Understanding ProbCalc

a short guide by PickleArtGeek

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Introduction

ProbCalc was originally developed as a one off, Google Sheets-based election predictor during November 2025. Since then, it has expanded to cover sports games, the complexities of constituency-based First Past the Post, and added a more complex winner identification system.

ProbCalc uses weighted polls to simulate election outcomes, and this is what the guidebook will seek to teach you.

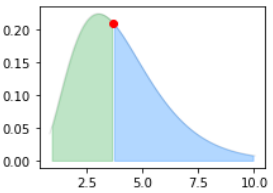
I. Gamma distribution

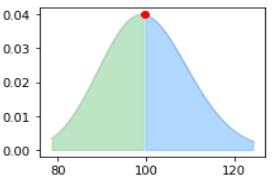
In order to model uncertainty in election outcomes, ProbCalc treats polling data not just as fixed values, but as a range of weighted inputs used to generate different election outcomes. To do this, it uses a gamma-based curve, specifically the inverse gamma form. We'll define three main parameters: α for shape, β for scale, and p for position.

$$f(x,a) = \frac{x^{-a-1}}{\Gamma(a)} \exp(-\frac{1}{x})$$

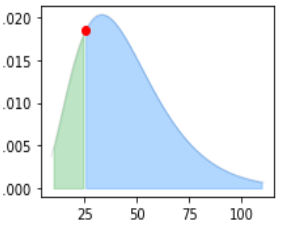
The exact details of this function do not matter as much as the parameters we can change. I will only define these important parameters.

- The bigger an α is in an inverse gamma function, the more concentrated the distribution becomes. If our α=4, β=1 and p=0.5, the output of inputting these parameters into the inv. gamma function would equal ~3.67, as shown in the graph. If the α is 100, then the curve would be much steeper, see second graph. The result equals ~99.67.
  Note: α CANNOT be smaller than 0, since the gamma function is undefined for non-positive shape values





- β defines the scale of our curve. It basically zooms in or out on the graph and the values. Let's go back to my first example and shift β up to 11. Since our β is at 11, we've zoomed out to the point where the original x axis of the graph is just 1/11th of the new one, while the shape remains unchanged. Shocker.
  Note: β CANNOT be smaller than 0.



- p or position defines how far along a certain curve the answer or output is. For instance, if p=0.2 in example 3, the output would equal 25.26, as shown in the graph.
  Note: p HAS to be within this range: 0<p<1

Now that we understand how the gamma distribution behaves, we will move on to how we calculate our α in *BaseCalc*.

II: Simple ProbCalc

II.I: BaseCalc

This section will go over how I get α from polling data, and each section will include practical exercises at the end to test your understanding.

To produce a reliable polling aggregate, we will need to take time of release and sample size into account. Recent polls are given more influence in the average than polls released earlier. Similarly, polls with larger sample sizes contribute more to the final result.
This keeps the average reflects the modern day as opposed to outdated polling data.

II.I.i: Data collection and formatting

All of my works as of April 2026 have used Wikipedia as the main and only source of polling data. Opinion polling sections/pages are a great source of the individual polls with very little clutter, so I just copy-paste it straight from Wikipedia to Google Sheets.
The important thing is to only select up to a certain pivotal point (e.g. start of the year, major changes in candidates/parties). I cut off the polling at the date when the Progressive Bulgaria party was founded, as including earlier polls introduces inconsistencies in the dataset.

