Quiz 3A, Math of Democracy

Fall 2019, Dr. Adam Graham-Squire

Name: Key

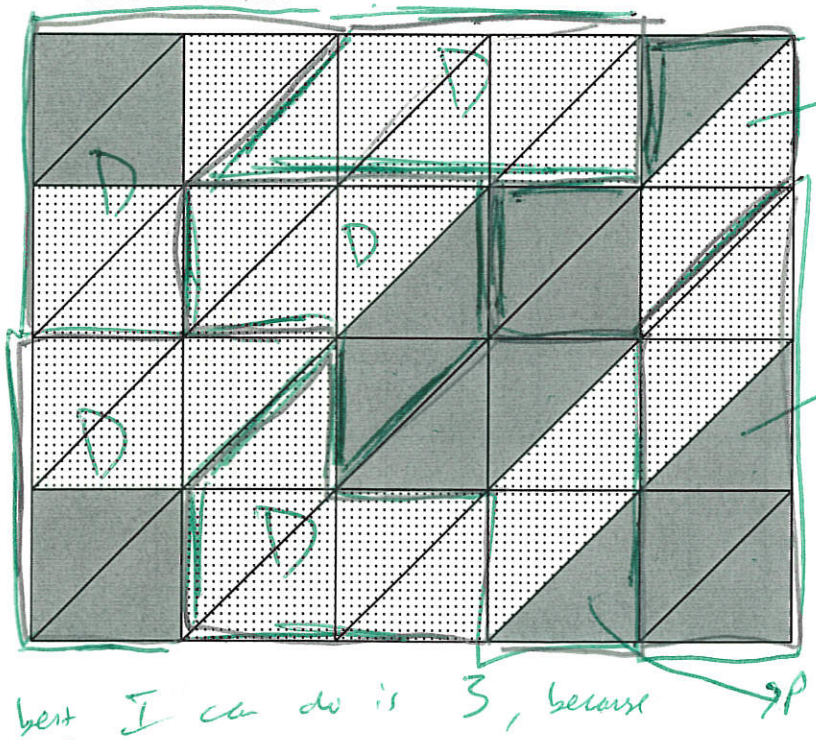
7:30 → 30 min

1. (5 points) Consider the state of Trunktopia below[1]. Each precinct is a triangle (40 total precincts), and the state must be divided into 8 equal-sized districts of 5 precincts each. The state is colored based on whether the Purple party or the Dot party has all of the votes in a given precinct.

   (a) Proportionally speaking, what would be a "fair" number of districts for the Purple party to win?

   (b) What is the *maximum* number of districts, theoretically, that the Purple party can win? Explain your reasoning.

   (c) Practically speaking, can you draw districts so the Purple party actually wins that many districts? Draw the *best* possible districts that you can for the Purple party, and either show that Purple can win their maximum number, *or* explain why Purple cannot achieve their maximum.



(a) Purple has $\frac{15}{40} = \frac{3}{8} = 37\%$ of the population, so they should win 3 districts.

(b) Theoretically, since it takes 3/5 precincts to win a district, Purple can win $\frac{15}{3} = 5$ districts!

(c) The best I can do is 3, because of the way the Purple blocks are distributed and needing to keep other districts contiguous

[1] this is where Ronan lived when he was one

3A Best

Quiz ~~3B~~, Math of Democracy

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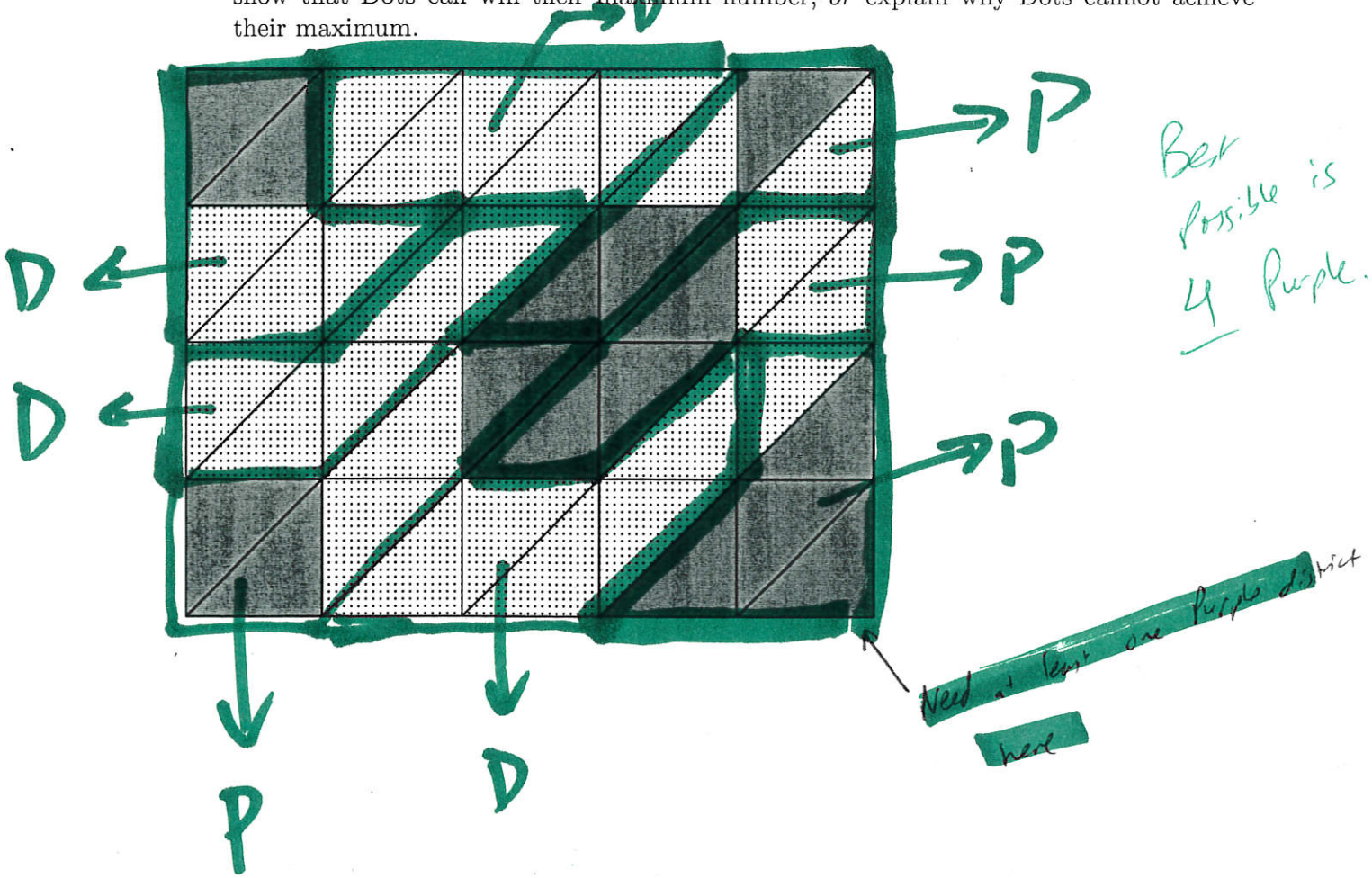
Name: _____

