

1. Which of the following sorting techniques is most efficient if the range of input data is not significantly greater than a number of elements to be sorted?

- a) Selection sort      b) bubble sort      c) counting sort      d) insertion sort

2. How many sub arrays does the quick sort algorithm divide the entire array into?

- a) one      b) two      c) three      d) four

3. Which is the worst method of choosing a pivot element?

- a) first element as pivot      b) last element as pivot  
c) median-of-three partitioning      d) random element as pivot

4. Apply Quick sort on a given sequence 7 11 14 6 9 4 3 12. What is the sequence after first phase, pivot is first element?

- a) 6 4 3 7 11 9 14 12      b) 6 3 4 7 9 14 11 12  
c) 7 6 14 11 9 4 3 12      d) 7 6 4 3 9 14 11 12

5. Find the pivot element from the given input using median-of-three partitioning method.

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

- a) 8      b) 7      c) 9      d) 6

6. Which of the following is incorrect with respect to binary trees?

- a) Let T be a binary tree. For every  $k \geq 0$ , there are no more than  $2^k$  nodes in level k  
b) Let T be a binary tree with h levels. Then T has no more than  $2^h - 1$  nodes  
c) Let T be a binary tree with N nodes. Then the number of levels is at least  $\text{ceil}(\log(n + 1))$   
d) Let T be a binary tree with N nodes. Then the number of levels is at least  $\text{floor}(\log(n + 1))$

7. Which of the following is false about a binary search tree?

- a) The left child is always lesser than its parent  
b) The right child is always greater than its parent  
c) The left and right sub-trees should also be binary search trees  
d) In order sequence gives decreasing order of elements

8.....is the process of arranging the elements of a particular data structure in some logical order.

- a. Merging      b. Insertion      c. traversing      d. Sorting

9. In which traversal root node is visited at the last

- a. Post-order traversal      b. Pre-order traversal  
c. In-order traversal      d. None

10. In which of the following link field of last node point to the first node

- a. singly linked list      b. doubly linked list  
c. singly circular linked list      d. both (a) and (c)

11. The structure which is best suited for hierarchical relationship is:  
 a. circular queue                      b. tree                      c. graph                      d. stack

12. In ....., the elements must be in sorted order  
 a. Linear search                      b. Quick sort                      c. binary search                      d. selection sort

13. How many elements are present in the root of the tree?  
 a. 1                      b. 3                      c. 2                      d. 4