Polling firm	Fieldwork date	Sample	GERB–SDS	PP–DB	Vaz.	DPS	BSP–OL	APS	ITN	MECh	Vell.	SB	PB[b]	Siy.	Others	NOTA	Lead
Trend	13–16 Apr 2026	1,004	19.1	11.2	7.1	10.2	4.0	1.6	2.1	3.7	1.7	1.0	**33.2**	3.9	1.2	–	14.1
Gallup	8–16 Apr 2026	803	21.0	10.7	6.8	10.5	4.0	1.0	3.0	2.8	2.0	0.8	**31.6**	3.2	2.6	2.8[c]	10.6
Alpha Research	13–15 Apr 2026	1,003	19.5	11.6	5.8	9.4	4.0	1.3	1.7	2.8	2.9	1.0	**34.2**	3.2	2.6	–	14.7
MarketLinks[d]	7–14 Apr 2026	1,003	19.8 57	13.1 37	5.6 16	7.5 21	3.0 0	– –	– –	3.1 0	3.4 0	– –	**38.0** **109**	3.1 0	3.4 0	–	18.2
CAM	3–14 Apr 2026	1,011	19.4	12.0	7.0	11.2	4.2	0.9	0.9	2.8	2.0	1.1	**32.1**	2.1	–	–	12.7
Myara	4–13 Apr 2026	1,002	18.5	11.4	7.4	9.1	4.0	1.9	1.4	3.5	2.2	–	**34.6**	3.6	2.4	–	16.1
Sova Harris	2–6 Apr 2026	800	19.0	11.2	7.8	9.7	4.5	2.3	–	3.1	2.0	–	**33.6**	3.1	3.7[e]		14.6
Gallup	20–30 Mar 2026	820	23.4	10.9	6.5	10.7	3.0	0.9	2.9	2.8	1.9	0.9	**28.4**	3.0	4.7	2.6[c]	5.0
Alpha Research	19–26 Mar 2026	1	21.2	11.1	6.9	9.8	3.9	1.2	1.4	3.0	2.7	1.6	**30.8**	2.8	3.6	–	9.6
MarketLinks	17–21 Mar 2026	1,008	22.2	13.3	5.5	10.5	3.7	1.7	1.1	3.2	2.4	2.0	**29.1**	2.0	3.3	16.1[c]	6.9
	20 mar 2026		Official start of the election campaign.														
Alpha Research	12–20 Mar 2026	1	20.7	11.5	6.8	9.9	3.8	1.9	1.7	3.3	2.2	1.5	**29.4**	2.4	4.9	–	8.7
Trend	13–19 Mar 2026	1,001	19.7	11.8	7.9	10.5	4.0	1.7	2.6	3.2	1.5	–	**31.1**	2.9	3.1	–	11.4
Myara	7–16 Mar 2026	809	19.3	12.9	7.9	10.6	4.1	1.3	1.4	3.6	2.5	–	**30.8**	2.3	3.3	–	11.5
MarketLinks	7–15 Mar 2026	1,006	23.5	15.2	6.2	9.1	3.8	1.6	0.3	3.5	3.4	1.5	**26.7**	1.3	3.9	1.8[c]	3.2
Sova Harris	7–12 Mar 2026	1	19.3	12.2	6.7	7.1	4.4	1.8	2.2	3.8	2.5	–	**30.9**	2.9	6.2	–[c]	11.6
Alpha Research	23 Feb–2 Mar 2026	1	19.7	12.6	6.4	9.6	3.6	1.6	1.2	3.5	1.8	1.5	**32.6**	–	5.9	–[c]	12.9
Gallup	10–28 Feb 2026	800	20.1	11.3	6.2	11.2	3.0	1.0	2.9	3.4	2.3	0.9	**30.6**	–	7.1	2.7[c]	10.5
CAM	17–24 Feb 2026	1,01	19.8	13.8	8.5	10.8	3.8	0.5	1.3	3.7	1.3	–	**35.3**	–	1.2	1.5[c]	15.5
Trend	12–18 Feb 2026	1,002	20.4	10.9	7.8	10.5	3.8	1.7	2.5	3.6	1.6	–	**32.7**	–	4.5	–[c]	12.3
Myara	9–15 Feb 2026	812	18.9	12.7	6.8	10.7	3.7	1.9	2.1	3.9	2.3	–	**33.3**	–	3.7	1.5[c]	14.4
MarketLinks	7–13 Feb 2026	1,019	18.9	15.3	5.5	12.9	2.8	0.5	1.8	3.1	2.1	–	**31.3**	–	4.0	1.8[c]	12.7

When you copy-paste it from Wikipedia, the table should look something akin to this. Even with the clarity of the dataset, some formatting is still required.

