Algebraic distance

- Definition: weight of a lightest series of operations that transform genome π into genome σ
- Recall: ρ is applicable to π when πρ is a genome
- Recall: weight of ρ = ||ρ||/2

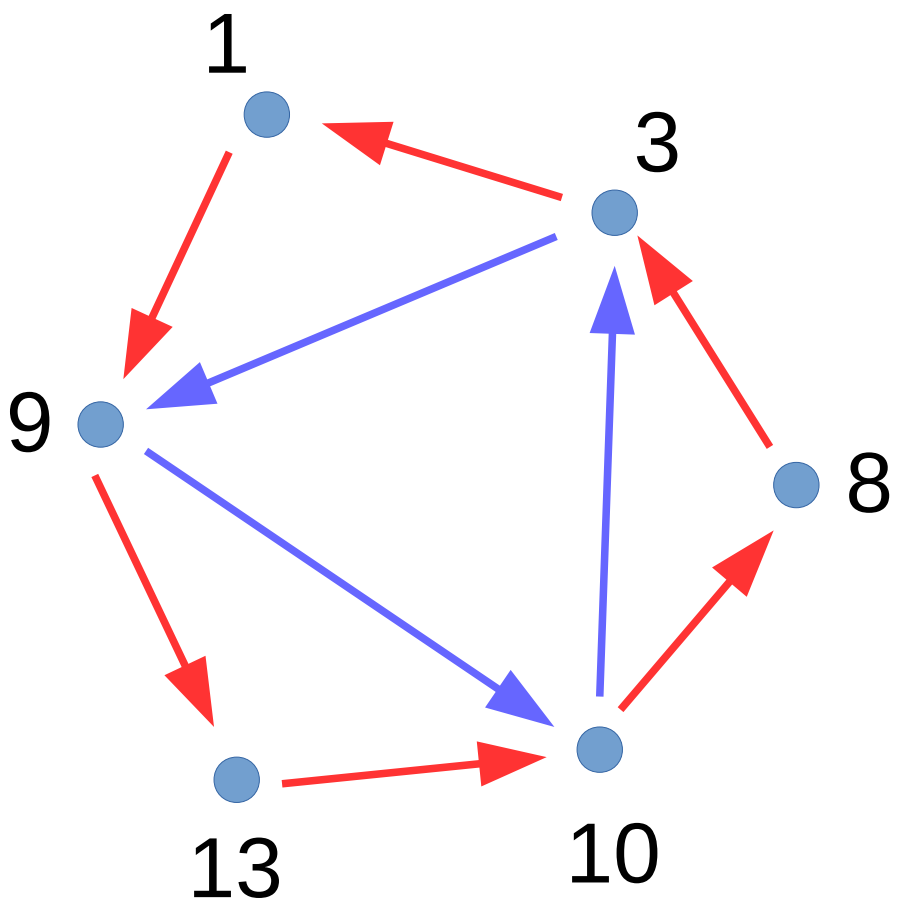
- $d_{alg}(\pi, \sigma) = ||\sigma\pi^{-1}||/2 = ||\pi\sigma^{-1}||/2 = ||\pi^{-1}\sigma||/2 = ||\sigma^{-1}\pi||/2$

- $d_{alg}(\pi, \sigma) = ||\sigma\pi||/2$ in adjacency algebraic

Finding sorting operations

- Compute $\sigma\pi^{-1}$
- Find a cycle μ dividing $\sigma\pi^{-1}$
- If μ and $\pi\mu^{-1}\pi^{-1}$ are disjoint, then $\rho = \mu\pi\mu^{-1}\pi^{-1}$ is a sorting operation on π

Cycles dividing cycles



Weights of classical operations

- Reversals, translocations, circular fusions, circular fissions: 2-breaks
- 2-breaks are of the form $\mu\pi\mu^{-1}\pi^{-1}$ for μ a 2-cycle
- 2-breaks have weight = 1
- Linear fusions, linear fissions, circularizations, linearizations: weight = 1/2

Relationship with DCJ

- Adjacency graph AG(π, σ)
- $d_{alg} = N - C - P/2$
- $d_{DCJ} = N - C - P_{odd}/2$
- Warning: P_{odd} in AG is not the same as P_{odd} in BG (breakpoint graph)

Linear chromosomes

- Chromosomal algebraic representation
- Circular chromosomes:
  - two cycles
  - each one is the reverse complement of the other
- Linear chromosomes:
  - one cycle
  - the cycle is self-reverse-complementary

Algebraic structure of operations

- Linear fission / linearization: ρ = (-u v)
  - u, v consecutive blocks
- Linear fusion / circularization: ρ = (u v)
  - u, v telomeres being linked

Algebraic structure of operations

- Reversal: ρ = (-u -v)(w x)
  - v, w consecutive blocks; u, x consecutive blocks
  - same chromosome, different strands
- Circular fission / excision: ρ = (-u -v)(w x)
  - v, w consecutive blocks; u, x consecutive blocks
  - same chromosome, same strand

Algebraic structure of operations

- Circular fusion / translocation: ρ = (-u -v)(w x)
  - v, w consecutive blocks; u, x consecutive blocks
  - different chromosomes, same type
- Circular reabsorption: ρ = (-u -v)(w x)
  - v, w consecutive blocks; u, x consecutive blocks
  - different chromosomes, different type

Algebraic structure of operations

- Transposition: ρ = (-u -v -w)(x y z)
  - u, z; v, y; w, x consecutive blocks
  - same strand, same order
- Block interchange: ρ = (-u -v)(w x)(-y -z)(p q)
  - v, w; y, q; u, x; z, p consecutive blocks
  - same strand, same order