Short Questions

1. What are abstract data types (ADTs) and why are they important in programming?
2. How is a singly linked list implemented in memory?
3. What are some common insertion operations in a linear list?
4. How does deletion work in a linear list, and what are its complexities?
5. How are searching operations performed on a linear list?
6. What are the main differences between array and linked representations of data structures?
7. How are stacks represented in memory, and what are their typical operations?
8. What are some common applications of stacks in computer science?
9. What operations are typically performed on queues?
10. How do array and linked representations differ in queue implementations?
11. What is a binary search tree (BST), and how does it differ from other tree data structures?
12. How do you determine the height of a binary tree, and why is it important?
13. Explain the concept of recursion and how it is applied in algorithms.
14. What is the difference between depth-first search (DFS) and breadth-first search (BFS) algorithms?
15. How do you implement a priority queue, and what are its applications?
16. What is dynamic programming, and how is it different from divide-and-conquer?
17. Explain the concept of memoization and its role in optimizing recursive algorithms.
18. What are the advantages and disadvantages of using arrays over linked lists, and vice versa?

19. How do you implement a hash table, and what are its main components?

20. What is the time complexity of various operations in a binary heap?

21. How do you implement a graph data structure, and what are its applications?

22. What is a spanning tree, and why is it important in graph theory?

23. Explain the concept of amortized analysis and its significance in analyzing data structures.

24. What are trie data structures, and what are their advantages in storing and retrieving strings?

25. How do you implement an AVL tree, and what are its properties?

26. What is a B-tree, and how does it differ from binary search trees?

27. Explain the concept of Big O notation and its role in analyzing algorithm efficiency.

28. What are the primary sorting algorithms, and how do they differ in terms of time complexity and implementation?

29. How do you detect cycles in a graph, and why is it important?

30. What are the applications of depth-first search (DFS) and breadth-first search (BFS) in graph theory?

31. What is the difference between a min heap and a max heap?

32. How do you implement a depth-first search (DFS) algorithm iteratively?

33. What are dynamic arrays, and how do they differ from static arrays?

34. How do you implement a doubly linked list, and what are its advantages over singly-linked lists?

35. What is the difference between a static and a dynamic data structure?

36. How do you implement a disjoint-set data structure, and what are its applications?

37. What is a trie data structure, and why is it efficient for storing and searching strings?

38. How do you implement a circular queue, and what are its advantages?

39. What are some common applications of hash tables in computer science?

40. How do you implement a binary search algorithm iteratively, and what are its time complexity and advantages?

41. What is a binary search tree (BST), and how does it differ from other tree data structures?

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51. How are linear lists represented in memory?

52. What is a skip list representation, and how does it differ from other linear list representations?

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54. How does deletion work in linear lists, and what are its complexities?

55. How are searching operations performed on linear lists?

56. What are hash functions, and how are they used in data structures?

57. How does collision resolution with separate chaining work in hash tables?

58. Explain the process of collision resolution using linear probing in hash tables.

59. How does collision resolution with quadratic probing work in hash tables?

60. What is double hashing, and how does it resolve collisions in hash tables?

61. How does rehashing contribute to maintaining the efficiency of hash tables?

62. What is extendible hashing, and how does it address dynamic storage allocation in hash tables?

63. How do operations like insertion and deletion affect the performance of skip lists compared to other linear list representations?

64. What are some advantages of using hash tables over other data structures for storing and retrieving data?

65. Explain the concept of open addressing with quadratic probing and how it differs from linear probing in hash tables.

66. How does double hashing help in reducing clustering and improving the performance of hash tables?

67. What is the significance of the load factor in hash tables, and how does it affect performance?

68. How does rehashing contribute to maintaining efficiency in dynamic hash tables?

69. What are some common applications where extendible hashing is used, and how does it address dynamic storage allocation?

70. How does a skip list representation provide an efficient alternative to other linear list representations?

71. Can you explain how insertion operations are performed in skip lists, and what is their time complexity?

72. What are some disadvantages of skip lists compared to other linear list representations?

73. How does searching work in skip lists, and what is their average-case time complexity for search operations?

74. Explain the concept of hash functions and their role in hash tables.

75. What factors should be considered when designing a hash function for a hash table?

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102. How does the search operation work in a Binary Search Tree?

103. What is the process of insertion in a Binary Search Tree?

104. How is deletion handled in a Binary Search Tree?

105. Can you define what a balanced Binary Search Tree is?

106. Why is balancing important in a Binary Search Tree?

107. What is the complexity of searching in a Binary Search Tree?

108. How does insertion complexity compare in a BST?

109. What is the worst-case complexity of deletion in a BST?

110. How do Binary Search Trees support the operation of finding the minimum and maximum value?

111. What is tree traversal, and how is it implemented in BSTs?

112. Can BSTs have duplicate keys, and how are they handled?

113. How does auto-balancing enhance the performance of BSTs?

114. What is the role of rotation operations in maintaining BST balance?

115. What distinguishes Binary Search Trees from other binary trees?

116. How is the complexity of BST operations affected by tree shape?

117. What strategies exist for deleting a node with two children in a BST?

118. How do BSTs compare to hash tables in terms of operations?

119. What are the applications of Binary Search Trees in software development?

120. How can the depth of a BST affect its performance?

121. What is the significance of the in-order traversal in BSTs?

122. How does the deletion of a leaf node in a BST differ from deleting a node with children?

123. What mechanisms ensure the efficiency of BSTs in dynamic data environments?

124. In what scenarios might a BST be preferred over a balanced tree like an AVL tree?

125. How do Binary Search Trees facilitate range queries?