Handed out 11/1/2021
Due 11/5/2021, midnight

You can refer to any class material and any online material, but can not ask questions on the Internet and can not discuss the problems with anyone other than the instructor. Please email a pdf to the instructor with the subject "MS&E 336/CS 366 midterm -- <your name>".

Problem 1: If you have not submitted problem 4 or problem 7 from the first hw then submit one of those two problems. Else, write a 200-300 word critical summary of the talk on gerrymandering, including a critique of the model and a statement of the results.

Problem 2: Recall that in the metric cost model, the distortion of candidate A with respect to candidate B (given a profile) is given by:

$$D(A,\ B)\ =\ max_{d:\ d\ is\ a\ consistent\ metric} \frac{\sum_v d(v,A)}{\sum_v d(v,B)}$$

where the summations are over all voters v.

Prove that if the given profile has a Condorcet winner C, then for any other candidate C', the distortion D(C', C) is at least 2.

Problem 3: (optional)
I am not sure what the answer is. It might be easy, or very hard! You can feel free to do this problem instead of both problems 1 and 2.

Using the definition above, define the distortion of a candidate A as

$$D(A)\ =\ max_B\ D(A,B)$$

where the max is over all candidates B. Consider the social choice rule that chooses the candidate C that has the minimum distortion. Prove that this social choice rule is Condorcet consistent, or give an example that proves otherwise.