Bielefeld University
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Algorithms for Genome Rearrangement

Summer 2017

Exercises

Exercise 05, 19.05.2017

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 P)

2. In the first lecture, we defined the unsigned reversal distance $rd(\pi, \sigma)$, but quickly simplified the notation to $rd(\pi) := rd(\pi, id)$, where id is the identity permutation. By this convention, we always sort towards the identity, which, among others, also simplifies the construction of breakpoint graph $BG(\pi)$. Given two permutations $\pi \neq id$ and $\sigma \neq id$, what would be the permutation τ such that $rd(\tau) = rd(\pi, \sigma)$? (3 P)

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? (2 P)

4. Given two genomes $\pi = (1, 4)(2, 3)(7, 8, 5)$ and $\sigma = (3, 6, 2, 1)(8, 4)$, (3 P)

   (a) compute the FFT distance $ad(\pi, \sigma)$ (also known as algebraic distance),

   (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.

Hand in solutions before tutorial on 26.05.2017