MATH 19-01: MATHEMATICS OF SOCIAL CHOICE

TUFTS UNIVERSITY DEPARTMENT OF MATHEMATICS
SPRING 2016

(1) Explain: if a 3-candidate election has two Smith candidates out of three, then there must be a tie in the pairwise comparison graph.

(2) Find a preference schedule and system for which there is a spoiler who is a Smith candidate. In your example, are they a winning spoiler? Losing spoiler? Weak spoiler?

(3) If there are $n = 10$ candidates, how many consolidations do you have to consider to run each of these methods?: plurality, runoff, elimination, Coombs, Borda, Smith, Smithified plurality, pairwise comparison, sequential, and dictatorship.

(4) What has to be true about a pairwise comparison graph for it to be helpful in checking whether a system is unanimity-fair? Supposing $N = 100$ voters and $n = 5$ candidates, draw an example of a PWCG with one unanimous preference, and explain what you would have to check about $\mathcal{W}$ if considering unanimity-fairness of your system.

(5) Build a preference schedule with a Condorcet candidate and a cycle.

(6) Build a preference schedule where nobody has 40% of the first-place votes, but there is some consolidation which produces a majority candidate.

(7) Explain: the runoff method is unanimity-fair.