

# Measuring Partisan Fairness

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## Michigan State Constitution Article IV, Section 6

13(d) Districts shall not provide a disproportionate advantage to any political party. A disproportionate advantage to a political party shall be determined using accepted measures of partisan fairness.

U.S. Constitution: equal population

Voting Rights Act of 1965

Contiguity

Communities of interest

No disproportionate advantage to any  
political party

No favoring or disfavoring incumbents  
or candidates

Consideration of county, city, township  
boundaries

Reasonable compactness

# Election Results

District	Party A	Party B	Total Votes	Percent of Votes	
				Party A	Party B
1	279	120	399	69.9%	30.1%
2	172	198	370	46.5%	53.5%
3	167	192	359	46.5%	53.5%
4	148	212	360	41.1%	58.9%
5	185	180	365	50.7%	49.3%
6	139	193	332	41.9%	58.1%
7	169	201	370	45.7%	54.3%
8	179	206	385	46.5%	53.5%
9	234	99	333	70.3%	29.7%
10	178	199	377	47.2%	52.8%
<b>TOTAL</b>	<b>1850</b>	<b>1800</b>	<b>3650</b>	<b>50.7%</b>	<b>49.3%</b>

- 10 districts of equal populations – 500 persons per district.
- Turnout varies some across the 10 districts, from 332 to 399 voters.

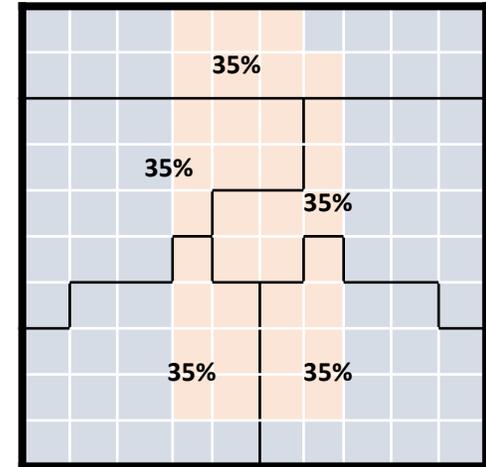
# Comparing Votes to Seats

District	Party A	Party B	Total Votes	Percent of Votes	
				Party A	Party B
1	279	120	399	69.9%	30.1%
2	172	198	370	46.5%	53.5%
3	167	192	359	46.5%	53.5%
4	148	212	360	41.1%	58.9%
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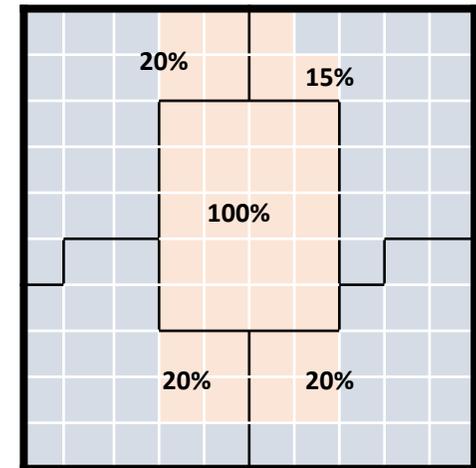
- Party A wins 3 seats (30%) with 50.7% of the vote
- Party B wins 7 seats (70%) with 49.3% of the vote
- Seats/Votes proportionality  
% of seats - % of votes
- Party A = 30% - 50.7%
- Proportionality bias = -20.7

# How is Partisan Bias Introduced?

- **Cracking** – spreading a party’s supporters across many districts relatively thinly so that their votes are all cast for losing candidates
- **Packing** – concentrating a party’s supporters into a few districts so that their votes will elect candidates with far more than 50% plus one vote threshold required to win



Plan that cracks Party A supporters across 5 districts



Plan that packs Party A supporters into single district

# Seats/Votes Scores

## 2012 State House Plan

DISTRICT	Composite Score				Dem	Vote Share	Count of Seats	Seat Share	Proportionality Bias
	Dem	Dem %	Rep	Rep %					
1	126,654	75.0%	42,298	25.0%	Rep	47.7%	60	54.5%	6.9%
2	124,080	74.6%	42,243	25.4%					
3	130,599	97.2%	3,723	2.8%					

