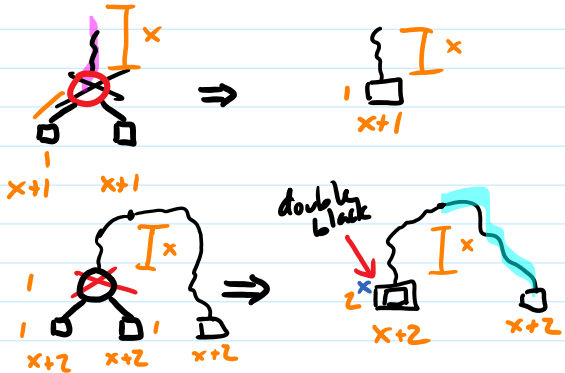
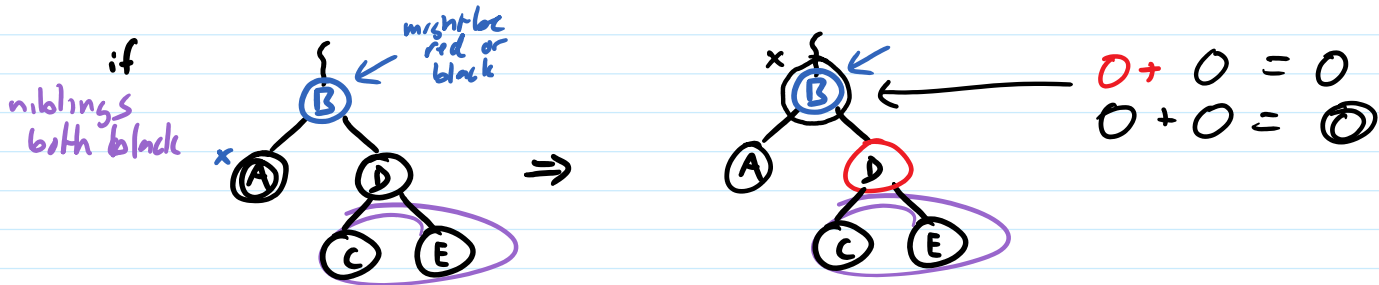
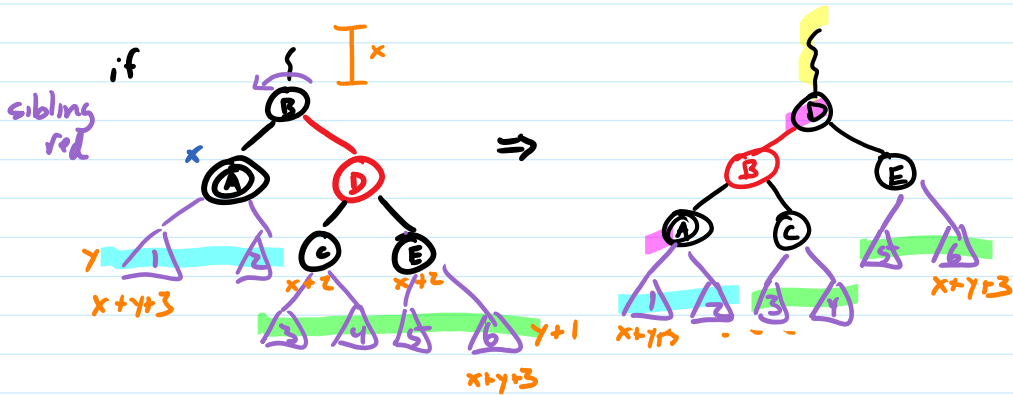
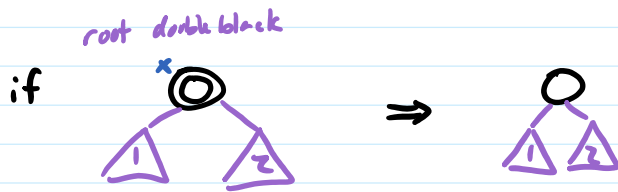