- Remove Wikipedia's event cells. This makes the dataset easier to follow, and alleviates part of the workload later down the line.
- Make sure all of your inputted data registers as numbers. For dates, use either the date of publication (used in the example above) or do an average. Averaging the date hurts polls that collect data for longer.
- Be aware of region-based differences in how Google Sheets formats numbers. For the Europeans, you'll need to change a lot more than the Americans will. This means that a period (.) in American Google Sheets separates wholes and decimals, while Europeans use a comma(,). Make sure to adjust the data in accordance

Polling firm	Fieldwork date	Sample	GERB–SDS	PP–DB	Vaz.	DPS	BSP–OL	APS	ITN	MECh	Vell.	SB	PB	Siy	Others	NOTA	Lead
Trend	16.4.2026	1,004	19,1	11,2	7,1	10,2	4	1,6	2,1	3,7	1,7	1	**33,2**	3,9	1,2	0	14,1
Gallup	16.4.2026	803	21	10,7	6,8	10,5	4	1	3	2,8	2	0,8	**31,6**	3,2	2,6	2,8	10,6
Alpha Research	15.4.2026	1,003	19,5	11,6	5,8	9,4	4	1,3	1,7	2,8	2,9	1	**34,2**	3,2	2,6	0	14,7
MarketLinks[d]	14.4.2026	1,003	19,8	13,1	5,6	7,5	3	0	0	3,1	3,4	0	**38**	3,1	3,4	0	18,2
CAM	13.4.2026	1,011	19,4	12	7	11,2	4,2	0,9	0,9	2,8	2	1,1	**32,1**	2,1	0	0	12,7
Myara	13.4.2026	1,002	18,5	11,4	7,4	9,1	4	1,9	1,4	3,5	2,2	0	**34,6**	3,6	2,4	0	16,1
Sova Harris	6.4.2026	800	19	11,2	7,8	9,7	4,5	2,3	0	3,1	2	0	**33,6**	3,1	3,7	0	14,6
Gallup	30.3.2026	820	23,4	10,9	6,5	10,7	3	0,9	2,9	2,8	1,9	0,9	**28,4**	3	4,7	2,6	5
Alpha Research	26.3.2026	1	21,2	11,1	6,9	9,8	3,9	1,2	1,4	3	2,7	1,6	**30,8**	2,8	3,6	0	9,6
MarketLinks	21.3.2026	1,008	22,2	13,3	5,5	10,5	3,7	1,7	1,1	3,2	2,4	2	**29,1**	2	3,3	16,1	6,9
Alpha Research	20.3.2026	1	20,7	11,5	6,8	9,9	3,8	1,9	1,7	3,3	2,2	1,5	**29,4**	2,4	4,9	0	8,7
Trend	19.3.2026	1,001	19,7	11,8	7,9	10,5	4	1,7	2,6	3,2	1,5	0	**31,1**	2,9	3,1	0	11,4
Myara	16.3.2026	809	19,3	12,9	7,9	10,6	4,1	1,3	1,4	3,6	2,5	0	**30,8**	2,3	3,3	0	11,5
MarketLinks	15.3.2026	1,006	23,5	15,2	6,2	9,1	3,8	1,6	0,3	3,5	3,4	1,5	**26,7**	1,3	3,9	1,8	3,2
Sova Harris	12.3.2026	1	19,3	12,2	6,7	7,1	4,4	1,8	2,2	3,8	2,5	0	**30,9**	2,9	6,2	0	11,6
Alpha Research	2.3.2026	1	19,7	12,6	6,4	9,6	3,6	1,6	1,2	3,5	1,8	1,5	**32,6**	0	5,9	0	12,9
Gallup	28.2.2026	800	20,1	11,3	6,2	11,2	3	1	2,9	3,4	2,3	0,9	**30,6**	0	7,1	2,7	10,5
CAM	24.2.2026	1,01	19,8	13,8	8,5	10,8	3,8	0,5	1,3	3,7	1,3	0	**35,3**	0	1,2	1,5	15,5
Trend	18.2.2026	1,002	20,4	10,9	7,8	10,5	3,8	1,7	2,5	3,6	1,6	0	**32,7**	0	4,5	0	12,3
Myara	15.2.2026	812	18,9	12,7	6,8	10,7	3,7	1,9	2,1	3,9	2,3	0	**33,3**	0	3,7	1,5	14,4
MarketLinks	13.2.2026	1,019	18,9	15,3	5,5	12,9	2,8	0,5	1,8	3,1	2,1	0	**31,3**	0	4	1,8	12,7