## 2022 State House Plan (Hickory) pre-2022 elections

DISTRICT	Composite Score				Dem	Vote Share	Count of Seats	Seat Share	Proportionality Bias
	Dem	Dem %	Rep	Rep %					
1	99,424	92.6%	7,944	7.4%	Rep	47.7%	53	48.2%	0.5%
2	100,508	59.9%	67,280	40.1%					
3	102,026	78.5%	27,984	21.5%					

## 2022 State House Plan post-2022 elections

DISTRICT	Composite Score				Dem	Vote Share	Count of Seats	Seat Share	Proportionality Bias
	Dem	Dem %	Rep	Rep %					
1	114,464	92.4%	9,412	7.6%	Rep	47.1%	50	45.5%	-1.7%
2	120,260	60.5%	78,643	39.5%					
3	118,018	78.1%	33,097	21.9%					

# Lopsided Margins Test

District	Party A	Party B	Total Votes	Percent of Votes		Party Wins	
				Party A	Party B	Party A	Party B
1	279	120	399	69.9%	30.1%	69.9%	
2	172	198	370	46.5%	53.5%		53.5%
3	167	192	359	46.5%	53.5%		53.5%
4	148	212	360	41.1%	58.9%		58.9%
5	185	180	365	50.7%	49.3%	50.7%	
6	139	193	332	41.9%	58.1%		58.1%
7	169	201	370	45.7%	54.3%		54.3%
8	179	206	385	46.5%	53.5%		53.5%
9	234	99	333	70.3%	29.7%	70.3%	
10	178	199	377	47.2%	52.8%		52.8%
<b>TOTAL</b>	<b>1850</b>	<b>1800</b>	<b>3650</b>	<b>50.7%</b>	<b>49.3%</b>	<b>63.6%</b>	<b>54.9%</b>

- Party A is winning districts with a much higher average vote (63.6%) than Party B (54.9%).
- This indicates Party A supporters are packed into a few districts; Party B is winning (more) districts with lower vote margins.

Winning Margin = Party A average winning vote share – Party B average winning vote share  
 $63.6 - 54.9 = 8.7$

# Lopsided Margin Scores

## 2012 State House Plan

DISTRICT	Party		Total Votes	Percent Votes		Party Wins		Average Winning Margin	Dem	68.6%
	Dem	Rep		Dem	Rep	Dem	Rep		Rep	
1	126,654	42,298	168,952	75.0%	25.0%	75.0%				
2	124,080	42,243	166,323	74.6%	25.4%	74.6%				
3	130,599	3,723	134,322	97.2%	2.8%	97.2%				
4	114,408	6,495	120,903	94.6%	5.4%	94.6%				
<b>Finding</b>									Rep	Districts have a lopsided margin advantage of
										<b>10.1%</b>

## 2022 State House Plan (Hickory) pre-2022 elections

DISTRICT	Party		Total Votes	Percent Votes		Party Wins		Average Winning Margin	Dem	64.5%
	Dem	Rep		Dem	Rep	Dem	Rep		Rep	
1	99,424	7,944	107,368	92.6%	7.4%	92.6%				
2	100,508	67,280	167,788	59.9%	40.1%	59.9%				
3	102,026	27,984	130,010	78.5%	21.5%	78.5%				
4	126,440	7,648	134,088	94.3%	5.7%	94.3%				
<b>Finding</b>									Rep	Districts have a lopsided margin advantage of
										<b>5.3%</b>

## 2022 State House Plan post-2022 elections

DISTRICT	Party		Total Votes	Percent Votes		Party Wins		Average Winning Margin	Dem	64.4%
	Dem	Rep		Dem	Rep	Dem	Rep		Rep	
1	114,464	9,412	123,876	92.4%	7.6%	92.4%				
2	120,260	78,643	198,903	60.5%	39.5%	60.5%				
3	118,018	33,097	151,115	78.1%	21.9%	78.1%				
4	143,916	9,869	153,785	93.6%	6.4%	93.6%				
<b>Finding</b>									Rep	Districts have a lopsided margin advantage of
										<b>5.3%</b>

