

6th Exercise Sheet

Advanced Algorithms (WS20)

Exercise 1 – Maximum agreement forest

For the definition of an agreement forest of two phylogenetic trees T and T' , we required that the roots of T and T' are labeled ρ . Show why this requirement is necessary for the equality $m(T, T') = d_{\text{SPR}}(T, T')$ to always hold. **6 Points**

Exercise 2 – Common subtree reduction

Let T and T' be two phylogenetic trees on $X = \{1, 2, 3, \dots, n\}$. Give an efficient algorithm to exhaustively apply the common subtree reduction to T and T' . **7 Points**

Exercise 3 – Nearest neighbour interchange

The rearrangement operation *nearest neighbor interchange (NNI)* transforms one phylogenetic tree into another one as illustrated in Figure 1. Note that NNI is a restriction of SPR. Determine the size of the neighbourhood of a phylogenetic tree T on n leaves under NNI, that is, the number of trees that can be reached from T by applying one NNI operation. **7 Points**

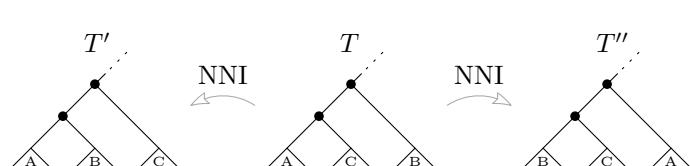


Figure 1: How an NNI operation can transform a phylogenetic tree T into a phylogenetic tree T' or T'' . The triangles labeled A , B , and C represent different pendant subtrees.

This assignment is due on December 14 at 10 am. Please submit your solutions via WueCampus. The exercises will be discussed in the tutorial session on December 14.