# Red-Black Tree Delete

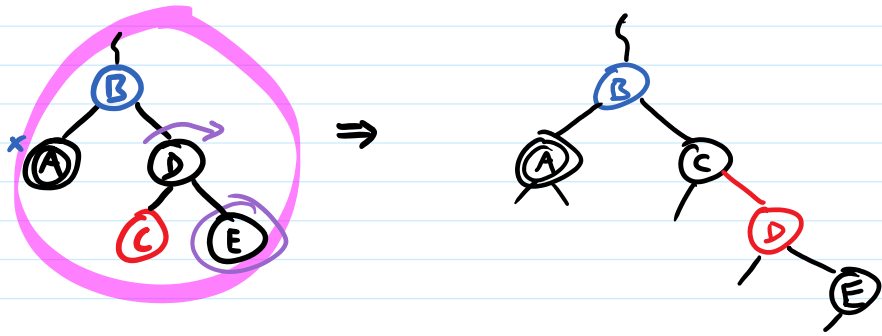
Do normal BST delete; if deleted node has 2 non-leaf children then moved node takes deleted's color do 1 non-leaf delete where moved node was



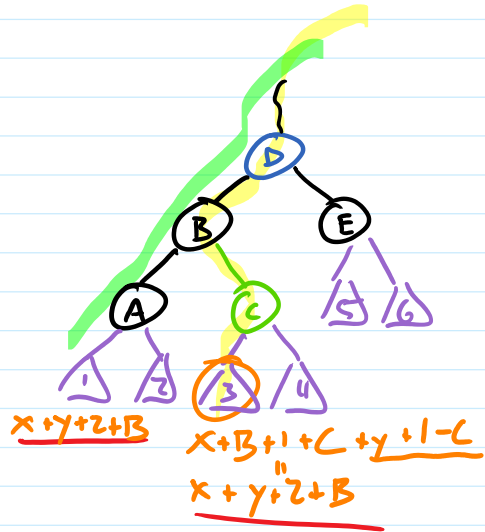
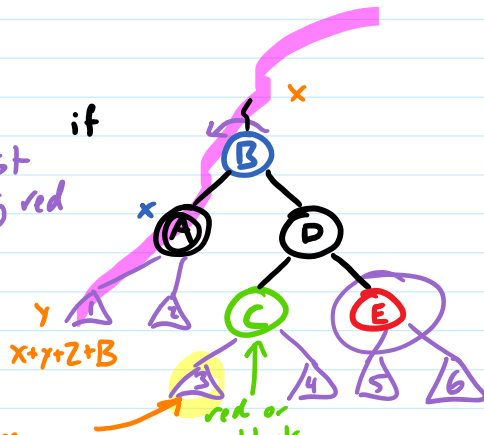
while x is doubly black



else if  
furthest nibling black



if  
furthest nibling red



DONE

count to here  
must also be  
 $x+y+z+B$ ,  
so count through  $\triangle 3$   
must be  $y+1-C$

$x+1+B+C+y+1-C$   
if  $x+y+z+B$

$x+y+z+B$

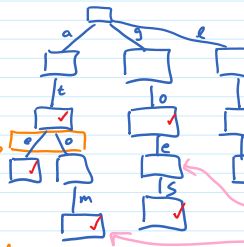
$x+B+1+C+y+1-C$   
 $x+y+z+B$

map/set where keys are sequences over some alphabet (strings)

keys

at  
ate  
atom  
game  
go  
goes  
lie

conceptual view



✓ indicates that string ending at that node is a key

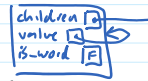
no check; li is not a key

check present; lie is a key

use a map to maintain pointers to children  
key: characters  
value: pointer to corresponding child

is atom a key? yes - end up @ node 4 check  
 is goe a key? no - end up @ node 4 no check  
 is loe a key? no - fall off trie after l  
 is liem a key? no - fall off trie after lie

implementation



curr starts at head and advances each iteration of the loop

just the hash table part of the gmap (metadata struct omitted to reduce clutter)

is\_word("ata")

curr

1st iteration moves curr here

2nd iteration

3rd iteration hits return false b/c a is not a key in

put\_word("game");

added on the 'a' iteration

added on the 'm' iteration

added on the 'e' iteration

set at end of loop