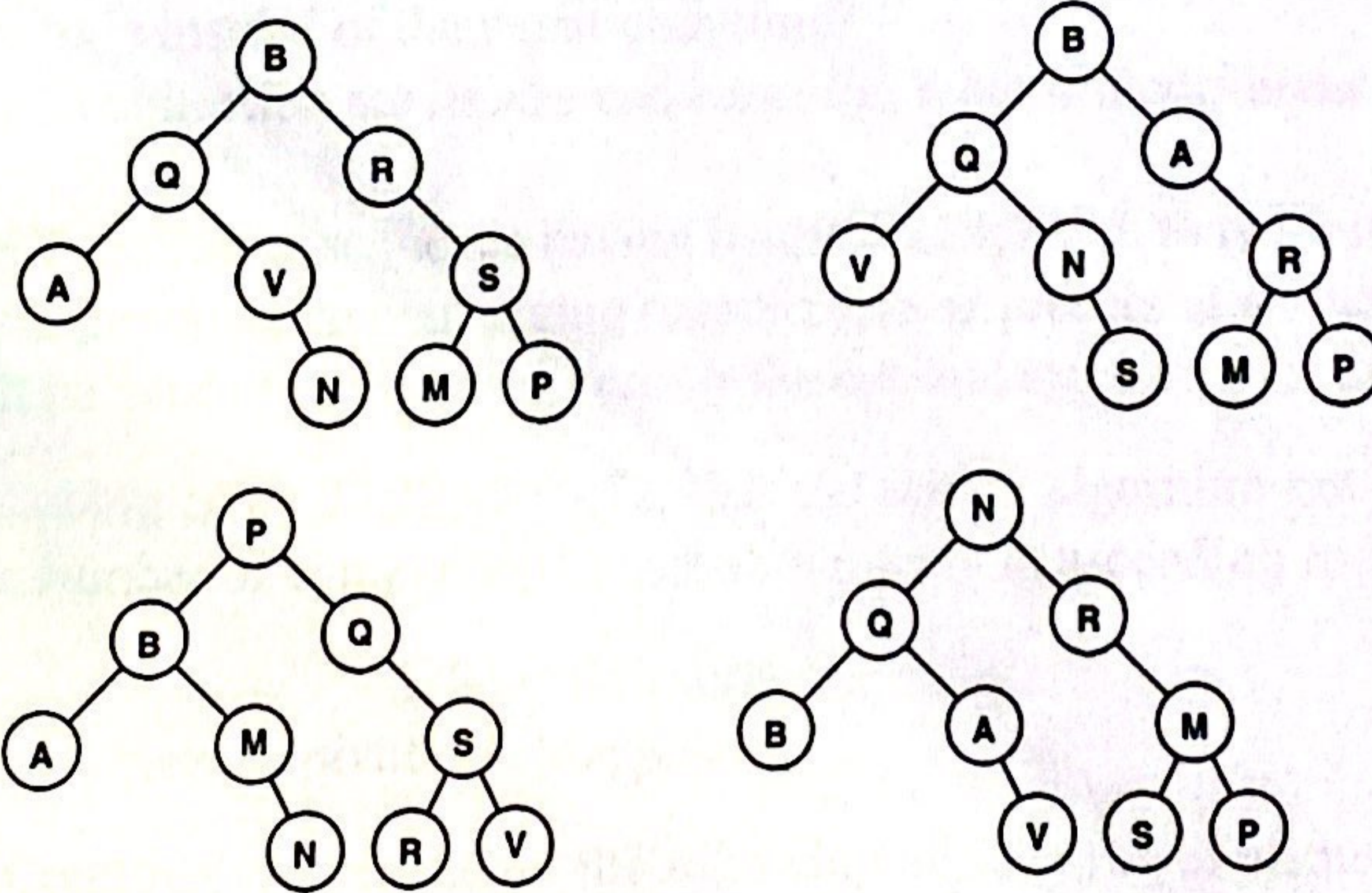
14. Which of the following is useful in implementing quick sort?  
 a. Recursion                      b. Breadth first search  
 c. Depth first search                      d. Both(a) and (c)

15. Which of the following is false?  
 a. Tree is a non-linear data structure                      b. A tree contains a cycle  
 c. A tree with n nodes contains (n-1) edges                      d. A tree is a connected graph

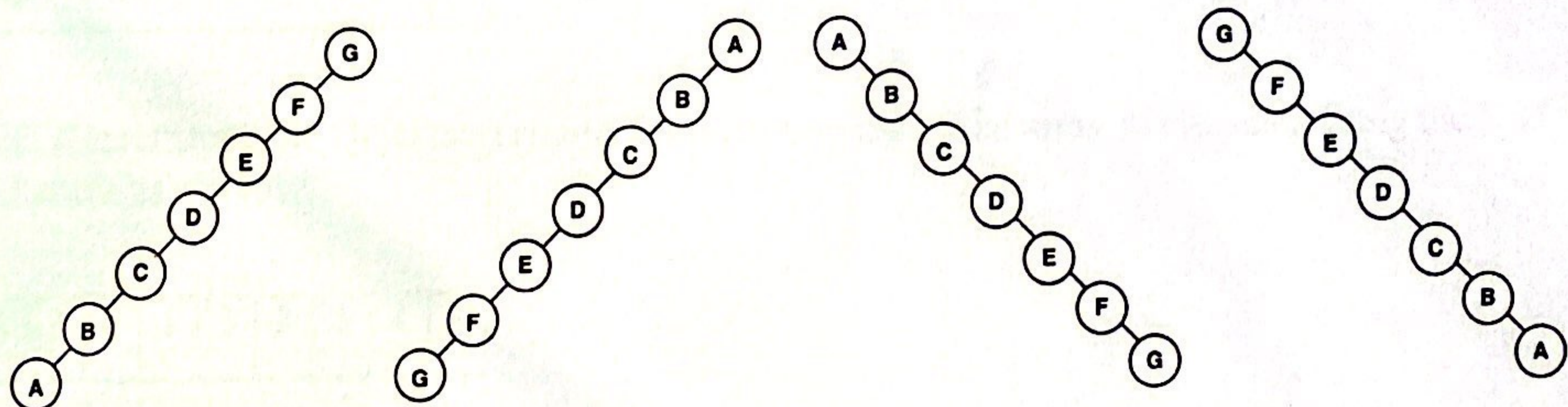
16. Traversing Trees.

