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