II.I.ii: Calculations

Polling firm	Fieldwork date	Sample	GERB–SDS	PP–DB	Vaz.	DPS	BSP–OL	APS	ITN	MECh	Veli.	SB	PB	Siy	Others	NOTA
Trend	3,00	1004	63,92133333	37,48266667	23,76133333	34,136	13,38666667	5,354666667	7,028	12,38266667	5,689333333	3,346666667	**111,1093333**	13,052	4,016	0
Gallup	3,00	803	56,21	28,64033333	18,20133333	28,105	10,70666667	2,676666667	8,03	7,494666667	5,353333333	2,141333333	**84,58266667**	8,565333333	6,959333333	7,494666667
Alpha Research	4,00	1003	48,89625	29,087	14,5435	23,5705	10,03	3,25975	4,26275	7,021	7,27175	2,5075	**85,7565**	8,024	6,5195	0
MarketLinks[d]	5,00	1003	39,7188	26,2786	11,2336	15,045	6,018	0	0	6,2186	6,8204	0	**76,228**	6,2186	6,8204	0
CAM	6,00	1011	32,689	20,22	11,795	18,872	7,077	1,5165	1,5165	4,718	3,37	1,8535	**54,0885**	3,5385	0	0
Myara	6,00	1002	30,895	19,038	12,358	15,197	6,68	3,173	2,338	5,845	3,674	0	**57,782**	6,012	4,008	0
Sova Harris	13,00	800	11,69230769	6,892307692	4,8	5,969230769	2,769230769	1,415384615	0	1,907692308	1,230769231	0	**20,67692308**	1,907692308	2,276923077	0
Gallup	20,00	820	9,594	4,469	2,665	4,387	1,23	0,369	1,189	1,148	0,779	0,369	**11,644**	1,23	1,927	1,066
Alpha Research	24,00	1000	8,833333333	4,625	2,875	4,083333333	1,625	0,5	0,5833333333	1,25	1,125	0,6666666667	**12,83333333**	1,166666667	1,5	0
MarketLinks	29,00	1008	7,716413793	4,622896552	1,911724138	3,649655172	1,286068966	0,5908965517	0,3823448276	1,112275862	0,8342068966	0,6951724138	**10,11475862**	0,6951724138	1,147034483	5,596137931
Alpha Research	30,00	1000	6,9	3,833333333	2,266666667	3,3	1,266666667	0,6333333333	0,5666666667	1,1	0,7333333333	0,5	**9,8**	0,8	1,633333333	0
Trend	31,00	1001	6,361193548	3,810258065	2,550935484	3,390483871	1,291612903	0,5489354839	0,8395483871	1,033290323	0,4843548387	0	**10,04229032**	0,9364193548	1,001	0
Myara	34,00	809	4,592264706	3,069441176	1,879735294	2,522176471	0,9755588235	0,3093235294	0,3331176471	0,8565882353	0,5948529412	0	**7,328588235**	0,5472647059	0,7852058824	0
MarketLinks	35,00	1006	6,754571429	4,368914286	1,782057143	2,6156	1,092228571	0,4598857143	0,08622857143	1,006	0,9772571429	0,4311428571	**7,674342857**	0,3736571429	1,120971429	0,5173714286
Sova Harris	38,00	1000	5,078947368	3,210526316	1,763157895	1,868421053	1,157894737	0,4736842105	0,5789473684	1	0,6578947368	0	**8,131578947**	0,7631578947	1,631578947	0
Alpha Research	48,00	1000	4,104166667	2,625	1,333333333	2	0,75	0,3333333333	0,25	0,7291666667	0,375	0,3125	**6,791666667**	0	1,229166667	0
Gallup	50,00	800	3,216	1,808	0,992	1,792	0,48	0,16	0,464	0,544	0,368	0,144	**4,896**	0	1,136	0,432
CAM	54,00	1010	3,703333333	2,581111111	1,589814815	2,02	0,7107407407	0,09351851852	0,2431481481	0,692037037	0,2431481481	0	**6,602407407**	0	0,2244444444	0,2805555556
Trend	60,00	1002	3,4068	1,8203	1,3026	1,7535	0,6346	0,2839	0,4175	0,6012	0,2672	0	**5,4609**	0	0,7515	0
Myara	63,00	812	2,436	1,636888889	0,8764444444	1,379111111	0,4768888889	0,2448888889	0,2706666667	0,5026666667	0,2964444444	0	**4,292**	0	0,4768888889	0,1933333333
MarketLinks	65,00	1019	2,962938462	2,398569231	0,8622307692	2,022323077	0,4389538462	0,07838461538	0,2821846154	0,4859846154	0,3292153846	0	**4,906876923**	0	0,6270769231	0,2821846154

