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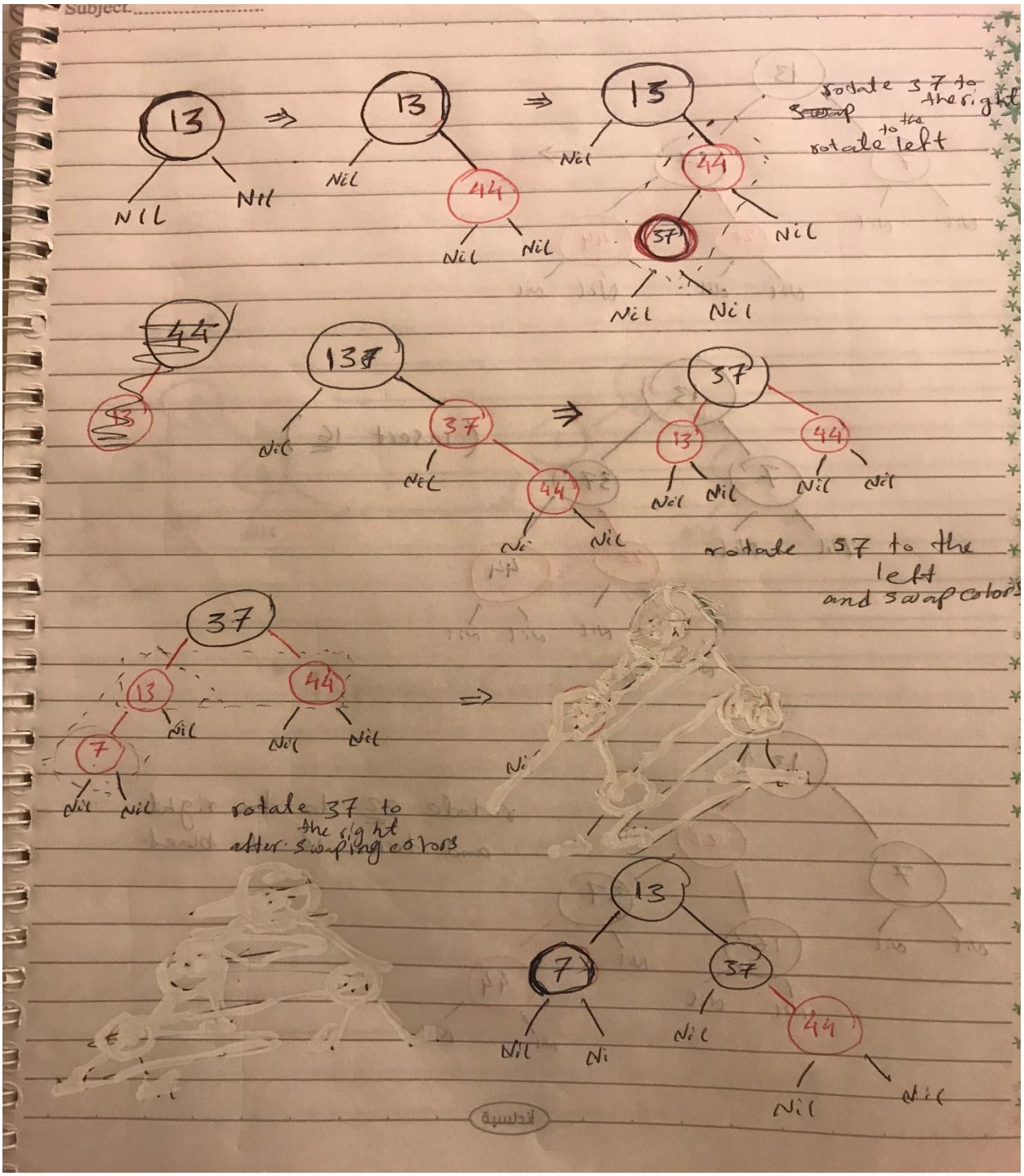
Question 1:

a)



