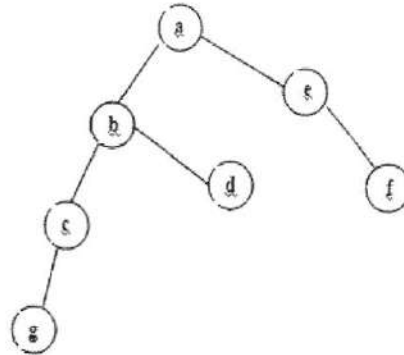


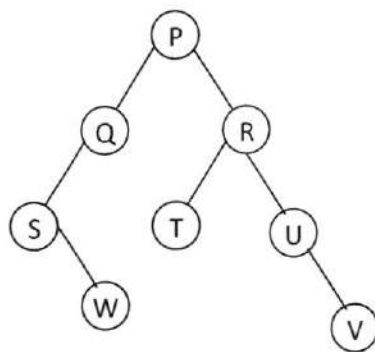


7. In the balanced binary tree in fig. given below, how many nodes will become unbalanced when a node is inserted as a child of the node 'g'?



- 1                       3                       7                       8
8. If you push the values 1, 2, and 3 in that order onto a stack, and then pop three times, in what order will the values be popped?  
 1, 2, 3                       3, 2, 1                       2, 3, 1                       3, 1, 2
9. Which searching algorithm is best for finding an element in a sorted array that is very large and spread across a uniform distribution?  
 Linear Search     Binary Search  
 Interpolation Search     Exponential Search
10. What is the meaning of load factor in a hash table?  
 The ratio of the number of elements to the number of slots  
 The ratio of the number of collisions to the number of slots  
 The size of each slot in the hash table  
 The ratio of keys to values in the table
11. The formula :  $\text{left\_subtree (keys)} \leq \text{node (key)} \leq \text{right\_subtree (keys)}$  is of \_\_\_\_\_.  
 Binary Tree     Complete Binary Tree  
 Binary Search Tree     Almost completely binary tree
12. What is the time complexity of searching for an element in a hash table with a good hash function and low load factor?  
  $O(n)$                         $O(\log n)$                         $O(n \log n)$                         $O(1)$
13. Which of the following traversal methods uses recursion and visits nodes in the order: left child, root, right child?  
 Preorder Traversal     Postorder Traversal  
 Inorder Traversal     Level Order Traversal
14. In a complete binary tree, how are nodes filled?  
 Only the root node is filled  
 All levels are fully filled  
 All levels except possibly the last are fully filled, and the last level is filled from left to right  
 The tree is filled from right to left

15. What is the time complexity of searching an element in a balanced Binary Search Tree (BST)?  
  $O(n)$                         $O(\log n)$                         $O(n \log n)$                         $O(1)$
16. For a linear search in an array of  $n$  elements the time complexity for best, worst and average case are \_\_\_\_\_ and \_\_\_\_\_ respectively.  
  $O(n)$ ,  $O(1)$  and  $O(n/2)$                         $O(1)$ ,  $O(n)$  and  $O(n/2)$   
  $O/1$  and  $O(n)$  and  $O(n)$                         $O(1)$ ,  $O(n)$  and  $O(n-1)/2$
17. What is the time complexity of Depth First Search (DFS) on a graph with  $V$  vertices and  $E$  edges?  
  $O(V + E)$                         $O(V * E)$                         $O(V^2)$                         $O(E^2)$
18. What is the main advantage of using insertion sort on small or nearly sorted arrays?  
 It has the lowest time complexity of all algorithms  
 It requires less space than other algorithms  
 It can sort in  $O(n)$  time for nearly sorted arrays  
 It works well with large, unsorted datasets.
19. The initial configuration of a queue is a, b, c, d ('a' is in the front end). To get the configuration d, c, b, a one needs a minimum of  
 2 deletions and 3 insertions                       3 deletions and 2 insertions  
 3 deletions and 3 insertions                       3 deletions and 4 insertions
20. Provide the breath first traversal for the following tree in fig.



- PQSWRTUV  
 WSQTVURP  
 PQRSTUWV  
 SWQPTRUV



KATHMANDU UNIVERSITY  
End Semester Examination [C]  
December, 2024

Level : B.E.  
Year : II  
Time : 2 hrs. 30mins.

Course : COMP 202  
Semester : I  
F. M. : 40

22 DEC 2024

SECTION "B"

[6Q. × 4 = 24 marks]

*Attempt ANY SIX questions.*

1. Describe the process of insertion and deletion in a Binary Search Tree. How do these operations affect the tree structure?
2. Here is an array of ten integers: 6 3 8 9 2 7 0 3 6 5  
Suppose we partition this array using quick sort's partition function and using 5 for the pivot.  
Draw the resulting array after the partition finishes.
3. Compare the efficiency of Prim's algorithm when implemented using an adjacency matrix versus an adjacency list. Under what circumstances would one be preferred over the other?
4. Discuss the time complexity of the various operations (enqueue, dequeue, front, isEmpty) in a queue implemented using an array and a linked list.
5. How would you implement a stack or queue using a linked list? Discuss the steps and operations for each case.
6. Explain the structure of a Binary Search Tree (BST). Describe the in-order, pre-order, and post-order traversal methods for a BST.
7. Define hashing. The table size is 10 (0.....9), hash function:  $h(x) = x \text{ mod } 10$ , Insert keys 21, 32, 3, 14, 22, 27, 8.

SECTION "C"

[2Q. × 8 = 16 marks]

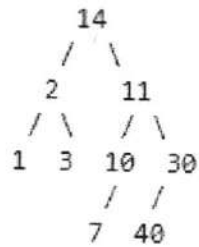
*Attempt ANY TWO questions.*

8. Explain how sorting algorithms play a vital role in optimizing search operations, particularly in databases and information retrieval systems. Discuss the impact of using efficient sorting algorithms on search operations, and explain the relationship between sorting and searching algorithms, especially binary search. Provide examples of real-world applications where sorted data improves search efficiency.
9. Define a Minimum Spanning Tree and explain its importance in fields such as network design and optimization. Describe the steps of Prim's and Kruskal's algorithms, compare their time complexities, and discuss the conditions under which each algorithm is desirable. Comprise examples of practical applications, such as designing efficient communication networks and clustering data.

**P.T.O.**

10.

- a. Draw a complete binary tree with exactly six nodes. Put a different value in each node. Then draw an array with six components and show where each of the six node values would be placed in the array (using the usual array representation of a complete binary tree).
- b. Here is a binary tree:



Write the order of the nodes visited in:

- i. An in-order traversal:
- ii. A pre-order traversal:
- iii. A post-order traversal: