

AAGB (TD5) - Nearest Neighbor Interchange

December 16, 2020

1 Introduction

1. How many nodes does an n -leaf rooted tree contain? How many edges?
2. Show that for n sequences / leaves, there are $(2n-3)!! = 1 \cdot 3 \cdot \dots \cdot (2n-3)$ possible rooted trees.
3. How does this change if the tree is non-rooted instead?

2 The Nearest Neighbor Interchange Algorithm

1. Given T a non-rooted tree, give the three possible ways to combine the 4 subtrees linked with a given edge E of this tree. Infer from this how many non-rooted trees one can generate this way, from a given n -leaves tree.
2. Let T be a non-rooted tree with n leaves. We define the “nearest neighbors” as the set of trees that can be built by exchanging of subtrees, for each internal node. For a tree with 5 leaves, how many elements are in a neighborhood?
3. Let's consider a 5-leaf tree (A,B,C,D) . How many non-rooted trees is it possible to generate? How many internal edges?
4. What is the principle of the NII algorithm? What is its use? Deduce an explanation of the following graph. One can for example start from the tree circled in red. Does the NII algorithm give the best possible tree?

