

Lecture 9-red-black trees

1. What type of data structure is a Red-Black Tree?

- a) Array
- b) Linked List
- c) Balanced Binary Search Tree
- d) Hash Table

Answer: c) Balanced Binary Search Tree

2. What is the guaranteed height of a balanced search tree with n items?

- a) $O(n)$
- b) $O(\log n)$
- c) $O(n^2)$
- d) $O(1)$

Answer: b) $O(\log n)$

3. What is the key invariant maintained by an AVL tree?

- A) The number of nodes in the left and right subtrees must differ by at most 1.
- B) The heights of the left and right subtrees of any node differ by at most 1.
- C) All leaf nodes are at the same level.
- D) The tree is always perfectly balanced.

Answer: B) The heights of the left and right subtrees of any node differ by at most 1.

4. What is the worst-case time complexity for insertion in an AVL tree?

- A) $O(1)$
- B) $O(n)$
- C) $O(\log n)$
- D) $O(n \log n)$

Answer: C) $O(\log n)$

5. Which structure uses a sequence of characters as keys and supports efficient prefix operations?

- A) AVL Tree
- B) Red-Black Tree
- C) Trie
- D) Hash Table

Answer: C) Trie

6. In a Red-Black Tree, what is done if the newly inserted node is the root?

- A) Recolor it to red
- B) Recolor it to black
- C) Rotate the tree
- D) Delete and reinsert it

Answer: B) Recolor it to black

7. Which of the following is a disadvantage of AVL trees compared to Red-Black Trees?

- A) Slower lookup operations
- B) More frequent rotations during insertion/deletion
- C) Less strict balancing
- D) Higher space complexity

Answer: B) More frequent rotations during insertion/deletion

8. In a Trie, how are keys typically represented?

- A) As atomic blobs
- B) As sequences of characters
- C) As numerical hashes
- D) As binary values

Answer: B) As sequences of characters

9. What is the maximum height difference allowed between the left and right subtrees in an AVL tree?

- A) 0
- B) 1
- C) 2
- D) $\log n$

Answer: B) 1

10. Which operation in a Trie determines if a string is present by checking both the path and the node's "isKey" flag?

- A) Insertion
- B) Deletion
- C) Search
- D) Rotation

Answer: C) Search