

## ***MUM\_TX Statement on SB4: Talking Points***

- Using ensemble analysis, mathematicians can now generate a large number of random, legally valid maps which can then be used as an unbiased baseline to understand what a typical map should look like.
- MathForUnbiasedMapsTX (MUM\_TX) performed such an analysis, generating over 600,000 TX Senate maps to compare with the proposed map S2168 (SB4)
- Their analysis shows that S2168 is gerrymandered along partisan and racial dimensions.

### Protecting incumbents from their voters

- S2168 artificially reduces the competitiveness of districts 10, 2, 9,8 and 12 (on the Republican side) and 16 and 14 (on the Democratic side) through “cracking and packing”.

### Partisan gerrymandering

- In S2168, if Republicans and Democrats split the vote 50-50, Republicans would win 19 seats and Democrats 12. In a typical unbiased map, Republicans would win 15 while Democrats would win 16.
- In S2168, Republicans win 16 seats with as little as 44% of the statewide vote; Democrats would need 56%. In a typical unbiased map, Republicans need 51% while Democrats need only 49%.
- Not a single map in the 600,000-member ensemble shows this level of bias towards Republican candidates

### Racial gerrymandering

- S2168 removes Black and Hispanic voters from districts where they form a narrow majority or a near majority, into districts where they will now have an overwhelming majority.
- This has the effect of decreasing the total number of districts in which Black and Hispanic voters have a majority (11 for the proposed map, vs. 12 or 13 for a typical member of the ensemble)

### *Finally...*

- There is no need to choose a gerrymandered map: literally \*hundreds of thousands\* of less biased maps can be found, and more can be generated in a matter of minutes!

## ***MUM\_TX Statement on SB4***

January 27, 2023

I am making these comments on behalf of ***Math For Unbiased Maps TX (MUM\_TX)***, an interdisciplinary, nonpartisan coalition of Texas mathematicians, political scientists and philosophers working to ensure a fair and transparent redistricting process. Our research concerns the development and application of ensemble sampling techniques, and in particular their application to the current TX redistricting cycle. In brief, we use *Markov Chain Monte Carlo* techniques to generate a large number of random, legally valid maps which can then be used as an unbiased baseline to understand what a typical map should look like. Conversely, when a proposed map is an outlier from the ensemble, this may be an indication of gerrymandering.

During the special session on redistricting in 2021, we applied our methods to every Senate map that has been made available by the Texas Legislative Council. For each map or amendment, we generated a table of two important statistics that are commonly used by political scientists to assess partisan gerrymandering: the mean-median score and partisan bias score. You can find the table at our webpage: [www.smu.edu/mumtx](http://www.smu.edu/mumtx).

We have also performed more detailed analysis for maps S2101, S2129, S2130, and now S2168 (which was passed by the TX Senate as SB4 on 10/6/21, and used in the 2022 election). We previously submitted comments on our analysis of S2101, and a comparison of S2129 and S2130.

S2168 is a highly gerrymandered plan that significantly reduces competitiveness of its districts. Instead of enabling voters to choose their legislators, therefore, it serves to protect those legislators from accountability to their voters.

The evidence of gerrymandering can be seen by comparing the proposed map against a collection – or *ensemble* – of over 600,000 randomly-drawn maps. Mathematicians call this process *ensemble sampling*, and it provides baseline expectations to which proposed maps can be compared. One piece of evidence is given by vote share vectors, in which districts are ordered by the number of votes a Democratic candidate for Texas Senate would have received in the 2020 election, had voters used “straight ticket” voting (See Figure 1 below). Here the blue “violins” illustrate the distribution of likely vote shares for a district with a given vote share ranking, along with its median (blue dot) and 1% and 99% quantiles (blue bars). On average, maps within our ensemble (blue dots) exhibit smoothly increasing vote shares as one moves from Republican-leaning to Democratic-leaning districts. This smooth increase is the hallmark of an unbiased map. But in the proposed map (red dots), the increase is highly disjointed, a clear sign of gerrymandering.

