Bielefeld University
Faculty of Technology

Algorithms in Comparative Genomics, Winter 2018/19

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Exercises

Exercise 02, 25.10.2018

1. Given permutation $\pi = (\ 2\ 1\ 3\ 5\ 4\ )$, (4 P)
   (a) calculate the reversal distance $srd(\pi)$
   (b) find a sorting scenario, i.e. a sequence of reversals $\rho_1, \cdots, \rho_d$ such that $\pi \circ \rho_1 \circ \cdots \circ \rho_d = \mathbf{id}$ and $srd(\pi) = d$.

2. Removing hurdles can require a *cycle merge reversal*, that is, a reversal is defined by two reality edges of two different cycles. The reversal merges the two cycles into one. Prove that this new cycle is always oriented. (4 P)

3. Develop a linear time algorithm to count the number of cycles in a graph whose vertices have all degree 2. (4 P)

4. Is the problem of computing the reversal distance for unsigned permutations simpler than that for signed permutations? Study the breakpoint graph for unsigned permutations to derive your arguments. (4 P)

   The breakpoint graph $BG(\pi)$ for an unsigned permutation π is constructed analog to that of a signed permutation, except that each element of π is not represented by two vertices, but one:

   Definition *The* breakpoint graph *of an unsigned permutation π with n elements is the graph $BG(\pi) = (V, E)$ whose vertex set is $V = \{0, \ldots, n+1\}$ and whose edge set E is the union of two hamiltonian paths $R = \{\{\pi_i, \pi_{i+1}\} \mid 0 \leq i < n\}$ (reality edges) and $D = \{\{i, i+1\} \mid 0 \leq i \leq n\}$ (desire edges) that both cover all vertices of V.*

Discussion of solutions in tutorial on 08.11.2018