The next step is to copy and paste the whole sheet, again. This time you'll copy your own formatted one to save you the hassle and perform calculations without changing the original data.
Under the “Fieldwork Date” column, change the formula to `=[ELECTIONDAY]-[ORIGINALFIELDWORKDATE].` Enter the election day as a date (convert it if necessary), then format it as a regular number. In practice your formula should look something like this: `=46131-B2`. Copy and paste this to every “Fieldwork date” cell in the new table.

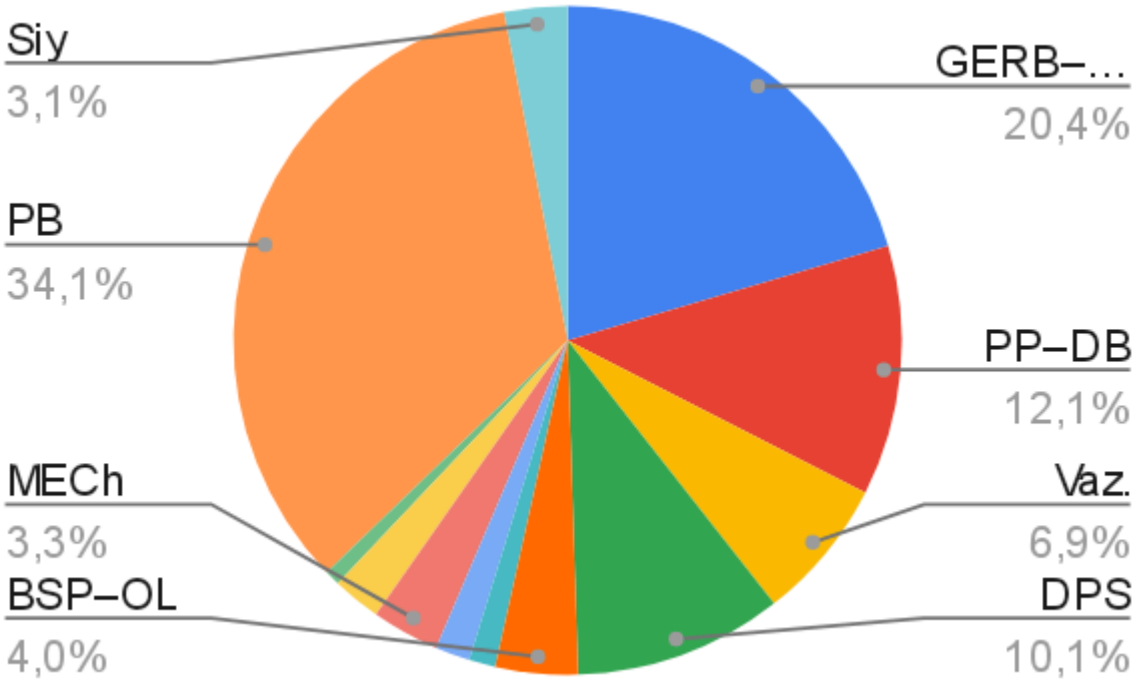
For the individual poll results, I use this formula:
`=([POLLRESULT]*[SAMPLESIZE])/([DAYSTILLELECTION]*100)`. Multiplying by sample size gives greater weight to larger polls. I subsequently divide the output by the distance from election day to publication to keep the data relevant to the modern day. The `*100` keeps α lower, which increases variation in the simulation.

Anchor the `[SAMPLESIZE]` column with a $ sign so that it stays in place when you copy and paste the formula. Do the same for the `[DAYSTILLELECTION]` parameter. The end result applied practically should end up looking like this:
`=(D3*$C3)/($B27*100)`.
When spreading the formula to cover the whole poll sheet, you can paste the formula only and keep the format via Paste Special > Formula Only, which is more aesthetically pleasing in my opinion.