1. (5 points) Consider the state of Trunktopia below[1]. Each precinct is a triangle (40 total precincts), and the state must be divided into 8 equal-sized districts of 5 precincts each. The state is colored based on whether the Purple party or the Dot party has all of the votes in a given precinct.

   (a) Proportionally speaking, what would be a "fair" number of districts for the Dot party to win?

   (b) What is the *maximum* number of districts, theoretically, that the Dot party can win? Explain your reasoning.

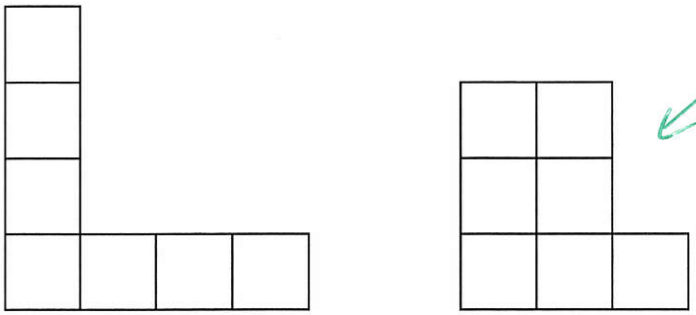
   (c) Practically speaking, can you draw districts so the Dot party actually wins that many districts? Draw the *best* possible districts that you can for the Dot party, and either show that Dots can win their maximum number, *or* explain why Dots cannot achieve their maximum.



[1] this is where Ronan lived when he was one

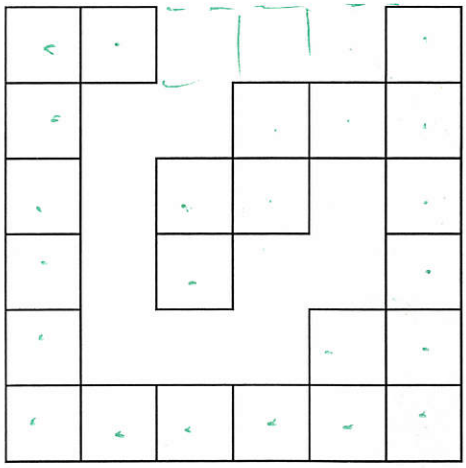
2. (5 points) Choose *two* of the three Compactness measures below (Skew, Square Reock, Polsby-Popper) and use the example districts (or keywords) to explain how/why that compactness measure can give less-than-desirable results.

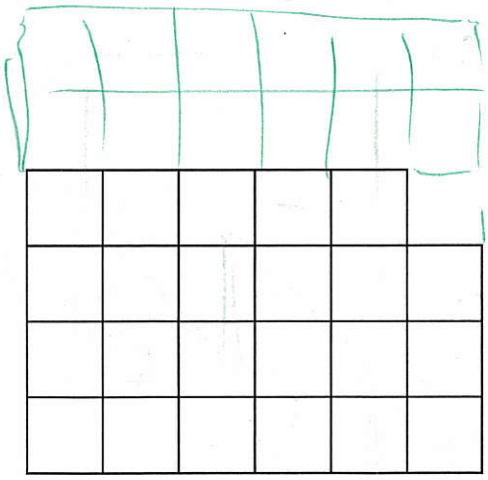
Skew examples:



Here this district seems more compact (like a square) than the L. But Skew gives both districts a perfect score of 1 ($\frac{4}{4}$ or $\frac{3}{3}$). So skew seems to be missing something.

Square Reock examples:





Both of these districts have A = 23 and S = 36 (6×6) so they have the same Reock score. But the second one looks way more compact than the snaky first one, and Reock does not differentiate between the two.

Real-world Polsby-Popper keywords: Coastlines or Rivers. (feel free to write on the blank back page if you need more space)