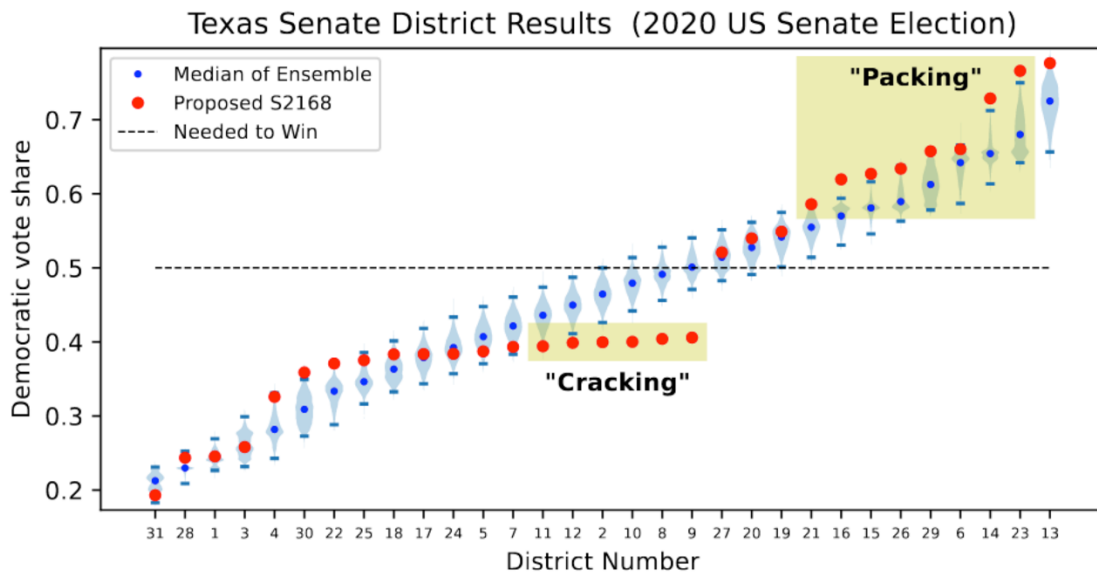


Figure 1: Vote share vectors for an ensemble of TX Senate plans generated randomly (blue violins) vs. the plan used in the 2022 election (red dots). Democratic vote share for each district was computed using the votes for US Senate in November 2020. Each blue violin also shows the median (blue dot) and 1% and 99% quantiles (blue bars) of the corresponding statistic. Results are similar if the Democratic vote share is computed using votes from the 2020 presidential election instead.

We note several specific features of the proposed plan (districts numbers are on the x-axis). First, Democratic voters are disproportionately removed from districts such as 12, 2, 10, 8, and 9 that would be competitive in an unbiased map (a process known as “cracking”), and placed into uncompetitive districts such as 16, 15, 14 and 23 (a process known as “packing”). Second, the list of outcomes between Districts 22 and 9 is very nearly flat, which is a hallmark of maps created with the assistance of computer algorithms designed to automate the gerrymandering process. Finally, the predicted vote share between districts 9 and 27 changes abruptly by about 10 points -- this represents a “wall” designed to protect legislators from changing voter opinions over time.

We also compute two common numbers that political scientists use to “score” maps. The first such number is called the “mean-median” score: the difference in statewide vote percentage each party would need to win the majority of the chamber. For the proposed map, the Republican Party would need to win only **43.9%** of the vote to win 16 seats, while the Democratic Party would need to earn **56.1%**; the difference of these numbers gives a “mean-median” score of **-12.2**. The second such score is called the “partisan bias” score: the difference in the number of seats each party wins if each were to earn 50% of the vote. For the proposed map, the Republican Party would win **19 seats** with 50% of the vote, while the Democratic Party would win only **12 seats**; the difference of these numbers gives a “partisan bias” score of **-7**.

