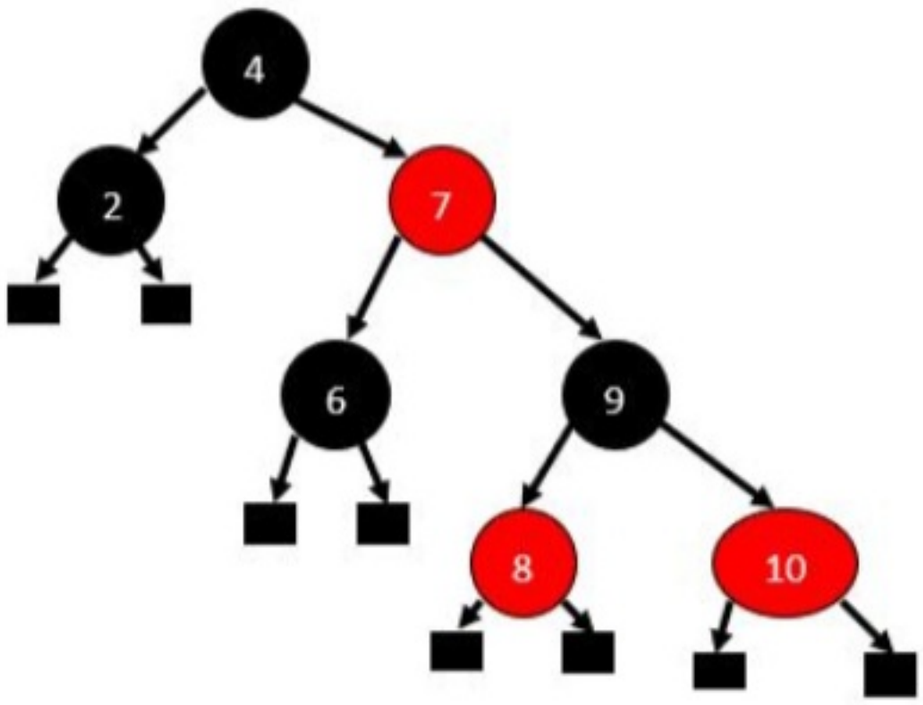
1. Consider the following red-black tree: sentinels (NIL) are shown by black squares.

1 / 1 point



Suppose we insert a new key “1” into this tree, which of the following options are true?

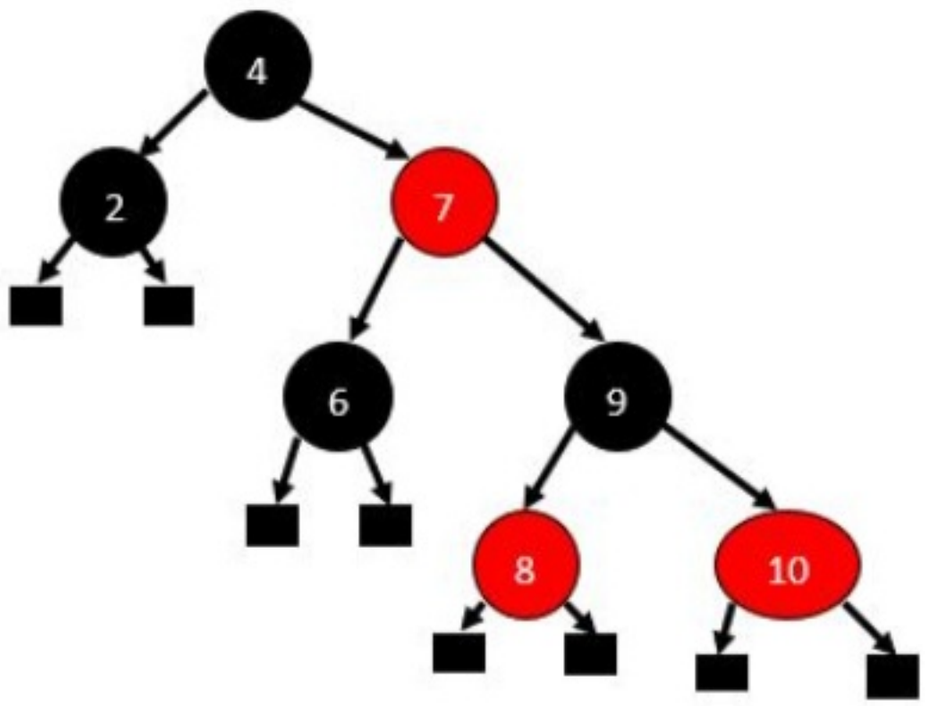
- [ ] The node with key 1 will be inserted as a black node which is a left child of the node 2.
- [x] The node with key 1 will be inserted as a red node which is a left child of the node 2.