# Mean-Median Difference

Party A	Percentages by District (sorted)
	41.1%
	41.9%
	45.7%
	46.5%
	46.5%
	46.5%
	47.2%
	50.7%
	69.9%
	70.3%
District median percentage	46.5%
Statewide mean percentage	50.7%
Mean-Median Difference	4.2%

Mean-Median Difference =  
Party's Mean Vote – Party's Median Vote

- A difference between a party's vote share in the median district and its vote share statewide is a measure of skewness. If the median score is lower, that party must win more votes to win an equal number of districts.
- Party A's median vote share (46.5%) is 4.2% lower than its mean vote share of 50.7%, indicating the districts are skewed in favor of Party B.
- Party A would have had to win 54.2% (50.0 + 4.2) of the statewide vote to win 50% of the seats.

# Mean-Median Difference Scores

DISTRICT	Party	
	Dem	Rep
1	75.0%	25.0%
2	74.6%	25.4%
3	97.2%	2.8%
4	94.6%	5.4%
5	95.2%	4.8%
6	92.1%	7.9%
7	97.9%	2.1%
8	96.7%	3.3%

## 2012 State House Plan

District Median Percentage	Dem	47.7%
	Rep	52.3%
Statewide mean percentage	Dem	53.8%
	Rep	46.2%
Mean-Median Difference	Dem	6.1%
	Rep	-6.1%
<b>Findings</b>		
Rep	Districts have a mean-median advantage of	
	<b>6.1%</b>	

## 2022 State House Plan (Hickory) pre-2022 elections

DISTRICT	Party		District Median Percentage	Dem	50.3%
	Dem	Rep		Rep	49.7%
1	92.6%	7.4%	Statewide mean percentage	Dem	53.1%
2	59.9%	40.1%		Rep	46.9%
3	78.5%	21.5%	Mean-Median Difference	Dem	2.7%
4	94.3%	5.7%		Rep	-2.7%
5	77.7%	22.3%			
6	82.2%	17.8%			
7	82.0%	18.0%			
8	79.4%	20.6%			
<b>Findings</b>					
	Rep	Districts have a mean-median advantage of			
		<b>2.7%</b>			

## 2022 State House Plan post-2022 elections

DISTRICT	Party		District Median Percentage	Dem	51.4%
	Dem	Rep		Rep	48.6%
1	92.4%	7.6%	Statewide mean percentage	Dem	53.7%
2	60.5%	39.5%		Rep	46.3%
3	78.1%	21.9%	Mean-Median Difference	Dem	2.3%
4	93.6%	6.4%		Rep	-2.3%
5	78.1%	21.9%			
6	82.7%	17.3%			
7	82.6%	17.4%			
8	79.8%	20.2%			
<b>Findings</b>					
	Rep	Districts have a mean-median advantage of			
		<b>2.3%</b>			

# Efficiency Gap

Efficiency gap measures the difference in the wasted votes of the two parties.

Wasted votes:

- Lost votes = votes cast for losing candidate
- Surplus votes = votes cast for winning candidate in excess of the 50% needed to win

$$\text{Efficiency Gap} = \frac{\text{Wasted Votes for Party A} - \text{Wasted Votes for Party B}}{\text{Total Number of Votes Statewide}}$$

The efficiency gap is interpreted as the percentage of seats the favored party wins over what it would have won with a redistricting map that is politically unbiased.

# Calculating the Efficiency Gap

District	Party A	Party B	Total Votes	Lost Votes		minimum to win	Surplus Votes		Total Wasted Votes	
				Party A	Party B		Party A	Party B	Party A	Party B
1	279	120	399	0	120	200	79	0	79	120
2	172	198	370	172	0	185	0	13	172	13
3	167	192	359	167	0	180	0	12	167	12
4	148	212	360	148	0	180	0	32	148	32
5	185	180	365	0	180	183	2	0	2	180
6	139	193	332	139	0	166	0	27	139	27
7	169	201	370	169	0	185	0	16	169	16
8	179	206	385	179	0	193	0	13	179	13
9	234	99	333	0	99	167	67	0	67	99
10	178	199	377	178	0	189	0	10	178	10
<b>TOTAL</b>	<b>1850</b>	<b>1800</b>	<b>3650</b>	<b>1152</b>	<b>399</b>		<b>148</b>	<b>123</b>	<b>1300</b>	<b>522</b>

$$1300 - 522 / 3650 = 778 / 3650 = .2131$$

Efficiency Gap in favor of Party B is 21.3 %

This is interpreted as the percentage of seats Party B won above what would be expected in a politically neutral map.

