CIS610, Homework 3 (Due: April 12, 2004)

Solve ALL the problems. Collaboration is prohibited

8 points total

Problem 1 (2 points) List the elements of the binary tree \( T \) (given below) in the following three orders: (1) preorder, (2) inorder, (3) postorder

```
        4
       / \  /
      3   1 7
     / \   / \  /
    5  2  9 10 11
   /  \ /  \
  8  13 15 14 12
```

Problem 2 (Tree-traversal in-place) (2 points) Assume a binary tree \( T \) is given with links \( \text{LeftSon}(v) \), \( \text{RightSon}(v) \) and \( \text{Father}(v) \) for each node \( v \) and the data stored in the node \( v \) is \( \text{Info}(v) \). The root-node is denoted by \( R \). The tree representation is read-only. The empty node is denoted by \( \text{NULL} \). Describe an algorithm which works in linear time and in-place (uses small memory, only few additional simple variables, no additional array, no stacks and no recursion) and prints the elements of the binary tree \( T \) in postorder. Write the algorithm in a pseudo-code.

Problem 3 (2 points)
A (potentially unbalanced) binary search tree \( T \) is a binary tree in which each left son contains a key which is smaller than its father and each right son contains a key which is greater than its father and there are no special requirements on the height and the structure of \( T \). We say that two permutations of numbers \( 1, 2, \ldots, n \) are \emph{bst-equivalent} if the same (not necessarily balanced) binary search tree results after inserting (using the method from the class) the numbers in orders corresponding to any of these permutations. Compute the number of all permutations which are \emph{bst-equivalent} to the permutation

\[
6 \ 2 \ 7 \ 1 \ 4 \ 8 \ 3 \ 5 \ 11 \ 10 \ 12
\]

Write the basic steps of your computation.

Problem 4. (AVL-trees) (2 points)

Draw AVL-tree which results after inserting elements

\[
3, \ 10, \ 9, \ 8, \ 7, \ 11, \ 1, \ 15, \ 6, \ 5, \ 12, \ 4, \ 13, \ 2, \ 14, \ 16
\]

(in this order) into initially empty tree using algorithm from the class. Write the last 5 stages.