Algorithms in Comparative Genomics

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https://gi.cebitec.uni-bielefeld.de/teaching/2024summer/cg

Exercise sheet 12, 28.06.2024

Exercise 1 (Computing IMin) (5 pts)

Develop an $O(n)$ algorithm for finding the bounds of intervals $IMin[p_i]$ for all p_i in a permutation p of size n. (Suggestion: Find the left and right bounds separately. You find a hint (almost a spoiler) in Algorithm 2 in Bergeron et al. "Computing common intervals of K permutations with applications to modular decomposition of graphs", SIAM J. Descrete Math., 2008)

Exercise 2 (Generators for common intervals) (5 pts)

For the permutation $(4\ 3\ 2\ 1\ 5\ 6\ 7)$,

1. compute $IMin$ and $IMax$,
2. compute generator $(R, L) = (Sup, Inf)$,
3. visualize the intervals $(i..R[i])$ and $(L[i]..i)$, and
4. add pointers to indicate $Support$.

Exercise 3 (Combining generators) (3 pts)

Prove (in your own words) the following lemma:

Lemma. *Let* (R_1, L_1) *and* (R_2, L_2) *be generators for common intervals of two sets* $\mathcal{P}_1$ *and* $\mathcal{P}_2$*. The pair* $(\min(R_1, R_2), \max(L_1, L_2))$ *is a generator for the common intervals of* $\mathcal{P}_1 \cup \mathcal{P}_2$*.*

Note that $\min(R_1, R_2)$ at position i is defined as $\min(R_1[i], R_2[i])$ and $\max(L_1, L_2)$ is defined analogously.

Exercise 4 (Commuting intervals) (2 pts)

Find five different commuting collections $\mathcal{C}_i$ of intervals over id_4 with $|\mathcal{C}_i| = 7$. (Hint: Do not forget the trivial intervals.)