BLG 335E
Analysis of Algorithms 1
Project 4

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150110029

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Part B

1. Actually there is no proper update operation for the Red Black Tree nodes because if it exists , after the updating all the keys are supposed to be compared with the new updated node to implement its correct place on the tree with its colour.

That is why first we should DELETE the node which we want to update. To do this DELETE operation firstly uses the RB-Transplant(T,u,v) function to keep the Red Black Tree features. After these operations RB-Delete-FixUp() function is called to handle the connections and rotations after a node deleted.

Then the proper insert operations will be operated to insert a new node which is desired to be updated.

2. To increase the age of all nodes by 1, it is enough to traverse all the node and while doing this increasing the age of nodes by 1 and set it. It will has no effect to structure of tree because here, the key is the name of the person so that there will be no change the order in tree but just about age of the nodes.

But the num_adult and num_non_adult might change because of the age issue about its adult issues.

```
void RedBlackTree::increase_one_age(RbNode *walker){
    if(walker->left != NIL) increase_one_age(walker->left);
    walker->setincreasedAge(1);
    if(walker->right != NIL) increase_one_age(walker->right);
}
```

3. Here the printed Red Black tree is shown as output. It is compiled in ssh , as it seems there are no error. And the output is printed with 5th adult and, 3rd non-adult person.

```
[[gokg@ssh ~]$ g++ 150110029.cpp
[[gokg@ssh ~]$ ./a.out input.txt
 (B) Glen F 29
 -(B) Dane F 14
 --(B) Blair F 11
 ---(R) Alex M 13
 ---(R) Casey F 35
 --(B) Evan M 18
 ---(R) Fran M 30
 -(R) Leah F 23
 --(B) Izzy M 27
 ---(B) Hayden M 28
 ---(B) Jude F 26
 ----(R) Kelly F 24
 --(B) Naomi F 21
 ---(B) Morgan M 22
 ---(R) Ryan F 17
 ----(B) Parker M 19
 -----(R) Ogden M 20
 -----(R) Quinn M 18
 ----(B) Taylor F 14
 -----(R) Shane M 16

5th adult: Hayden
3rd non-adult: Dane
[gokg@ssh ~]$ █
```