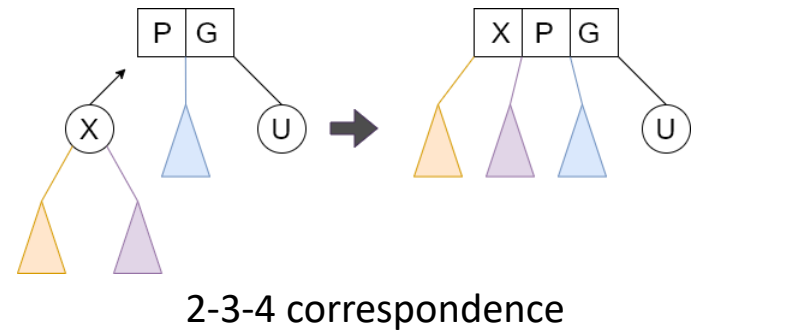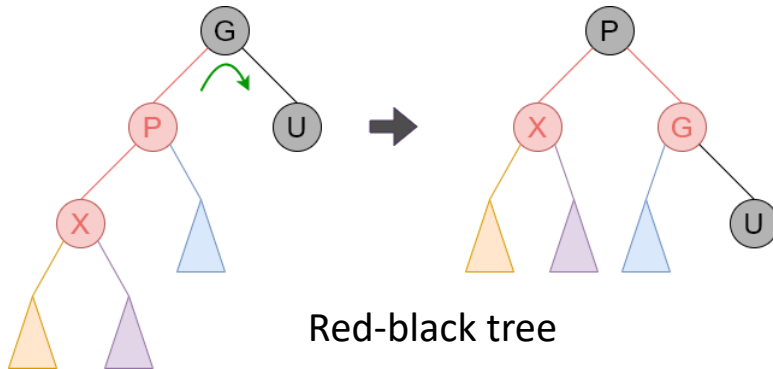# Red-Black Trees: Insertion (top-down)

On the way down from the root, when we see a node X that has two red children, repaint X as red and the children as black. Then, make the following checks:

Case 1: X is root. Repaint it as black.

Case 2: Parent P is black. No change.

case 3-4 mirror cases with right and right-left rotation = right child x

Case 3: Parent P is red. Uncle U is black.   x is left child

Right rotation at grandparent G. Repaint P as black and G as red.

Red-black tree

2-3-4 correspondence

Case 4: Parent P is red. Uncle U is black.   x is right child

Double left-right rotation at grandparent G. Repaint X as black and G as red.

Red-black tree

2-3-4 correspondence