

True, False, Explain

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

Problem 1. Given an array of n distinct comparable integers, we can identify and sort the $\frac{n}{\log n}$ smallest of them in $O(n)$ time using a heap.

[True / False]

Problem 2. Given k distinct integer keys, there exists a binary search tree containing all k of them that satisfies the max heap property.

[True / False]

Problem 3. Depth-first search solves single-source shortest paths in an unweighted, directed graph $G = (V, E)$ in $O(|V| + |E|)$ -time.

[True / False]

Problem 4. Given a connected weighted directed graph having positive integer edge weights, where each edge weight is at most k , we can compute single source shortest paths in $O(k|E|)$ time.

[True / False]

Problem 5. Given a Set AVL tree storing n keyed items ordered by key, one can construct a key-ordered max-heap on the same n items in worst-case $O(n)$ time.

[True / False]

Problem 6. Given a weighted connected undirected graph $G = (V, E)$ containing exactly $|V| - 1$ edges, one can solve weighted Single-Source Shortest Paths from any $s \in V$ in $O(|V|)$ time.

[True / False]

Problem 7. A max heap can be converted into a min heap in linear time.

[True / False]

Problem 8. Performing a single rotation on a binary search tree always results in binary tree that also satisfies the BST Property.

[True / False]

Problem 9. If a node a in an AVL tree is not a leaf, then a 's successor is a leaf.

[True / False]

Problem 10. Given an array of n integers representing a binary min-heap, one can find and extract the maximum integer in the array in $O(\log n)$ time.

[True / False]

Problem 11. Any binary search tree on n nodes can be transformed into an AVL tree using $O(\log n)$ rotations.

[True / False]

Problem 12. Given a graph where all edge weights are strictly greater than -3, a shortest path between vertices s and t can be found by adding 3 to the weight of each edge and running Dijkstra's algorithm from s .

[True / False]