1 Definitions

Suppose that the nodes $A$, $B$, $C$ in a binary search tree are arranged as follows.

A
   B
      C

Which of the following describes the relationship between $A$, $B$, $C$?

- $A \leq B, C$
- $A \geq B, C$
- $A \leq B \leq C$
- $B \leq A \leq C$

Correct

Now suppose that nodes $A$, $B$, $C$ are arranged as follows in the binary search tree.

A
   B
      C

What is the relationship between $A$, $B$, $C$?

- $B \leq A \leq C$
- $B \leq C \leq A$
- $C \leq B \leq A$
- $C \leq A \leq B$

Correct

If two different binary search trees contain the same set of values, which of the following is common between them?

- Their pre-order traversals.
- Their in-order traversals.
- Their post-order traversals.
- Their root nodes.

Correct

Which of the following describes the height of a binary search tree on $n$ nodes?

- $O\left(\log n\right)$
- $\Omega\left(\log n\right)$
- $\Theta\left(\log n\right)$
- All of the above.

Correct

If the length of a path from the root of a red-black tree to one of the leaf NIL nodes is 100, what could be the length of another path from the root to some other NIL node?

- 45
- 180
- 30
- All of the above.

Correct

2 Red-Black Trees

Is the following a valid red-black tree? We are not drawing the implicit NIL nodes.

Yes
No

Correct

Is the following a valid red-black tree?

Yes
No

Correct

Is the following a valid red-black tree?

Yes
No

Correct

Which of the following describes the height of a red-black tree on $n$ nodes?

- $O\left(\log n\right)$
- $\Omega\left(\log n\right)$
- $O\left(\log^2 n\right)$
- All of the above.

Correct

If the length of a path from the root of a red-black tree to one of the leaf NIL nodes is 100, what could be the length of another path from the root to some other NIL node?

- 45
- 180
- 30
- All of the above.

Correct

Suppose that $r$ is the root of a red-black tree on $n$ nodes. Assume all nodes have distinct values. If we sort the values stored in the tree to get $x_i < x_2 < \cdots < x_n$, and find the index $i$ where $r = x_i$, what can be said about $i$?

- $i \leq O\left(n\right)$
- $i \leq O\left(\sqrt{n}\right)$
- $i \leq 0.01n$

Correct

What is the worst-case runtime of operations INSERT/DELETE/SEARCH on a red-black tree storing $n$ nodes?

- $O\left(n\right)$
- $O\left(\log n\right)$
- $O\left(n\log n\right)$

Correct