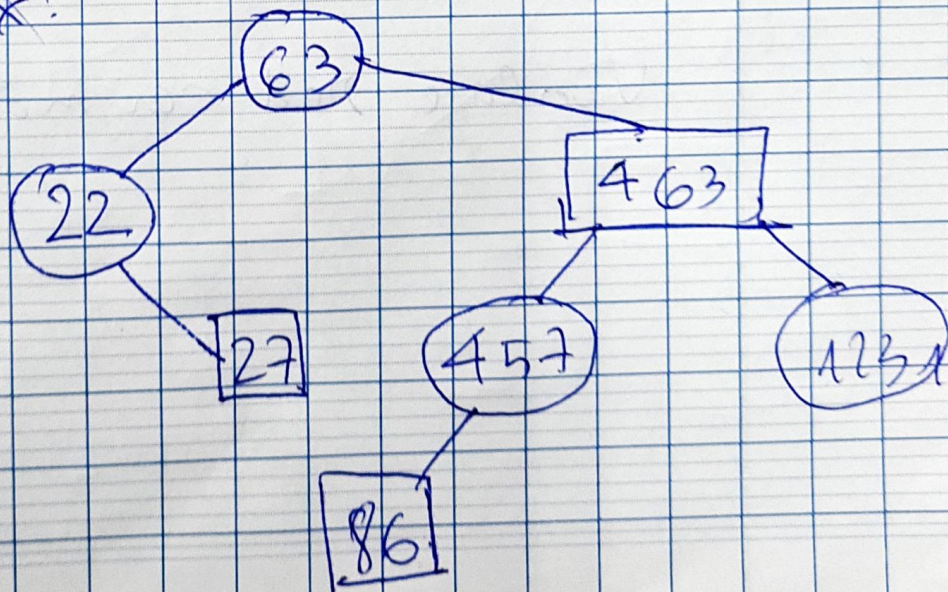3.1)

1. A red black tree have:
   - root is always black
   - other nodes are red or black.
   - Path from ~~each nod~~ root to each
leaf must have same number of

black nodes.
   - 2 red cannot be ~~next to eac~~
connected (⟺) cannot be parent or child
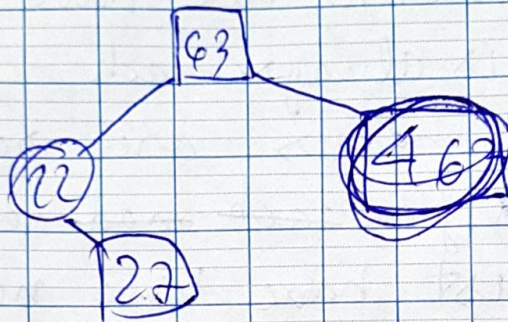   red   of red.
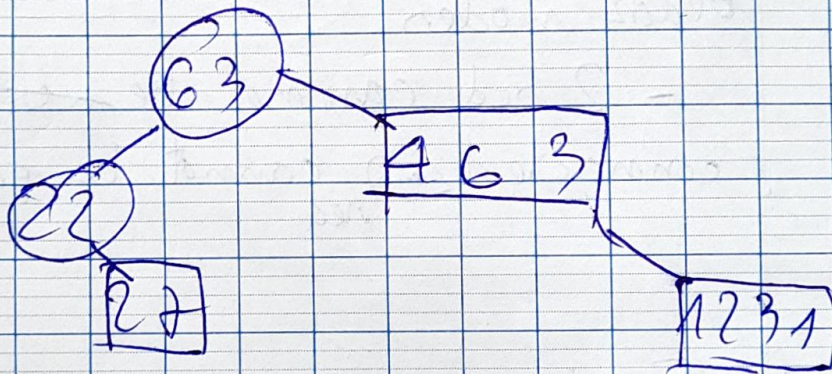
Ex:

○ : black

▢ : red

Ex:

□ : red

Ⓞ : black

63

22

27

46

Vuolate
root is black (1)

□ : red

Ⓞ : black

63
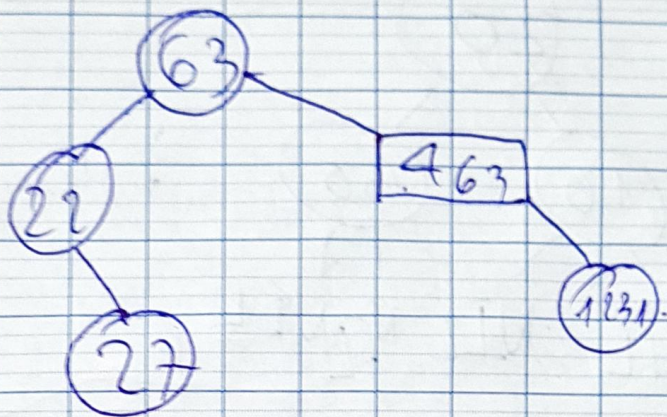
22

27

463

1231

Vuolate red can not be next
to
each
other
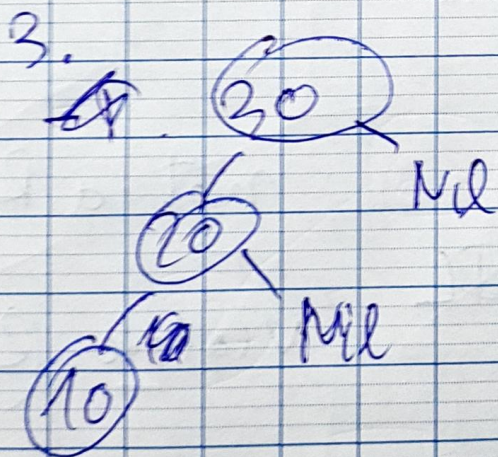
②

