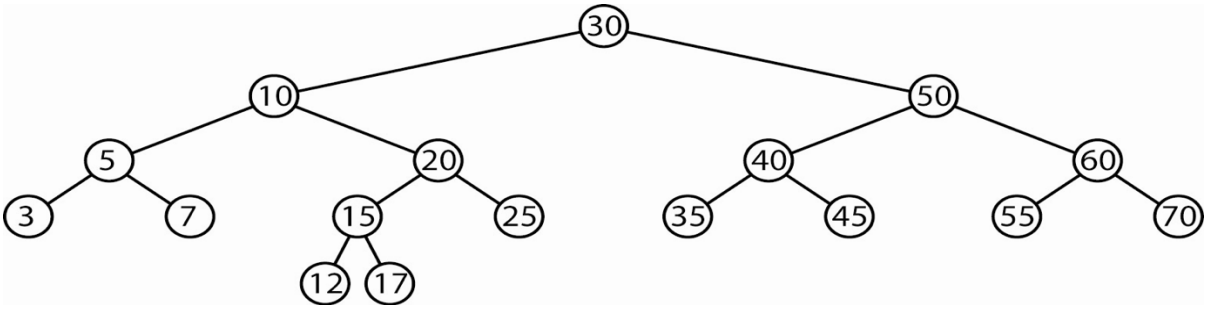
Data Structure and Algorithm

Tutorial (All Chapter)

Semester: III **Program**: BESE(D) **Deadline**: 2080 Falgun 15

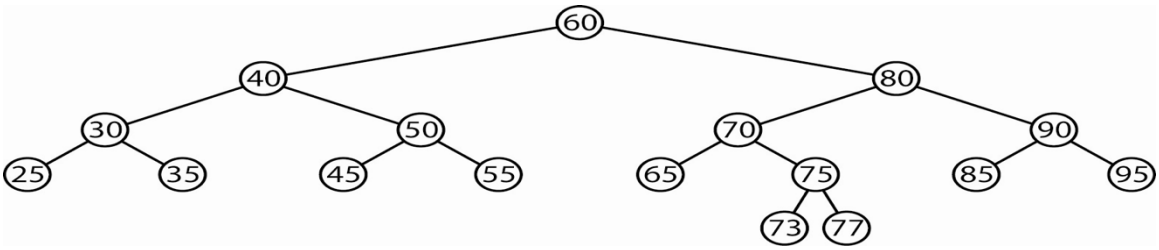
1. What is data structure? Compare and contrast between primitive and non-primitive data structure. Classify different data structures as linear and non-linear on the basis of logical organization and memory organization.
2. Explain the concept of algorithm analysis, focusing on the Best, Worst, and Average Case Analysis. Describe how these analyses help in understanding the behavior and performance of algorithms. Provide examples to illustrate the difference between best, worst, and average-case scenarios for algorithms.
3. Justify the statement "Data Structure is the backbone of software programming". How can we represent a polynomial using array? Explain with pros and cons. Explain polynomial as an ADT.
4. Explain the basic operations of stack. Write an algorithm for insertion and deletion of an element in a stack using array. Also mention the condition for overflow and underflow.
5. Define infix and postfix expression. In an application, the client request you to process their data in a particular format. The format states that the in the data count of 1000, first data entered in the application is the first that comes out if the application. Write down the insert and delete mechanism for manipulation of data.
6. Convert the given expression into postfix expression showing the content of stack at each step: (A + B) * (C $ D) – E / F
7. Write the algorithm to convert the infix expression to postfix expression using stack implementation. Evaluate the following expression: A B C /- D E * F -* (Where A = 6, B = 5, C = 2, D = 3, E = 4 and F = 1)
8. Explain the application area of queue. What will happened if front is equal to rear in linear queue? Demonstrate the concept of enqueue, dequeue and traverse operation with suitable example and supporting algorithm.
9. What is a benefit of circular queue when compared to linear queue? Write enqueue , dequeue and traverse algorithm of circular queue.
10. What is double ended queue? Explain different types of deque? What are the operations that we can perform in those types of deque?
11. Compare contiguous list with linked list. Can you implement stack using linked list? Illustrate.
12. Explain the advantages of doubly linked list over singly linked list? Write an algorithm to insert a node of the linked list (all possible cases).
13. What are benefits of using dynamic list over static list? Write an algorithm to insert an item at the specified position of a static list.
14. Differentiate between singly circular linked list and singly linked list. Implement queue using Linked list.
15. What is doubly linked list (DLL)? How does it differ from circular linked list (CLL). Explain with appropriate example.
16. How polynomial can be represented using linked list? Illustrate with example. Write an algorithm to insert a node in doubly linked list(all possible cases).
17. What are the advantages and disadvantages of Linked list? Write an algorithm to delete a node from singly linked list(all possible cases).
18. Write an algorithm to delete a node from doubly linked list(all possible cases).
19. Differentiate SCLL and DCLL. Write all insert and delete algorithm(all possible cases) in SCLL and DCLL.

20. Generate the Huffman code for the symbol A, B, C, D, E, F with the probability of occurrence are 0.2, 0.28, 0.2, 0.16, 0.12, 0.04 respectively.
21. Create the B tree of order 5 from the following set of data. 10, 20, 50, 60, 40, 80, 100, 70, 130, 90, 30, 120, 140, 25, 35, 160, 180.
22. Create a binary search tree from the following sequence of character. Also perform the balancing algorithm. B I N A R Y S E A R C H T R E E A L G O
23. Show the AVL tree that results when 11 is inserted.