	GERB–SDS	PP–DB	Vaz.	DPS	BSP–OL	APS	ITN	MECh	Veli.	SB	PB	Siy
Sum	359,6826537	212,5181467	121,3434666	177,6783349	70,08377825	22,47505213	29,66193623	57,64883505	41,47449376	12,96748194	600,7426664	53,83046382
%	20,44%	12,07%	6,89%	10,09%	3,98%	1,28%	1,69%	3,28%	2,36%	0,74%	34,13%	3,06%

You will then sum the values together through the `SUM` function, e.g. `=SUM([RANGEBORDER1]:[RANGEBORDER2])`. Practically, it looks like this: `=SUM(D27:D47)`. The function adds everything that you throw at it together. Copy paste it column to column without anchoring.
This is your α parameter. For the percentage, take your first cell, in my case GERB-SDS, and divide it by the sum of all alphas, so `=[CELL]/SUM([RANGEBORDER1]:[RANGEBORDER2])`. Make sure to anchor your `[RANGEBORDER1]` and `[RANGEBORDER2]`, as without it, the cells would shift upon

copy-pasting. It looks like this in practice: `=D52/SUM($D52:$O52)`. Apply this to each cell, and you have not only your alpha, but your poll average as well.



This is just how it looks put into a pie chart.

II.I.iii: Exercise

Take the data points from 2024 Pennsylvania Senate polling, and use the September 10th Presidential Debate as your cutoff date. Reformat the data and calculate the poll average.

Your average should come out to roughly *48.7% Casey* – *45.5% McCormick*
This, while not reflecting the real results, shows us that polls and their averages are not always correct.

II.II: ProbCalc

II.II.i: First simulation

Create a new sheet to simulate the elections. Start by copying and pasting the individual party names into a vertical format, and fetch the alphas with this formula: `=[SHEETNAME!CELL]`. In practice, this would be something like `=BaseCalc!D51`.

	A	B	C	D
1	GERB–SDS		359,6826537	20,44%
2	PP–DB		212,5181467	12,07%
3	Vaz.		121,3434666	6,89%
4	DPS		177,6783349	10,09%
5	BSP–OL		70,08377825	3,98%
6	APS		22,47505213	1,28%
7	ITN		29,66193623	1,69%
8	MECh		57,64883505	3,28%
9	Veli.		41,47449376	2,36%
10	SB		12,96748194	0,74%
11	PB		600,7426664	34,13%
12	Siy		53,83046382	3,06%

Next, apply the inverse gamma distribution. In Google Sheets this is written as: `=GAMMA.INV([p];[α];[β])`. Recall that p defines the position along the distribution, and we ought to make that random using `RAND()`.Your α variable should be the BaseCalc result we carried over, whereas β should remain at either 1 or 0.1. Your ProbCalc formula should look like this: `=GAMMA.INV(RAND();$C$1; 1)`. Remember to anchor both your column and row identifiers in the α, and manually adjust your first simulation's row reference to correspond with the actual data by party.

	A	B	C	D	E
14	GERB–SDS		3,52088292	20,02%	PB
15	PP–DB		2,177704526	12,38%	
16	Vaz.		1,229792327	6,99%	
17	DPS		1,835564918	10,44%	
18	BSP–OL		0,7305705342	4,15%	
19	APS		0,2719219226	1,55%	
20	ITN		0,2854800911	1,62%	
21	MECh		0,5848364614	3,33%	
22	Veli.		0,3502055345	1,99%	
23	SB		0,1224408033	0,70%	
24	PB		5,964176877	33,92%	
25	Siy		0,5111592886	2,91%	

The percentage rows can then be calculated by following the steps in the BaseCalc section.

II.II.ii: Identifying the winner and probability

The most crucial thing on the list right now is actually counting who won.
For this, we will use the `INDEX`, `MATCH`, and `MAX` functions. The formula should be placed in the beginning cell of the simulation:

```
=INDEX([PARTYNAMEBEGIN]:[PARTYNAMEEND];MATCH(MAX([GAMMABORDER1]:[GAMMABORDER2]); [GAMMABORDER1]:[GAMMABORDER2]; 0))
```

This may look complex at first, but it is straightforward.

- `MAX` finds the highest number in the output range, but does not give the actual cell number.
- That's what `MATCH` is for. It finds the same exact value in the range and returns its position.
- This is used by `INDEX` to provide the name of the winning party/candidate.