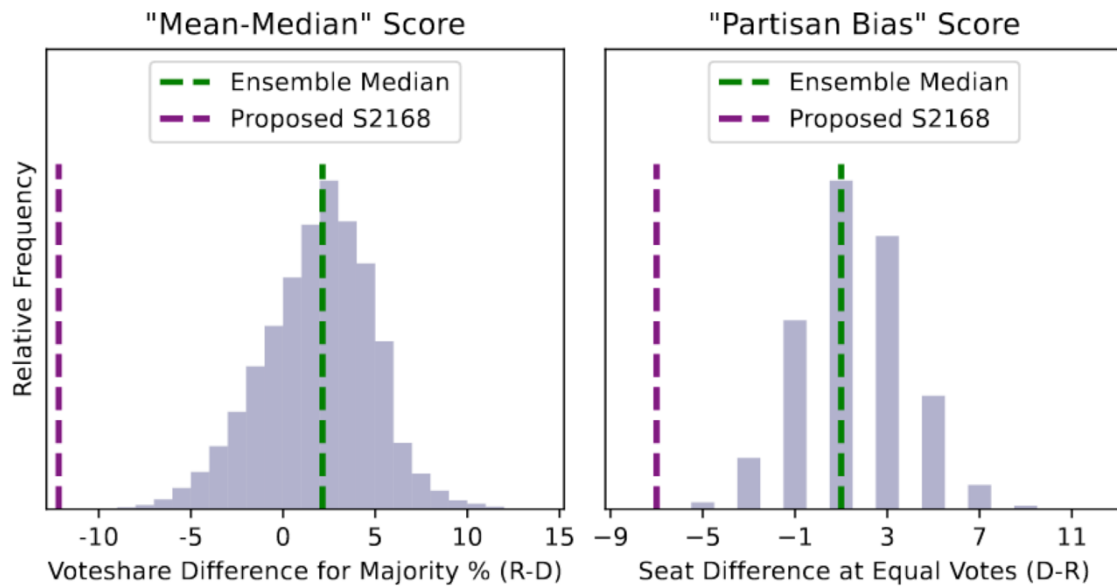


Figure 2: Distribution of mean-median (left) and partisan bias (right) for the random maps we generated (light blue) and for the map used in 2022 (purple). The ensemble median is also shown (green).

Of course, no plan is going to be perfectly aligned with the ensemble, so just how gerrymandered is this plan? A little? A lot? An extreme amount? This question can be answered using statistics, by comparing each score above to the *distribution* of those scores within the 600,000-map ensemble. Unfortunately, the results are disappointing (see Figure 2). Both the “mean-median” and “partisan bias” scores are very far from their typical values within an unbiased ensemble. In fact, the mean-median score for the proposed map was *\*more extreme than any value found in our ensemble\**; not a single map had a mean-median score as large. The partisan bias score for the proposed map was nearly the most extreme score we observed in our 600,000 ensemble; only **1 in 3,000** maps shared this score. Finally, **not a single map** in our 600,000-map ensemble exhibited this level of bias on *\*both\** metrics!

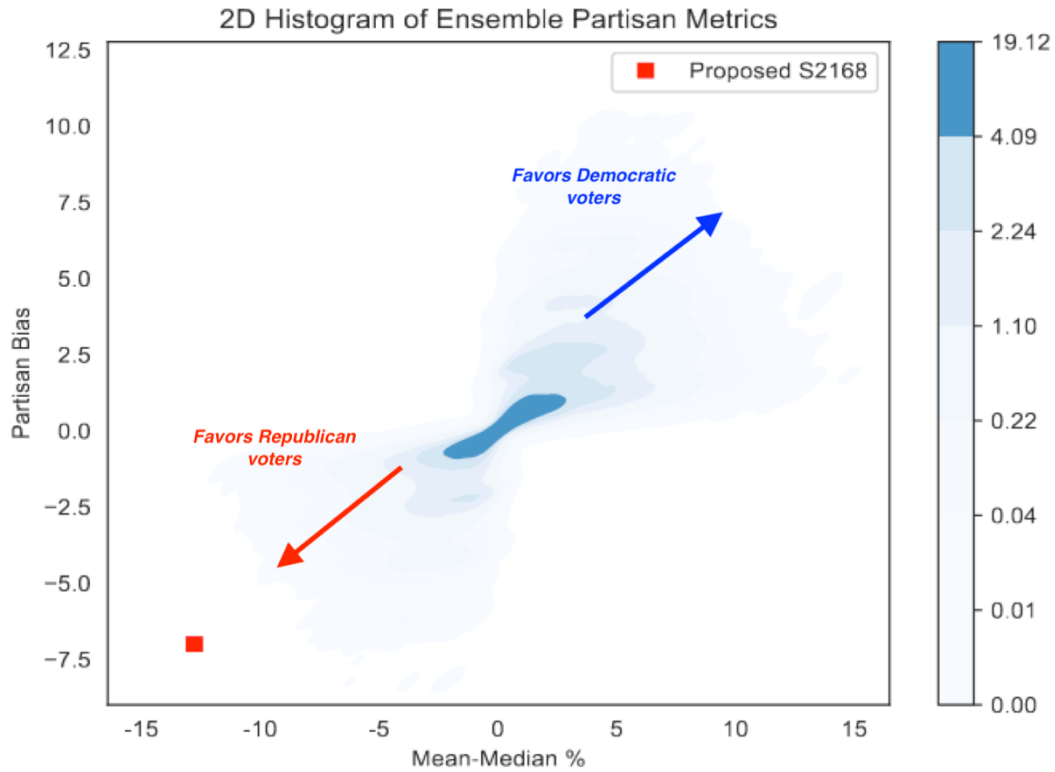
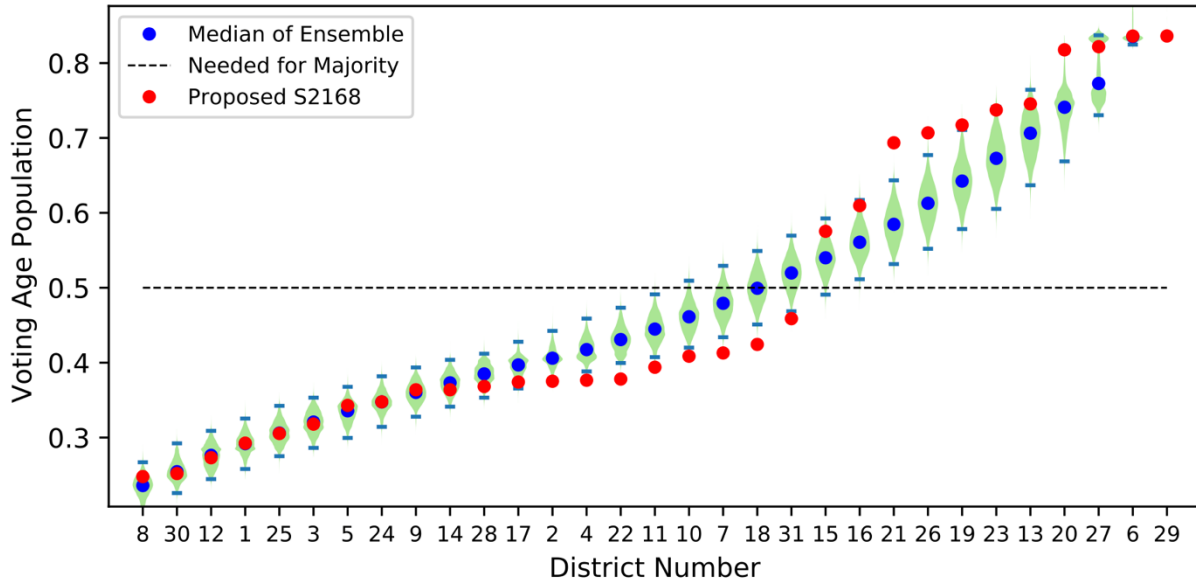