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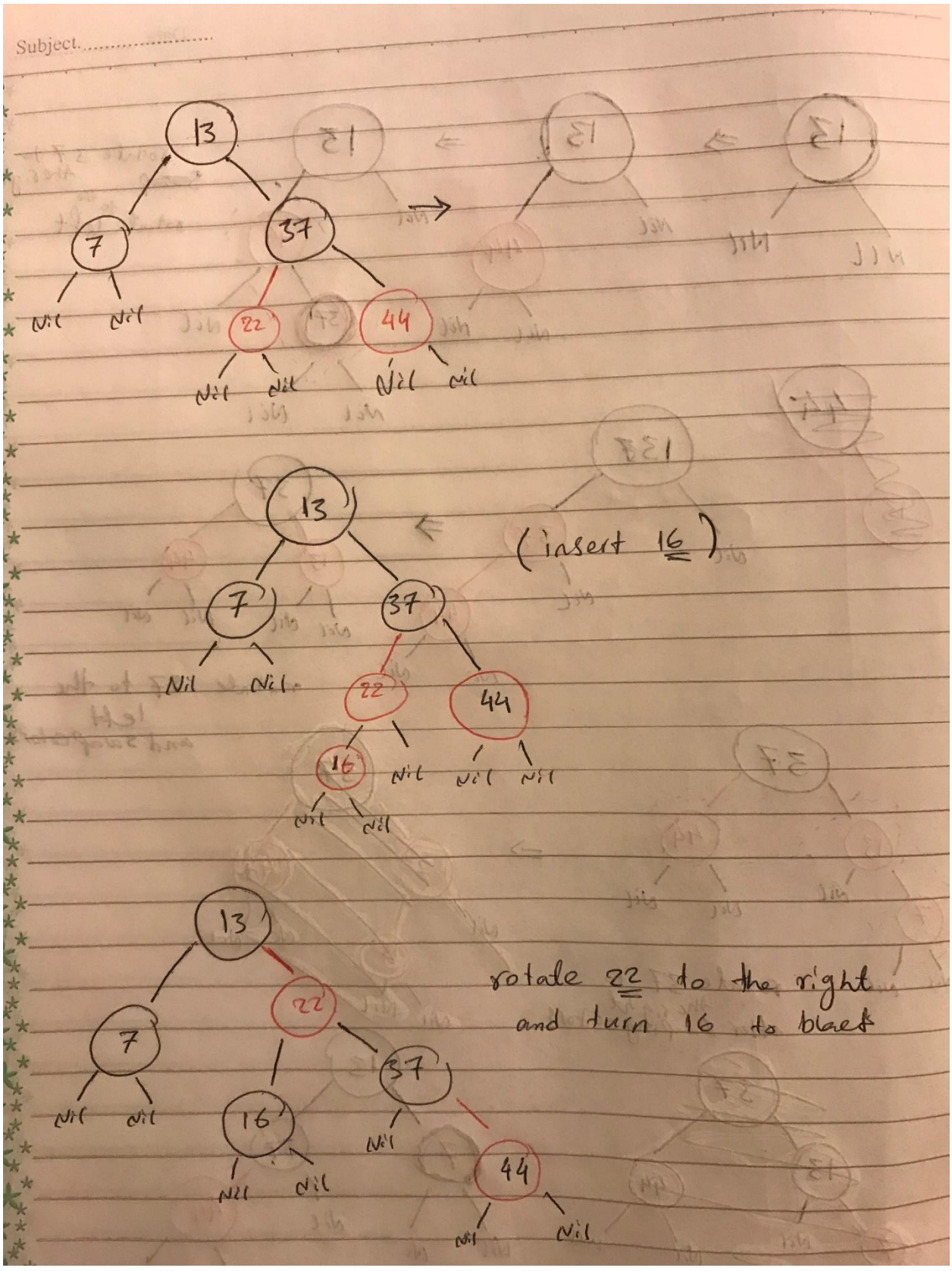