Correct
Correct.

- [ ] The insertion of the new node as a black node will not cause any violations.
- [x] The new node if inserted as a red node will cause no further violation of the red-black tree properties.

Correct
Correct

2. Consider again the following red-black tree: sentinels (NIL) are shown by black squares.



Suppose we wish to insert the node with key 11. Which of the following facts are true about the subsequent steps in removing the red-red violation that results?

- [x] The inserted node will be a right child of the node 10.

Correct
Correct

- [x] The inserted node when colored red will cause a red-red violation.

Correct
Correct

- [x] Since the node 8 is red, the inserted node falls into the case where it has a “red uncle”.

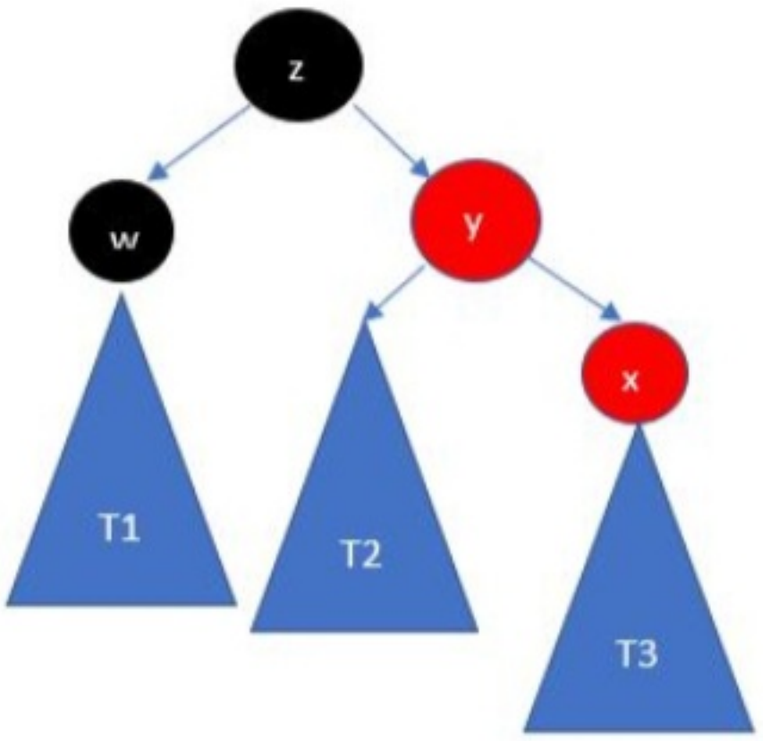
Correct
Correct

- [ ] All red-red violations can be fixed by coloring nodes 8, 10 black while coloring the node 9 red.
- [x] The result of eliminating the red-red violation between newly inserted node and its parent causes a red-red violation further up in the tree.

Correct
Correct

3. Consider a left (anti clock wise) rotation of the following tree with a red-red violation at node z.

1 / 1 point



Select all the facts that hold in the resulting tree. It may help to first draw the result on a piece of paper before answering the questions below.

- [x] The node y is now the root of the tree with z being its left child.

  Correct
  Correct

- [ ] The node y is now the root of the tree with z being its right child.

- [x] The node w and subtree T1 remains to the left of z.

  Correct
  Correct

- [x] The node x and T3 remain to the right of y.

  Correct
  Correct

- [x] Subtree T2 becomes the right subtree of z.

  Correct
  Correct

- [ ] The binary search tree property i.e, the relative ordering between keys of a node and those of its left and right subtrees are broken by tree rotations.