Violates (b)th from leaves to
                    root to leaves

have same number of black nodes.

(3)

3.
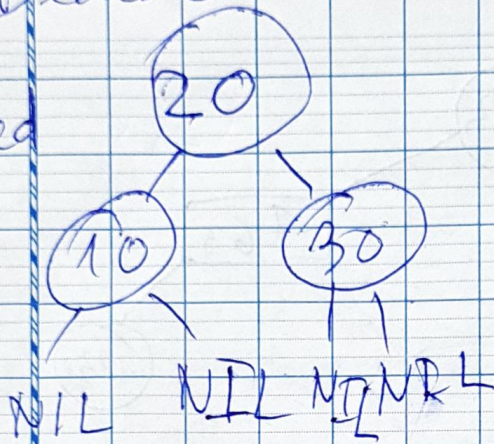   [A]   (20)   is not RB tree
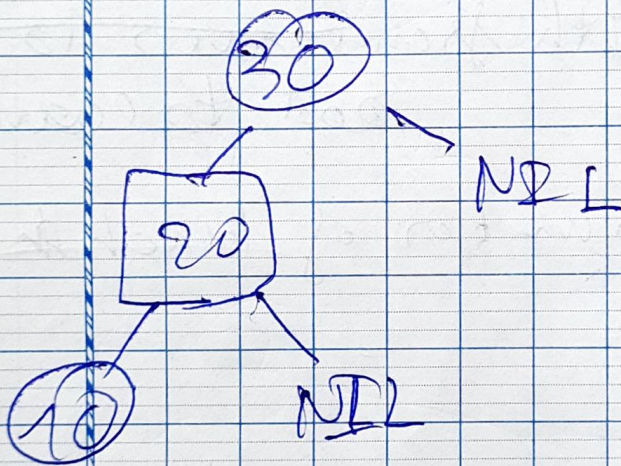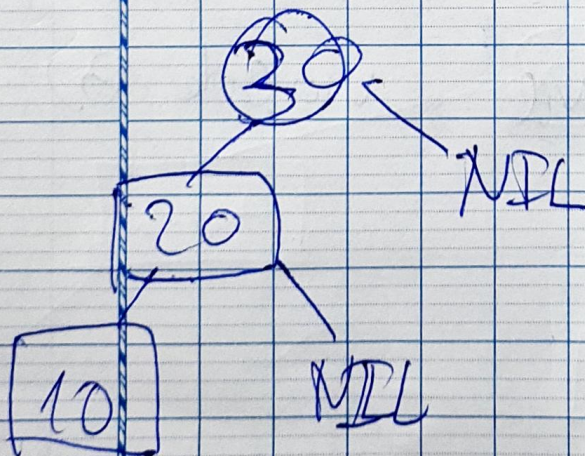   Nil   violate (3)
        (10)
      (10) [10]   Nil

(0) : black

[ ] : red

◯ : Black

▢ : red

(20)
(10)   (30)   : is a red black
                          tree
NIL   NIL NILNIL

(30)
        (20) ➚ NIL   : not a RB
                                tree
(10)   NIL
                          violate (3)

(30)
        (20) ➚ NIL   : not a RB

(10)   NIL   violate (2)
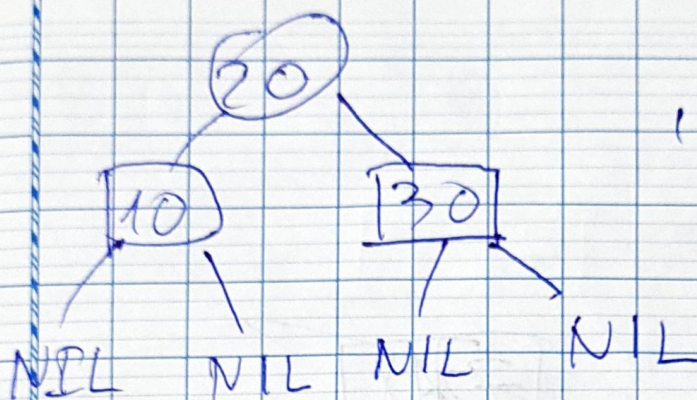
is a RB tree

4.

node 7 : black height = 3

node 3 : '' = 1

node 18 : '' = 2

node 10 : '' = 1

node 22 : '' = 1

node 8 : '' = 1

node 11 '' = 1

node 26 '' = 1