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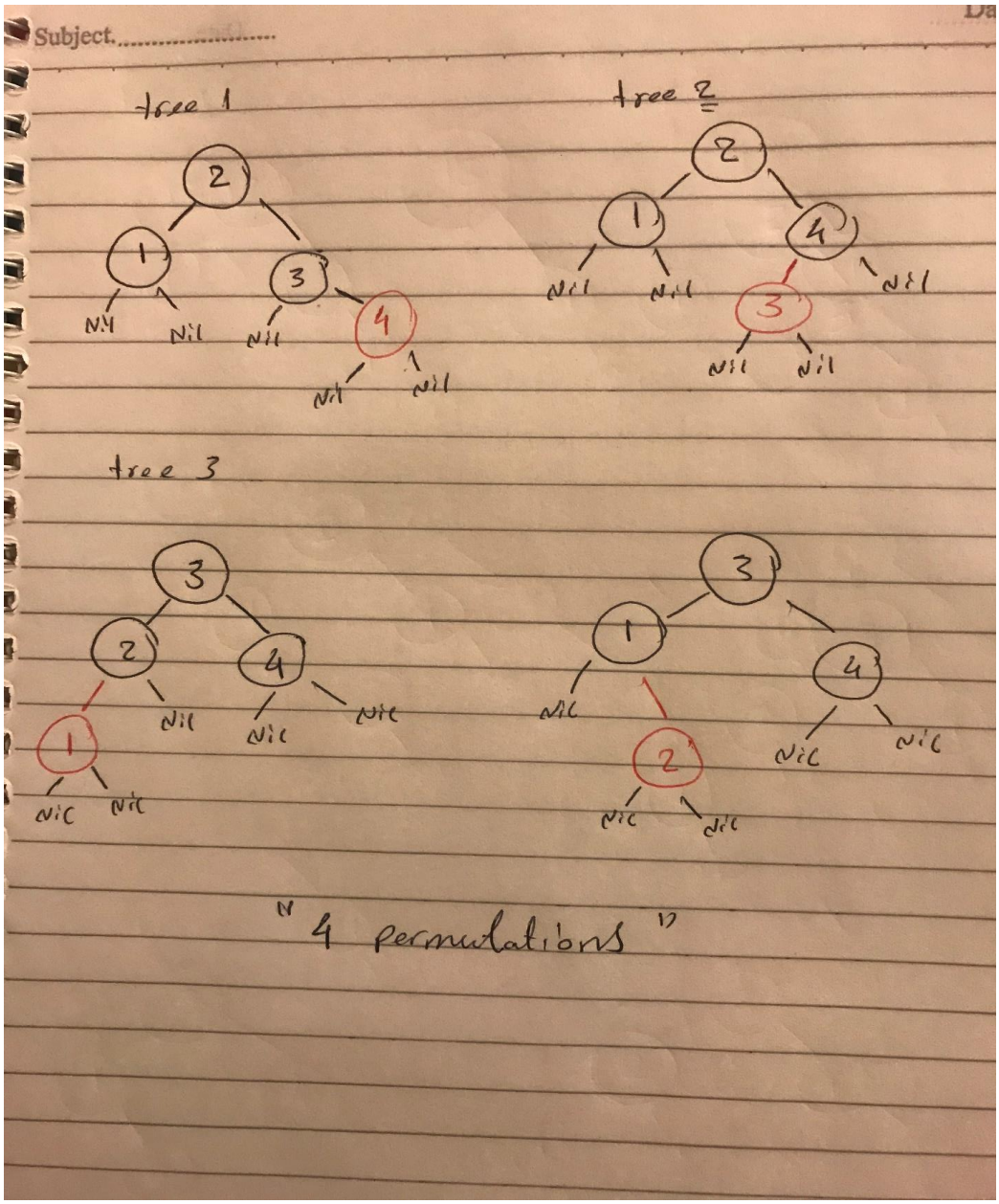
Question 1

b)



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Bonus question (C)

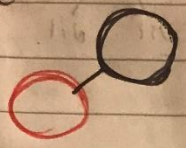
Subject. Question 1 Date.

(C)

assume that a red-black tree has K nodes
when $1 < n \leq K$

Base case

the root node is black with a red child

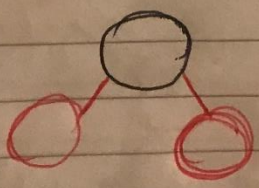


after the insertion of the root node and the first redchild we have two options:

* insert a child of the red node or insert a child of the black root node
using the same method of insertion on the slides

Case1 insert a red node as a child of the red node - we do the right rotation and we swap colors, So we have one black node and two red children

Case2 insert a red node as a child of the black root. in this case, the tree will be balanced.



So, for $n > 1$, we will always have at least 1 red node.

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References :

The slides for lectures 13,14,15

Book: Introduction toAlgorithms and Data Structure