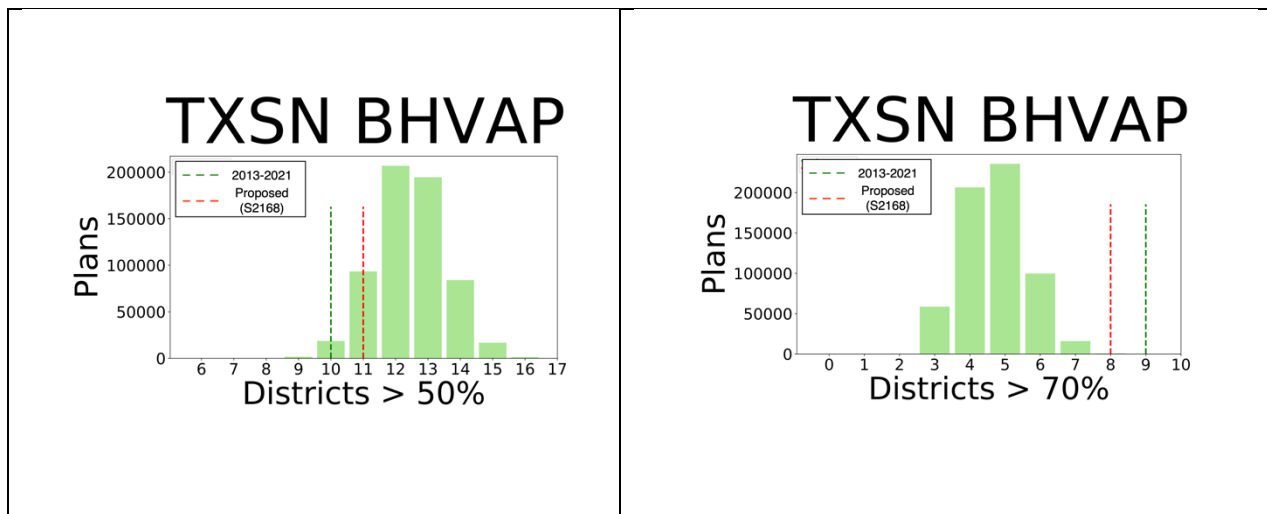
Figure 3: 2D Histogram of mean-median and partisan bias (partisan bias is integer-valued, so the plot has been smoothed for visualization). The blue shades reflect values that came from randomly generated maps. Points toward the lower left favor Republican voters; points towards to upper right favor Democratic voters. The overwhelming majority of maps we generated give no particular advantage to either party.