Using the tree that results from above problem, show the AVL tree that results when 27 is inserted.

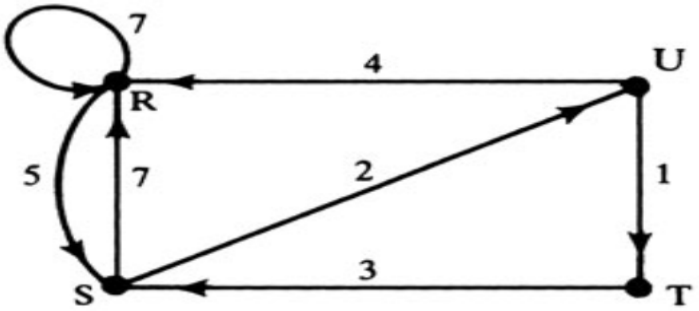
24. Show the AVL tree that results when 72 is inserted.



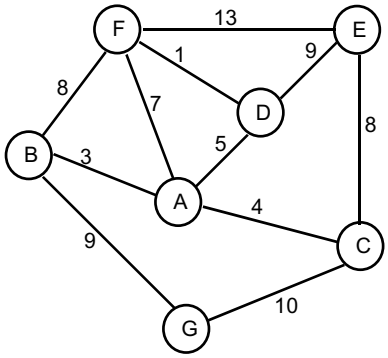
Using the tree that results from above problem, show the AVL tree that results when 78 is inserted.

25. Perform insertion sort from the following set of data. 40, 50, 12, 30, 90, 18, 06, 60.
26. How the shell sort is perform on following set of data. Take span 4, 2 and 1.
    45, 36, 75, 20, 05, 90, 80, 65, 30, 50, 10, 75, 85.
27. What is balance factor in AVL tree? Construct an AVL tree from following sequence of number inserted in an order of empty binary tree.3,5,11,8,4,1,12,7,2,6,10.
28. What is binary search tree? Construct the binary search tree from following pre-order traversal of binary search tree.
    In-order : F D B A C E J H G I K L.
29. Use the quicksort algorithm to sort 36, 15, 40, 1, 60, 20, 55, 25, 50, and 20 is a stable sorting algorithm? Also explain the partition algorithm.
30. What is binary heap? Sort 13, 25, 17, 22, 5, 8,3 using max heap. Also write the sorting algorithms.
31. What is bucket sort? Perform radix sort from the following sequence of unordered list.
    102, 1012, 985, 768, 56, 1233, 568, 670, 490, 1246
32. Trace the merge sort algorithm for following sequence of number. 5,99,25,42,9,56,27,35. Also show the recursive tree of merge sort taking reference of above sequence.
33. Define the terms hashing, load factor, hash function and collision. Given input {1,16,49,25, 64,0,81,4,9} and a hash function h (x) = x mod 10. Show the resulting:
    i. Hash Table using linear and quadratic probing.
    ii. Hash table using chaining.
    iii. Hash table using double hashing (define your own double hash function)

34. Draw the binary search tree whose elements are inserted in the following order. 50, 72, 96, 94, 107, 26, 12, 11, 9, 2, 10, 25, 51, 16, 17, 95. Show how the tree would look after the deletion of 26, 50, 16, and 10 respectively. Explain each steps of deletion.
35. The key of each node in a binary search tree is a short character string. Show AVL tree after the following words were inserted (in the order indicated):
Monkey, canary, donkey, deer, zebra, yak, walrus, vulture, penguin, quail.
36. What are the basic difference between dijkstra's algorithm and Floyd warshall algorithm? Perform warshall algorithm for following graph.



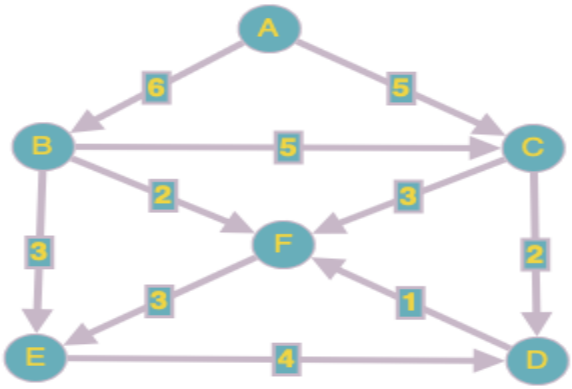
37. What is minimum spanning tree? Find minimum spanning tree for the given graph using Kruskal's and prim's algorithm.



38. Draw the graphs using following representations.

a) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ b) $\begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$ c) $\begin{bmatrix} 0 & 1 & 3 & 0 & 4 \\ 1 & 2 & 1 & 3 & 0 \\ 3 & 1 & 1 & 0 & 1 \\ 0 & 3 & 0 & 0 & 2 \\ 4 & 0 & 1 & 2 & 3 \end{bmatrix}$

39. What is the difference between traversing in a graph and traversing in a tree? Perform dijkstra's algorithm and find the shortest path from vertex A to any other vertex from following graph.



40. Differentiate graph vs tree. What is topological sorting? Perform topological sort from below graph.