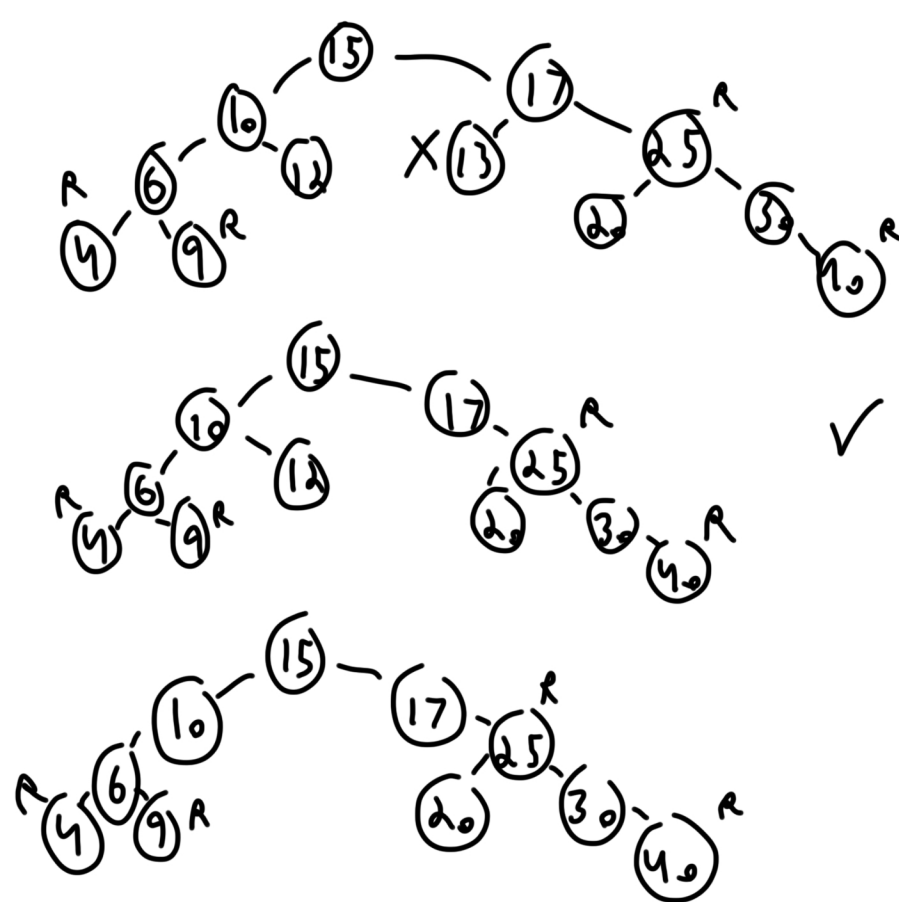


2



swap successor and
delete

3

Whenever you insert a node into a red black tree, the node always starts as red. Therefore, before any adjusting, it has at least one red node. If any adjusting is needed it is because the new red node's parent is also red. If this is the case, after adjusting in any way, either a color shift or rotation, you are still left with at least one or two red nodes.

4

[12]

[12, 13]

[12, 13, 17]

[10, 12] [13] [17]

[4, 10, 12] [13] [17] [4, 6] [10, 13] [12] [17]

[4, 6, 9] [10, 13] [12] [17]

[4, 6, 9] [10, 13] [12] [15, 17] [4, 6, 9] [10, 13] [12] [15, 17, 30] [4, 6, 9] [10, 13, 17] [12] [15] [25, 30] [4, 6, 9] [10, 13, 17] [12] [15] [20, 25, 30]

[13]
[10] [17, 25]
[4, 6, 9] [12] [15] [20] [30, 40]

5

[3]
[1, 2] [4, 5]

[2, 4]
[1] [3] [5]

6

[c, f, k, a, s]

[k]
[c, f, h] [l, a, s, t, v]

[k, s]
[c, f, h] [l, m, n, v, r] [t, v, w]

[k, n, s]
[a, b, c, f, h] [l, m] [p, v, r] [t, v, w, x, y] [c, k, n, s]
[a, b] [d, e, f, h] [l, m] [p, v, r] [t, v, w, x, y]

[c, k, n, s, w]
[a, b] [d, e, f, h] [l, m] [p, v, r] [t, v] [x, y, z]