This is vividly illustrated by the 2D histogram showing the joint distribution of these scores across the ensemble (the plot has been smoothed for visualization, as partisan bias is integer-valued). Another evident fact from this histogram is that there is no good reason why the legislature must pick such a manipulated map; there are literally hundreds of thousands of maps that are less biased.

### Texas Senate District Results (Black+Hispanic)



In the next figure we present another “violin” plot, but with districts sorted according to the fraction of the voting age population that is Black + Hispanic. We clearly observe the same type of trend as in the sorting by parties: some districts (4, 22, 11, 10, 7, 18, and 31) all contain many fewer Black + Hispanic voters than would be expected from an unbiased map, whereas others (21, 26, 19) all contain many more Black + Hispanic voters than would be expected. The story is essentially identical to that observed above – SB4 removes Black and Hispanic voters from districts where they form a near majority, and their voices might influence election outcomes, into districts where they already form a large majority.

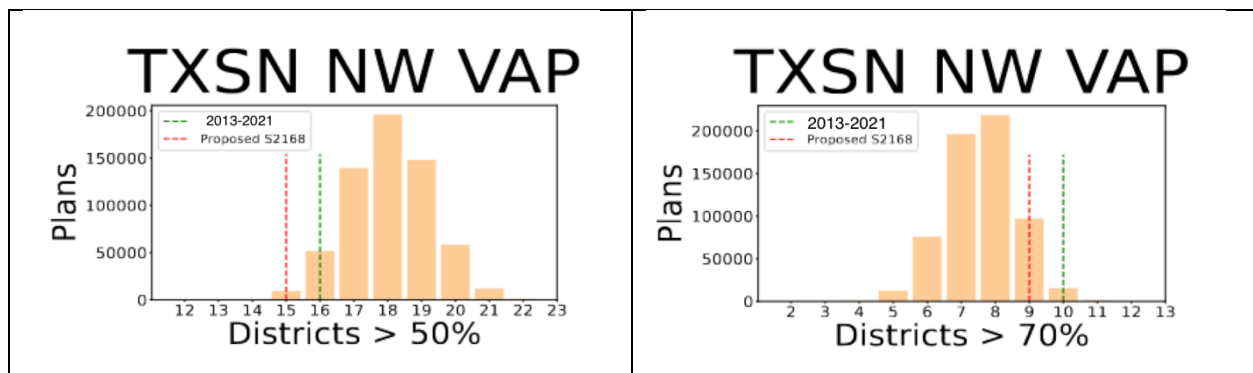


We illustrate this point by next asking, “How many Districts have an BHVAP over 50%?” (or 60%, or 70%, etc.). The BHVAP is the combined Black and Hispanic voting age population.

These histograms show the values for the ensemble. The values for the “Current” (green; this is the map used 2013-2021) and Proposed (red) maps are also shown (if you can only see one vertical line, then they are equal). Above, we show the number of districts that have BHVAP above 50% and 70%; that is the number of districts that are majority-minority, vs. the number of Districts that are *overwhelmingly* majority-minority. Here is what we observe:

- The number of majority-minority districts in both the 2013-2021 map (S2100) and Proposed (S2168) plan are lower than the typical value in the ensemble (10 or 11, vs. 12 or 13).
- The number of overwhelmingly majority-minority districts is higher than the typical value in the ensemble (8 or 9, vs. 4 or 5).
- This suggest that minority voters have been packed into a small number of districts, at the cost of reducing the total number of districts in which they may be able to elect representatives of their choice.

A similar pattern is in evidence is we compare the number of districts that are majority non-white (i.e. we also include Asian American (AAPI) and Native American/Alaskan Native voters). A typical unbiased map would have 18 districts with a majority of nonwhite voters; the current map has only 15.



In summary, S2168 fails Texas voters by gerrymandering along both partisan and racial dimensions. First, this map artificially reduces the competitiveness of several districts (10, 2, 9, 8, and 12 in particular). The map also inflates the advantage to the Republican Party, in comparison to a typical unbiased map; such a map is closely balanced between the parties (and more reflective of the views of actual Texas voters, who voted 54% to 46% in the 2020 election). Second, this map packs Black and Hispanic voters into a relatively small number of overwhelmingly minority districts, at the cost of reducing the total number of districts which effectively perform for minorities. We urge legislators to go back to the drawing board and return with a map that is fair to Texas voters.