Sorting by Block Interchanges

- Unichromosomal genomes
- Block interchange (BI): swap two blocks
- Blocks not necessarily adjacent
- If blocks are adjacent: transposition

  bid(π) = min. # of BI needed to “sort” π

- Never exchanges strands: “positive” perms only

Minimal block interchange

Blue = “inplace” (sorted)

- π = [1 2 3 ...]
- x = smallest value “out of place”
- π = [1 2 3 ... x-1 ... ... x ...]
- y = largest value between x-1 and x
- π = [1 2 3 ... x-1 ... y ... x ... y+1 ...]
- exchange: ... x-1 ... y ... x ... y+1 ...]
- $\overline{\pi}$ = [1 2 3 ... x-1 x ... ... y y+1 ...]

Effect on cycles

- Breakpoint graph
- Minimum BI always increases # of cycles by 2
- On the other hand, no BI can add more than 2
- Therefore, minimal BI is always sorting
- Leads to optimal series of operations

$$bid(\pi) = (n+1 - c(\pi)) / 2$$

Algorithms

- O(n) to compute distance (DFS-like)
- O(n^2) to obtain optimal series of operations