

MATH 19-01: PRACTICE PROBLEMS FOR EXAM 2

TUFTS UNIVERSITY DEPARTMENT OF MATHEMATICS
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- (1) For any voting method of your choice, you can take the example below from HW7 and move O into first place column by column. First you change the column $PMNO \rightarrow POMN$ moving O into second place, then $POMN \rightarrow OPMN$ moving O into first. If that doesn't flip the outcome, you move to the next column.

Without strong monotonicity, we can't be *sure* that the winner will switch from P to O at some point, but we can check and see if that happens. Let k be the column where the switch occurs from one winner to another. What is k for (a) Plurality with alphabetical tiebreaker? (b) Beatpath with alphabetical tiebreaker? (c) Borda with alphabetical tiebreaker?

#1	#2	#3	#4	#5
P	P	P	P	P
M	M	M	M	M
N	N	N	N	N
O	O	O	O	O

- (2) Prove that the Beatpath method is Condorcet-fair.
- (3) Explain why Beatpath has no weak spoilers.
- (4) Explain: if a preference schedule is changed by a move favorable to candidate H , what are all the ways that the pairwise comparison graph can change?
- (5) Explain: any system that is Pareto-efficient and strongly monotonic must also be unanimity-fair. (This justifies the use of the unanimity criterion in the proof of Müller-Satterthwaite.)
- (6) Practice one-shot and recursive rankings using questions 10 and 11 on the [Voting Handout](#).

Answers will be provided on Wednesday.