

True, False, Explain

Decide whether each of the following statements is true or false, and give a reason.

Problem 1. The height of any binary search tree with n nodes is $O(\log n)$.

[True / False]

Problem 2. Inserting into an AVL tree with n nodes requires $\log n$ rotations.

[True / False]

Problem 3. The depths of any two leaves in a max heap differ by at most 1.

[True / False]

Problem 4. A tree with n nodes and the property that the heights of the two children of any node differ by at most 2 has $O(\log n)$ height.

[True / False]

Problem 5. Given n distinct elements and an empty AVL tree, there is an order in which you can insert the n elements into the AVL tree such that no rotations are required.

[True / False]

Problem 6. Every directed acyclic graph has exactly one topological ordering.

[True / False]

Problem 7. If we double all the edge weights in a directed graph, any shortest path in the original graph will still be a shortest path in the new graph.

[True / False]

Problem 8. The following array is a max heap: $[10, 3, 5, 1, 4, 2]$.

[True / False]

Problem 9. In a BST, we can find the next smallest element to a given element in $O(1)$ time.

[True / False]

Problem 10. In a weighted undirected tree, depth-first search from a vertex s finds single-source shortest paths from s in $O(V + E)$ time.

[True / False]

Problem 11. Given an array of n numbers in sorted order, an AVL tree on those keys can be built in time $O(n)$.

[True / False]

Problem 12. If we square all the edge weights in an undirected graph, any shortest path in the original graph will still be a shortest path in the new graph.

[True / False]