BONUS (9.1CC)

Consider a RB-tree formed by inserting n nodes with RB-Insert.

Argue if $n > 1$, the tree has atleast one red node.

Consider 3 cases

Case 1: new node and its grandparent node is RED, if the loop ends the new node can never be the root, thus new node is RED after RB-Fixup is called.

Case 2:

new node & its parent node is RED, when the loop ends parent node cannot be the root after rotation, thus parent node is RED after the fix up.

Case 3:

new node is RED and new node cannot be the root because $n > 1$, ∴ new-node is RED after RB fixup is called.

Reference

Intro to Algo CLRS book