(a) Circle the correct *binary tree* (not necessarily a BST) that would produce both of the following traversals:

In-order: AQVNBRSMP                      Pre-order: BQAVNRSMP



(b) Circle the correct *Binary Search Tree* that would produce the following traversal:  
 Post-order: ABCDEFG



17. Consider the following three algorithms:

Algorithm 1 solves problems of size  $n$  by recursively dividing them into 2 sub-problems of size  $n/2$  and combining the results in time  $c$  (where  $c$  is some constant).

Algorithm 2 solves problems of size  $n$  by solving one sub-problem of size  $n/2$  and performing some processing taking some constant time  $c$ .

Algorithm 3 solves problems of size  $n$  by solving two sub-problems of size  $n/2$  and performing a linear amount (i.e.,  $cn$  where  $c$  is some constant) of extra work.

(a) For each algorithm, write down a recurrence relation showing how  $T(n)$ , the running time on an instance of size  $n$ , depends on the running time of a smaller instance.

(b) For each recurrence relation, what is the running time for each  $T(n)$  ?

18. Draw the binary search tree that is created if the following numbers are inserted in the tree in the given order. 12 15 3 35 21 42 14

19. What is the *expected* time needed by Quicksort to sort a list with  $n$  items?

$O(1)$   $O(\log n)$   $O(n)$   $O(n \log n)$   $O(n^2)$   $O(n^3)$   $O(2^n)$

20. What is the *worst-case* time needed by Quicksort to sort a list with  $n$  items?

$O(1)$   $O(\log n)$   $O(n)$   $O(n \log n)$   $O(n^2)$   $O(n^3)$   $O(2^n)$

21. What needs to be true about the implementation of Quicksort to ensure that the sort only requires the expected time instead of the worst-case time?

22. Two properties of a collection are its *size* and *capacity*. What is the difference between these two properties?

23. Suppose P, Q, R, S, T are sorted sequence having length 20, 24, 30, 35, 50 respectively. They are to be merged into a single sequence by merging together two sequences at a time the number of comparisons that will be needed in the worst case by the optimal algorithm for doing this is:

24. Consider the following array 23, 32, 45, 69, 72, 73, 89, 97 which algorithm out of the following options uses the least number of comparison to sort above array in ascending order.

1. Insertion sort
2. Selection sort
3. Quick using the last element as pivot
4. Merge sort.

25. Demonstrate the Counting sort results for the following initial array of elements

8	3	5	1	3	8	6	4	3
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26. Demonstrate the Quick sort results for the following initial array of elements using the first element as a pivot

8	3	5	1	3	8	6	4	3
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27. Demonstrate the Merge sort results for the following initial array of elements

38	27	43	3	9	82	10
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28. What would be the output after performing the following operations in a Deque?

