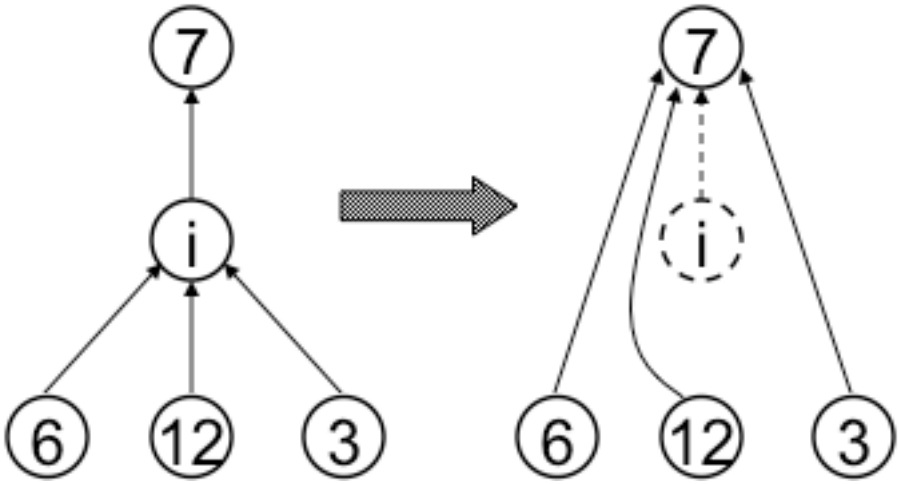
CS 410/586: Quiz 4, 19 April 2011 Name:_____KEY_____

No books or notes. Work individually.

Prof. Fumble claims he has a method to support DELETE's in the tree-structured UNION-FIND algorithm in a way that allows a sequence of n operations (UNION, FIND and DELETE) in $O(n\,G(n))$ time. His method is described by the following pseudo-code and figure.

DELETE(i)
for each child c of the node for i
    Parent(c) ← Parent(i)
remove the node for i.



You point out two problems with Prof. Mumble's method.

Question 1 (4 points): DELETE(i) won't work correctly for all items. Why?
The problem is if i is the root of a tree, then Parent(c) will be set incorrectly.
(Note the problem occurs whether "rootness" is indicated by Parent(i) = i or Parent(i) = nil.

Question 2 (6 points): A sequence of n operations might actually take $O(n^2)$ time. Why?
*The problem is the **for-each** loop. We don't have a way to find just the children of node i without iterating through all the nodes in the graph.*
[Note 1: I should have said $\Omega(n^2)$ time, since, for example, $n \cdot G(n)$ is in $O(n^2)$.]
[Note 2: There might be a way to build a specific shape of tree that takes a long time to do repeated DELETEs, but I haven't found one yet.]