
Beginner-Level Theory Questions

These cover fundamental concepts and terminologies that form the basis of DSA.

1. **What are the terminologies of a tree?** (e.g., node, root, leaf, parent, child, etc.)
2. **What is the difference between a linear and non-linear data structure?**
3. **What is the difference between a tree and a graph?**
4. **What is a complete binary tree? Provide an example.**
5. **What is the difference between a full binary tree, complete binary tree, and perfect binary tree?**
6. **What is a degenerate tree?**
7. **What is the degree of a node?**
8. **What is the difference between the degree of a node and the degree of a tree?**
9. **What is the depth of a node in a binary tree?**
10. **What is the height of a tree?**
11. **What is the difference between height and depth of a node in a binary tree?**
12. **What is a binary tree?**
13. **What is a binary search tree (BST)?**
14. **What is the difference between a binary tree and a binary search tree (BST)?**
15. **What is a trie (prefix tree)?**
16. **What are the advantages of tries?**
17. **What is the difference between a suffix trie and a prefix trie?**
18. **What is a compressed trie?**
19. **What is a heap?**
20. **What is the difference between a max heap and a min heap?**
21. **Is a heap a complete binary tree?**
22. **What is a priority queue?**
23. **What is a graph?**
24. **What is the difference between a directed graph and an undirected graph?**

25. **What is the difference between a weighted graph and an unweighted graph?**

26. **What is a disconnected graph?**

27. **What is the degree of a vertex in a graph?**

28. **What is an adjacency list?**

29. **What is an adjacency matrix?**

30. **What is the difference between an adjacency list and an adjacency matrix?**

31. **What are the types of graphs?**

32. **What is a bipartite graph?**

33. **What is a spanning tree?**

34. **What is a minimum spanning tree?**

35. **What is the use of a spanning tree?**

36. **What is a quadratic time complexity?**

37. **What is a linear time complexity?**

38. **What are internal nodes in a tree?**

39. **What are siblings in a tree?**

Intermediate-Level Theory Questions

These require understanding of beginner concepts and dive into more specific properties, applications, or comparisons.

1. **What are the applications of trees?**

2. **What are the applications of binary search trees (BST)?**

3. **What is the difference between a BST and a heap?**

4. **What are the applications of heaps?**

5. **What is the purpose of heap sort?**

6. **What are the limitations of a heap?**

7. **What are the applications of a priority queue?**

8. **What are the applications of tries?**

9. **What are the types of tries?**

10. **What are the applications of graphs?**

11. **How are graphs used in social media to find mutual friends?**

12. **What are the applications of weighted graphs?**

13. **What is a balanced vs. unbalanced tree?**

14. **What is a self-balancing tree?**

15. **What is an AVL tree?**

16. **What is a red-black tree?**

17. **What is the difference between an AVL tree and a red-black tree?**

18. **What is an N-ary tree?**

19. **What is a ternary tree?**

20. **What is a B-tree?**

21. **What is a segment tree?**

22. **What is a cycle in a graph?**

23. **What is a loop in a graph?**

24. **What is a connected graph?**

25. **What is the difference between BFS and DFS in graphs?**

26. **What data structures are used for DFS and BFS traversal of a graph?**

27. **What is the lowest common ancestor (LCA) in a tree?**

28. **What is a subtree?**

29. **What is the difference between level-order traversal and post-order traversal?**

30. **What is the time complexity of inserting a value into a heap?**

31. **What is the time complexity of BST insertion?**

32. **What is the time complexity of searching in a binary tree?**

33. **What is the difference in time complexity for search, insert, and other operations between a binary tree and a BST?**

34. **What is the time complexity of BFS in a graph?**

35. **What is the time complexity of DFS in a graph?**

36. **What is the time complexity of heap sort?**

37. **What is the complexity of initializing a graph?**

38. **What is the complexity of initializing a trie?**

39. **What is the complexity of trie operations (e.g., insert, search, delete)?**

40. **What is the advantage of recursion?**

Advanced-Level Theory Questions

These involve complex algorithms, advanced data structures, or deeper analysis of properties and optimizations.

1. **What is the time complexity of removing the second largest element in a BST?**
2. **What is the time complexity of searching in a balanced binary tree?**
3. **What are the rotations in AVL trees?**
4. **How does a red-black tree maintain balance?**
5. **What are the special cases in BST deletion?**
6. **What is trie serialization and deserialization?**
7. **What is a radix tree?**
8. **What is the heapify process, and how does it work (heapify up and down)?**
9. **What is the complexity of heapify?**
10. **What is Dijkstra's algorithm, and how does it work for finding the shortest path in a weighted graph?**
11. **What is Prim's algorithm for finding a minimum spanning tree?**
12. **What is Kruskal's algorithm for finding a minimum spanning tree?**
13. **What is the difference between Prim's and Kruskal's algorithms?**
14. **How do you detect cycles in a graph?**
15. **How do you count cycles in a graph?**
16. **How do you find the shortest path in a graph?**
17. **How do you find the shortest distance between two vertices in a graph?**
18. **What is the shortest path in an unweighted graph using BFS?**
19. **What is backtracking in DFS?**
20. **What is the complexity analysis of various data structures (tree, graph, trie, heap)?**
21. **What is the sliding window pattern, and how is it used?**
22. **What is the concept of logarithmic values and functions in the context of DSA?**
23. **What is graph indexing?**

24. **How is a graph represented in memory?**

25. **What is the difference between a suffix trie and a self-balancing trie?**

26. **How do you validate whether a tree is a BST, including negative scenarios?**

27. **What is the significance of allowing duplicate elements in a BST?**

28. **How do you count single-child nodes in a BST?**

29. **What is the difference between a complete graph and other graph types?**

30. **What are the applications of hash tables in DSA?**