# Efficiency Gap Scores

## 2012 State House Plan

DISTRICT	Party		Total Votes	Lost Votes		Minimum to win	Surplus Votes		Total Wasted Votes		Total Wasted Votes	% Wasted Votes of Total Votes
	Dem	Rep		Dem	Rep		Dem	Rep	Dem	Rep		
1	126,654	42,298	168,952	0	42,298	84,476	42,178	0	42,178	42,298	6,632,361	30.81%
2	124,080	42,243	166,323	0	42,243	83,162	40,919	0	40,919	42,243		
3	130,599	3,723	134,322	0	3,723	67,161	63,438	0	63,438	3,723	<b>Finding</b>	
4	114,408	6,495	120,903	0	6,495	60,452	53,957	0	53,957	6,495	Rep	Candidates have an efficiency gap advantage of
5	83,198	4,158	87,356	0	4,158	43,678	39,520	0	39,520	4,158	<b>11.6%</b>	

## 2022 State House Plan (Hickory) pre-2022 elections

DISTRICT	Party		Total Votes	Lost Votes		Minimum to win	Surplus Votes		Total Wasted Votes		Total Wasted Votes	% Wasted Votes of Total Votes
	Dem	Rep		Dem	Rep		Dem	Rep	Dem	Rep		
1	99,424	7,944	107,368	0	7,944	53,684	45,740	0	45,740	7,944	5,846,545	27.16%
2	100,508	67,280	167,788	0	67,280	83,894	16,614	0	16,614	67,280		
3	102,026	27,984	130,010	0	27,984	65,005	37,021	0	37,021	27,984	<b>Finding</b>	
4	126,440	7,648	134,088	0	7,648	67,044	59,396	0	59,396	7,648	Rep	Candidates have an efficiency gap advantage of
5	168,716	48,556	217,272	0	48,556	108,636	60,080	0	60,080	48,556	<b>4.3%</b>	

## 2022 State House Plan post-2022 elections

DISTRICT	Party		Total Votes	Lost Votes		Minimum to win	Surplus Votes		Total Wasted Votes		Total Wasted Votes	% Wasted Votes of Total Votes
	Dem	Rep		Dem	Rep		Dem	Rep	Dem	Rep		
1	114,464	9,412	123,876	0	9,412	61,938	52,526	0	52,526	9,412	6,858,478	26.53%
2	120,260	78,643	198,903	0	78,643	99,452	20,809	0	20,809	78,643		
3	118,018	33,097	151,115	0	33,097	75,558	42,461	0	42,461	33,097	<b>Finding</b>	
4	143,916	9,869	153,785	0	9,869	76,893	67,024	0	67,024	9,869	Rep	Candidates have an efficiency gap advantage of
5	200,874	56,233	257,107	0	56,233	128,554	72,321	0	72,321	56,233	<b>3.1%</b>	

# Composite Political Index

- Each of the 16 general elections included in the GIS matrix can be used individually to calculate the four political fairness scores.
- Composite political index can also be used. This index combines the results of all general elections in the matrix. Prior to the 2022 elections, there were 13 general elections in the matrix. Now the composite political index includes 16 elections – the 3 statewide 2022 elections have been added.
- The index weights the elections so that a year with more elections (for example, 2018, with 4 elections) does not outweigh a year with fewer elections (for example, 2020, with only 2 elections).

# Conclusion

- Each of the four measures described have advantages and disadvantages associated with them.
- No mathematical measure is likely to produce a universally accepted yes-or-no as to whether a redistricting plan unacceptably favors one political party over the other.
- In fact, the measures themselves occasionally disagree as to how fair a redistricting map is. (Note the seats/votes proportionality score versus the other three post-2022 scores for the state house plan.)
- These four measures are generally accepted and do bring precision to the process of determining if a map is politically fair. This is especially true when several measures are considered rather than relying on a single measure.