Genomes and Games
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Background
- Ciliates are one-celled organisms with encrypted copies of their genomes.
- Ciliates decrypt these copies using context-directed reversals (CDR) and context-directed swaps (CDS).
- We use game theory to study the CDR and CDS sorting process on permutations.

CDR and CDS Games
- Ciliate sorting operations applied to permutations produce fixed points that need not be desired sorting outcome - Figure 1.
- Two-player games model this dynamic of ciliate sorting operations.
- Desired sorting outcomes are assigned to player ONE, the rest to TWO.
- ONE and TWO alternately apply a ciliate sorting operation.
- ONE wins a play if the fixed point reached is as desired. Else, TWO wins.

Objective
- Understand the mathematical aspects of DNA sorting
- Determine which player has a winning strategy in CDS and CDR games

CDR and CDS

CDR
- Pointers \((i,i+1)\) are used to make moves.
- Let \(\alpha = \{2,3,\} -1, -4, -\}
- 2 and 3 have opposite sign in \(\alpha\).
- So CDR \((2,3)\) can be done to \(\alpha\), resulting in:
- \([4,1,3,2,5]\)

CDS
- Let \(\beta = \{2,3,\} 6, 2, 4, 5, 6, 1\)
- The pointers \((2,3)\) and \((5,6)\) overlap in \(\beta\), and \(2, 3, 5, 6\) all have the same sign.
- So CDS \((2,3),(5,6)\) can be done to \(\beta\), resulting in:
- \([4,5,6,2,3,1]\)

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