

# Algorithms in Comparative Genomics

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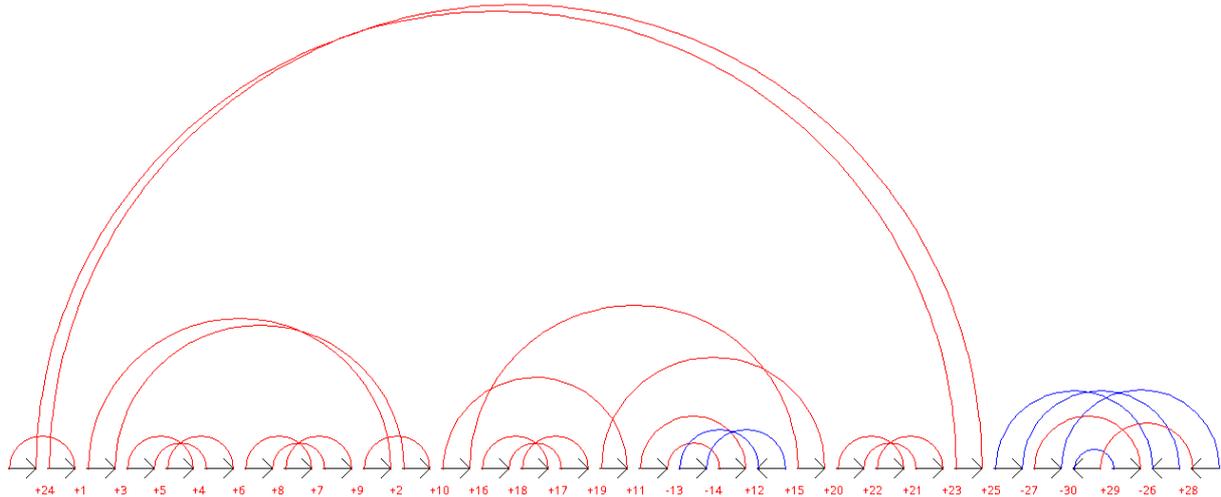
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Exercise sheet 7, 07.06.2024

## Exercise 1 (Component Tree)

(6 pts)

Consider this breakpoint diagram for two genomes  $\mathbb{A}, \mathbb{B}$ .



1. Draw the component tree  $T_P$ .
2. What is pruned component tree  $T'$ ?
3. Calculate the Inversion distance for this pair of genomes.
4. Find a series of optimal reversals, such that all components in the breakpoint graph are good.

## Exercise 2 DCJ-Indel Relational Diagram

(4 pts)

Consider the following pair of genomes:  $\mathbb{A} = \{[1\ 2\ 3], [4\ 5], [6]\}$ ,  $\mathbb{B} = \{[\bar{1}\ 7\ 3][\bar{4}\ 8\ 6][9\ 10]\}$ .

1. Draw the Relational Diagram for this pair of genomes.
2. How many paths of each type are there?

## Exercise 3 DCJ-Indel Basic Lemma

(2 pts)

Given a subset of components  $X$  (such as the set of  $P_{ab}$  paths), and a DCJ operation  $d$ ,  $\Delta_d(X) := |X| - |X'|$  is the difference between the set before and after  $d$  ( $X$  and  $X'$ , respectively).

What is the smallest  $k \in \mathbb{N}$  for which the following statement true?

For any subset of components  $X$  and DCJ  $d$ ,  $|\Delta_d X| \leq k$ .