University of Helsinki
Department of Computer Science

Intensive Course on Genome Rearrangements, Winter 2018

Dr. Daniel Dörr

Exercises

Exercise 03, 10.01.2018

1. Given permutations $\pi = (1\ 3\ 5\ 6\ 4\ 2)$ and $\sigma = (2\ 6\ 1\ 4\ 5\ 3)$, calculate $\tau = \pi \circ \sigma$. What is the minimum cycle decomposition of τ?
2. Consider the algebraic distance $ad(\pi, \sigma) := \|\sigma\pi^{-1}\|$. Calculating genome rearrangement distances, convention often dictates to sort towards identity, i.e., one is usually interested in the distance $ad(\pi) := ad(\pi, \mathbf{id})$, where $\mathbf{id}$ is the identity permutation. Given any two permutations π and σ, what would be the permutation τ such that $ad(\tau) = ad(\pi, \sigma)$?
3. Given permutations $\pi = (1, 4)(7, 3, 5, 6)$ and $\sigma = (1, 6)(2, 3)(5, 7)$ in *cycle notation*. Calculate $\tau = \pi \circ \sigma$. What is the normal representation of permutation τ?
4. Given two genomes $\pi = (1, 4)(2, 3)(7, 8, 5)$ and $\sigma = (3, 6, 2, 1)(8, 4)$,
   (a) compute the algebraic distance $ad(\pi, \sigma)$,
   (b) find an optimal rearrangement scenario transforming π into σ,
   (c) draw the cycle graph for all steps of your rearrangement scenario from (b) and indicate the corresponding fusions, fissions, and transpositions of your scenario.

Discussion of solutions in tutorial on 11.01.2018 10:15-11:45 AM