

## Write-up

### Red-black tree (insertion)

Let  $x \leftarrow$  newly inserted node

- 1) Perform standard BST insertion and make <sup>colour of</sup> newly inserted node as RED.
- 2) If  $x$  is root, change the colour to BLACK.
- 3) If colour of  $x$ 's parent is not BLACK and  $x$  is not the root :-
  - a) If  $x$ 's uncle is RED,
    - i) change colour of parent and uncle to BLACK
    - ii) colour of grandparent is RED
    - iii) change  $x = x$ 's grandparent, repeat 2 and 3 steps for new  $x$
  - b) if  $x$ 's uncle is BLACK,
    - i) left-left case ( $p$  is left child of  $g$  and  $x$  is left child of  $p$ ).
    - ii) left-right case ( $p$  is left child of  $g$  and  $x$  is the right child of  $p$ ).
    - iii) right-right case (mirror of case i)
    - iv) right-left case (mirror of case ii)