1. What is a full binary tree?
   1. Each node has exactly zero or two children
   2. Each node has exactly two children
   3. All the leaves are at the same level
   4. Each node has exactly one or two children
2. What is the average case time complexity for finding the height of the binary tree?
   1. h = O(loglogn)
   2. h = O(nlogn)
   3. h = O(n)
   4. h = O(log n) [D]

Explanation: The nodes are either a part of left sub tree or the right sub tree, so we don’t have to traverse all the nodes, this means the complexity is lesser than n, in the average case, assuming the nodes are spread evenly, the time complexity becomes O(logn).

1. Which of the following is not an advantage of trees?
   1. Hierarchical structure
   2. Faster search
   3. Router algorithms
   4. Undo/Redo operations in a notepad [D]
2. What is the parent for a node ‘w’ of a complete binary tree in an array representation when w is not 0?
   1. floor(w-1/2) [a]
   2. ceil(w-1/2)
   3. w-1/2
   4. w/2
3. Which of the following statements for a simple graph is correct?
   1. Every path is a trail [a]
   2. Every trail is a path
   3. Every trail is a path as well as every path is a trail
   4. Path and trail have no relation
4. Which of the following is true for a Binary Search Tree (BST)?
   1. All nodes have at most one child.
   2. The left subtree of a node contains only nodes with keys less than the node’s key. [b]
   3. The right subtree of a node contains only nodes with keys less than the node’s key.
   4. Both left and right subtrees of a node contain only nodes with keys greater than the node’s key.
5. Which algorithm is used to find the shortest path in a graph with non-negative weights?
   1. Depth-First Search (DFS)
   2. Breadth-First Search (BFS)
   3. Dijkstra’s Algorithm [c]
   4. Prim’s Algorithm
6. the number of nodes at level l (assuming the root is at level 0) can be at most:
   1. ( 2^{l} ) [a]
   2. ( 2^{l+1} - 1 )
   3. ( l )
   4. D) ( 2^{l-1} )
7. What is the time complexity of inserting an element into a max-heap of size ( n )?
   1. O(1)
   2. O(n)
   3. O(log n) [c]
   4. O(n log n)
8. Which of the following is true for a connected undirected graph with V vertices and E edges?
   1. ( E \geq V )
   2. ( E = V - 1 )
   3. ( E \leq V - 1 )
   4. ( E \leq \frac{V(V-1)}{2} ) [d]
9. Which of the following is true about trees?
   1. Trees can have cycles.
   2. Trees are connected graphs with no cycles. [b]
   3. Trees must have a root node.
   4. Trees can have multiple root nodes.
10. In a binary tree, each node can have a maximum of how many children?
    1. 0
    2. 1
    3. 2 [c]
    4. 3
11. Which of the following algorithms is commonly used to traverse a tree data structure in depth-first order?
    1. Breadth-first search (BFS)
    2. Depth-first search (DFS) [b]
    3. Dijkstra's algorithm
    4. Prim's algorithm
12. Which of the following is true about graphs?
13. A graph can have multiple disconnected components. [a]
14. A graph must be acyclic.
15. A graph cannot have parallel edges.
16. A graph always has a unique path between any two nodes.

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1. Which of the following is used to represent the shortest path between nodes in a weighted graph?
   1. Dijkstra's algorithm [a]
   2. Breadth-first search (BFS)
   3. Depth-first search (DFS)
   4. Floyd-Warshall algorithm
2. Which of the following statements is true for a binary tree?
   1. Every node has exactly two children.
   2. Each node has at most two children. [b]
   3. The tree is always perfectly balanced.
   4. The height of the tree is always equal to the number of nodes.
3. In a binary search tree (BST), where would you find the smallest element?
   1. Root node
   2. Rightmost node
   3. Leftmost node [c]
   4. Middle node
4. In an AVL tree, what is the maximum difference allowed between the heights of the left and right subtrees of any node?
   1. 0
   2. 1 [b]
   3. 2
   4. 3
5. Which of the following operations can violate the properties of a red-black tree?
   1. Insertion
   2. Deletion
   3. Both insertion and deletion [c]
   4. Searching
6. Which of the following correctly defines an undirected graph?
   1. A graph where each edge has a direction associated with it.
   2. A graph where edges do not have directions. [b]
   3. A graph where all nodes are connected in a single line.
   4. A graph that does not contain any edges.
7. Which traversal of a binary tree gives the nodes in non-decreasing order in a BST?
8. Pre-order
9. In-order [b]
10. Post-order
11. Level-orde
12. In an undirected graph, the sum of the degrees of all vertices is always:
13. Equal to the number of edges.
14. Twice the number of edges. [b]
15. Half the number of edges.
16. The number of edges minus one.
17. Which of the following traversal methods does not use recursion?
18. Pre-order traversal
19. In-order traversal
20. Post-order traversal
21. Level-order traversal [d]
22. What is the maximum height of an AVL tree with n nodes?
23. 𝑂(𝑛)
24. 𝑂(log⁡𝑛) [b]
25. 𝑂(𝑛)
26. 𝑂(𝑛log 𝑛)
27. Which balancing technique is used in B-trees to maintain balance during insertion and deletion?
28. Rotation
29. Rebalancing
30. Splitting
31. Merging
32. A tree is a hierarchical data structure that must satisfy which of the following properties?
    1. Directed edges and a single cycle
    2. Undirected edges and zero cycles
    3. Directed edges and zero cycles [c]
    4. Undirected edges and multiple cycles
33. In a binary tree, each node can have at most how many children?
    1. 1
    2. 2 [b]
    3. 3
    4. No limit
34. A graph is a collection of:
    1. Nodes only
    2. Edges only
    3. Nodes connected by edges [c]
    4. None of the above
35. Which of the following is NOT a common real-world application of graphs?
    1. Modeling social networks
    2. Representing chemical compounds
    3. Finding the optimal route for deliveries
    4. Performing text analysis using natural language processing (NLP) [d]
36. Which of the following applications commonly utilizes trees?
    1. Social network connections
    2. File system directory structure
    3. Route planning algorithms
    4. All of the above [d]