Insertfront(10);

Insertfront(20);

Insertrear(30);

Insertrear(40);

Deletefront();

Insertfront(50);

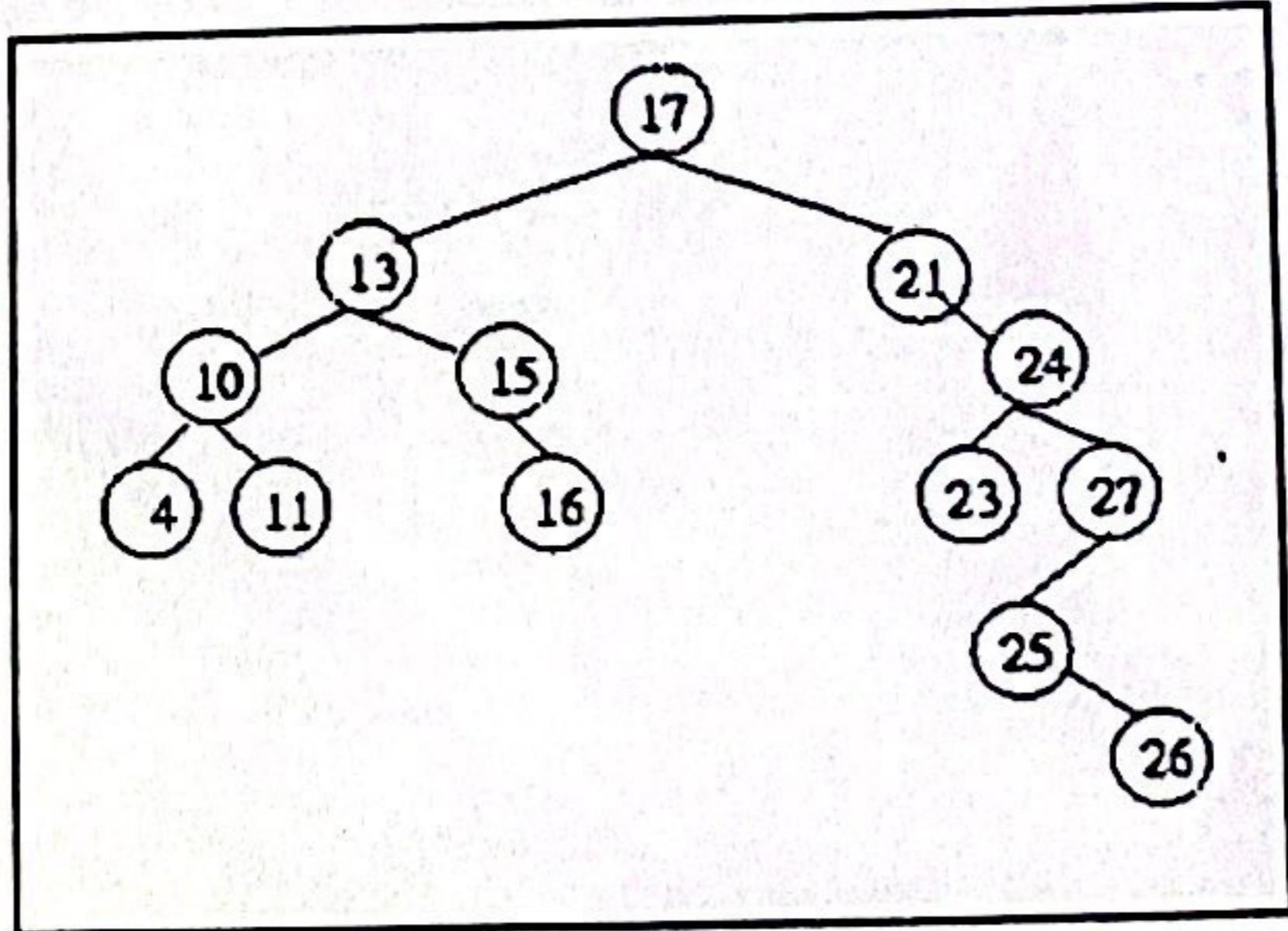
Deleterear();

Display();

- a. 10, 20, 30
- b. 50, 10, 30
- c. 40, 20, 30
- d. None of the above

29. Consider the following binary tree,

a) Delete node 4 , 10 and 13



30. Write a recursive function size that returns the number of nodes in a binary tree.