

Algorithms in Genome Research
Winter 2020/2021

Exercises

Number 11, Discussion: 2021 February 05

1. Given two linear, unichromosomal genomes

$$A = [-2 \ 1 \ 3 \ 5 \ 4 \ 6 \ -12 \ -11 \ -9 \ -10 \ -8 \ 7]$$

and

$$B = [1 \ 2 \ 3 \ 4 \ 5 \ 6 \ 7 \ 8 \ 9 \ 10 \ 11 \ 12].$$

- What is the breakpoint distance between A and B ?
 - Draw the adjacency graph of A and B .
 - What is the DCJ distance between A and B ?
 - Give an optimal DCJ sorting scenario from A to B .
 - Name the operations in your sorting scenario. If it contains operations other than inversions and transpositions, find an alternative optimal DCJ sorting scenario that consists only of these two types of operations.
 - What is the inversion distance between A and B ?
2. How many different optimal DCJ sorting scenarios can you find for the following two linear genomes?

$$\begin{aligned} A &= [1] [4 \ 3 \ 2 \ 5] \\ B &= [1 \ 2 \ 3 \ 4 \ 5] \end{aligned}$$

3. Given the following linear genomes:

$$\begin{aligned} A &= [2 \ 1 \ x \ -4 \ 5 \ y \ -z \ -3] \\ B &= [1 \ 2] [3 \ 4 \ 5] \end{aligned}$$

Give a scenario sorting A into B with 4 DCJs and 1 indel.

4. Given three unichromosomal linear genomes

$$A = [1 \ 2 \ 3 \ 4 \ 5], \quad B = [2 \ 1 \ -5 \ -4 \ 3], \quad C = [2 \ 3 \ 1 \ -5 \ -4].$$

Compute an SCJ median of A , B and C . (Note that the median does not necessarily need to be unichromosomal linear.)

5. Consider the special case of Sorting By Reversals where only inversions of length two are allowed, called SB2R.
- Give an algorithm for optimal SB2R of an unsigned permutation.
 - Give an algorithm for optimal SB2R of a signed permutation.