In practice, it looks like this: `=INDEX($A$1:$A$12; MATCH(MAX(D14:D25); D14:D25; 0))`. Apply this formula to identify the winner of a simulated result. Now, copy and paste the simulations from your simulation #1 down to row 100.
The final step of creating a basic ProbCalc is to count the number of victories. For readability, I would recommend taking the party names and colours (again) and pasting them to the side. We will use the `COUNTIF` function like so:
`=COUNTIF([COLUMNSTART]:[COLUMNEND]; [PARTYNAMECELL])`. The first part of the bracket defines the range while the second part looks in that range to find and count any matches with the defined text. In application, it looks like this `=COUNTIF(D:D; F2)`.
Copy and paste until you have all of your parties covered, and if desired, add a percentage calculator.

	A	B	C	D	E	F	G	H	I	J
1	GERB–SDS		359,6826537	20,44%		Party		Number of victories	%	
2	PP–DB		212,5181467	12,07%		GERB–SDS		0	0,00%	
3	Vaz.		121,3434666	6,89%		PP–DB		0	0,00%	
4	DPS		177,6783349	10,09%		Vaz.		0	0,00%	
5	BSP–OL		70,08377825	3,98%		DPS		0	0,00%	
6	APS		22,47505213	1,28%		BSP–OL		0	0,00%	
7	ITN		29,66193623	1,69%		APS		0	0,00%	
8	MECh		57,64883505	3,28%		ITN		0	0,00%	
9	Veli.		41,47449376	2,36%		MECh		0	0,00%	
10	SB		12,96748194	0,74%		Veli.		0	0,00%	
11	PB		600,7426664	34,13%		SB		0	0,00%	
12	Siy		53,83046382	3,06%		PB		75	100,00%	
13						Siy		0	0,00%	
14	GERB–SDS		3,210154543	19,43%	PB					
15	PP–DB		1,756862824	10,64%						
16	Vaz.		1,080408411	6,54%						
17	DPS		1,627129341	9,85%						
18	BSP–OL		0,6847361314	4,15%						
19	APS		0,1959261681	1,19%						
20	ITN		0,3907782361	2,37%						
21	MECh		0,6467031452	3,92%						
22	Veli.		0,3499516212	2,12%						
23	SB		0,151530794	0,92%						
24	PB		5,964687632	36,11%						
25	Siy		0,4595533823	2,78%						
26										

II.II.iii: Exercise

Open your Pennsylvania US Senate 2024 sheet and find a scenario where *David McCormick* wins with more than 60% of the vote. Do this by adjusting either the scale factor or shrinking the α.

III. Complex ProbCalc

In this section, I will lay out three more complex formulas and go over what they actually do. This part is slightly more theoretical, as I am assuming that you are already comfortable with this kind of sheet setup.

III.I: Structured majority identification

We will extend our previous winner-identification formula to also include the type of victory (plurality, majority, or supermajority).

```
=INDEX([PARTYNAMEBEGIN]:[PARTYNAMEEND];MATCH(MAX([%RANGEBORDER1]:[%RANGEBORDER2]); [%RANGEBORDER1]:[%RANGEBORDER2]; 0))
 & " – " &
IF(MAX([%RANGEBORDER1]:[%RANGEBORDER2])>=0,66;"Supermajority";IF(MAX([%RANGEBORDER1]:[%RANGEBORDER2])>=0,5;"Majority";"Plurality"))
```

I'll admit, this does look very scary at first, but it only consists of two major parts:

- In the first part of our formula, we identify the winner.
- In the second, we determine by how much they win.
- All of this is joined by an em dash or hyphen.

Our `[%RANGEBORDER1]:[%RANGEBORDER2]` parameter contains the percentage or seat values.

`IF(MAX([%RANGEBORDER1]:[%RANGEBORDER2])>=0,66;"Supermajority";` checks whether the largest percentage value is exceeds 66%, and if so, it types out *[Winner] – Supermajority*.

We then get to our `ELSE` function, which we will split to another `IF` tree that defines if the winner has more than 50%. If it finds the winner has over 50%, it writes out *[Winner] – Majority*, and if they don't, then it writes out *[Winner] – Plurality*.

