Exercises – Algorithms for Genome Rearrangement

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http://wiki.techfak.uni-bielefeld.de/gi/Teaching/2015summer/gr

Exercise List 1 – 13.04.2015

Hand in exercises by: 20.04.2015

Exercise 1 **(1 Point)**

Consider the permutation $\pi = (\ 4\ \ 5\ \ 6\ \ 1\ \ 2\ \ 3\ )$.

(a) Sort π, showing at each step the number of breakpoints.

(b) Is your solution optimal? Why?

Exercise 2 **(2 Points)**

You have a biologist friend that wants to compare a genome with 2 chromosomes, for instance, $(\ 1\ \ 4\ \ 2\ )$ and $(\ 3\ \ 5\ \ 6\ )$, with another genome, that has chromosomes $(\ 1\ \ 2\ \ 3\ )$ and $(\ 4\ \ 5\ \ 6\ )$.

(a) Only using what know about reversals, how would you find the rearrangement distance between these genomes?

(b) Is there any kind of multichromosomal operation that was "artificially" included in your algorithm?

Exercise 3 **(2 Points)**

A *signed permutation* is similar to a normal permutation, but each element now can have either a positive or a negative sign (positive signs can be ommited). For instance, $\pi = (\ -2\ \ \ 3\ \ \ 4\ \ -6\ \ -5\ \ \ 1\ )$.

(a) How would you adapt the concept of breakpoints, increasing and decreasing strips to signed permutations?

(b) Using this adapted concepts, can you sort the signed permutation π above?

Exercise 4 **(3 Points)**

Kececioglu and Sankoff proved the following theorem:

Theorem: Let π be a permutation with a decreasing strip. If every reversal that removes a breakpoint of π leaves a permutation with no decreasing strips, π has a reversal that removes two breakpoints.

(a) Give an example of a such a permutation π satisfying this theorem, also finding the reversal that removes two breakpoints.

(b) Try to prove for this theorem, or at least give a "sketch" of a proof, using the example in the previous item.