If you want to do this in a parliamentary simulation, adjust the numbers in the `IF` tree to match the seats required. In practice, it looks like this:

```
=INDEX($A$1:$A$12; MATCH(MAX(D14:D25); D14:D25; 0)) & "-" &
IF(MAX(D14:D25)>=0,66;"Supermajority";IF(MAX(D14:D25)>=0,5;"Majority";"Plurality"))
```

In order to count the victories by type and winner, update your `COUNTIF` to match the output, e.g. instead of `=COUNTIF(D:D; F2)`, use the actual output `=COUNTIF(D:D; F2 & "Plurality")`. This takes very little manual work compared to some other methods, it is recommended to utilise this method. It is also advised to organize these into a table for readability.

Party		Plurality	Majority	Supermajority	Total
	Fidesz–KDNP	0	0	0	0
	TISZA	2	123	0	125
	Mi Hazánk	0	0	0	0
	MKKP	0	0	0	0
	Democratic Coaltion	0	0	0	0
Total		**2**	**123**	**0**	**125**

III.I.i: Exercise

Returning back to the Pennsylvania 2024 US Senate ProbCalc, build a similar system, but for widely-used predictor margins/probabilities: Safe, Likely, Lean and Tilt.

III.II: Split vote count and extrapolation

Now, we will tackle how to actually count results by smaller groups, such as demographics or administrative divisions. Firstly, get your by-group data, and format it so that the parties align and ideally, that there's an equal number in the previous election result and the election you're trying to simulate.
I'll make a mock spreadsheet like this:

	A	B	C
1	Election results / Party	Previous election	This election's aggregate (Your BaseCalc)
2	Let's Get (LG)	53,40%	48,85%
3	ProbCalc To Work (PCW)	46,60%	51,15%

	A	B
5	Previous Demographic Resuts	
6	working class	
7	Let's Get (LG)	48,43%
8	ProbCalc To Work (PCW)	51,57%
9	middle class	
10	Let's Get (LG)	57,56%
11	ProbCalc To Work (PCW)	42,44%
12	upper class	
13	Let's Get (LG)	54,21%
14	ProbCalc To Work (PCW)	45,79%

For the sake of simplicity, there's only two parties and three main groups. We will only calculate the percentage. You can, however, do this via actual vote counts, though these are generally less accurate than the percentages themselves. What I'm going to do now is calculate the relative margin of a group compared to the topline margin by subtracting the group result from the topline.
`=[TOPLINE]-[GROUPRESULT]`
With this piece of data, we can just add this adjustment to our BaseCalc in order to get our new results.
`=[BASECALC]+[COMPARISON]`. This formula is also used when counting parliamentary seats, especially those without local polling.

III.II.i: Getting a feasible vote count

Take the sum of your alpha's and multiply it by the division of the vote count last election and the alpha. `=[BASECALC]*([VOTECOUNT]/[BASECALC])`. Use this after your gamma simulation.

III.II.ii: Exercise

Calculate the expected 2024 Pennsylvania US Senate margin of *Bob Casey* with college-educated voters. Use 2022 data for the past election data.

III.III: Counting the votes

In this section, we will go over a simple formula that allows you to count votes in each and every simulation.

```
=SUM(FILTER([RANGEBORDER1]:[RANGEBORDER2];
MOD(SEQUENCE(ROWS([RANGEBORDER1]:[RANGEBORDER2]));[NUMBEROFPARTIES
+1IFBLANKSPACE])=1))
```

Let's go over all of this step by step.

- The `ROWS` function counts how much rows there is in a given range,
- The `SEQUENCE` function "lists" the number of rows, e.g. 1,2,3…
- The `MOD` function, short for Modular Arithmetics, points out whether or not row numbers are an exact multiple of the given number `[NUMBEROFPARTIES+1IFBLANKSPACE]`.
- The `FILTER` function with the `=1` parameter at the end filters out only the cells for which the `MOD` function is "True"
- And finally, the `SUM` function counts all of these cell values together.
- Combining these 6 functions together gives us a master formula for counting a party's votes in a vertical simulation system, alternatively, you can simply reformat your simulations/calculations to be in a horizontal format, in which you can simply use the `SUM` function to count the votes.

Here's what this formula looks like in practice:

```
=SUM(FILTER($H4:$H$1118; MOD(SEQUENCE(ROWS($H4:$H$1118));7)=1))
```

Make sure to anchor some points, like columns and `[RANGEBORDER2]` cell numbers for easier copy-pasting.

III.III.i: Exercise

Run and count the votes by education level and then at-large in the 2024 Pennsylvania US Senate Election.