

Why the sample count numbers are regarded as fairly indicative of the possible final outcome and why is there a 4-percentage-point margin of error? How confident are we with this 4% point margin of error?

2015 Singapore GE

Aljunied GRC: PAP 48%	WP 52%	
Ang Mo Kio GRC: PAP 78%	RP 22%	
Bishan-Toa Payoh GRC: PAP 74%	SPP 26%	
Bukit Batok SMC: PAP 74%	SDP 26%	Indep 0%
Bukit Panjang SMC: PAP 69%	SDP 31%	
Chua Chu Kang GRC: 76%	PPP 24%	
East Coast GRC: PAP 61%	WP 39%	
Fengshan SMC: PAP 57%	WP 43%	
Holland-Bukit Timah GRC: PAP 66%	SDP 34%	
Hong Kah North SMC: PAP 74%	SPP 26%	
Hougang SMC: PAP 42%	WP 58%	
Jalan Besar GRC: PAP 67%	WP 33%	
Jurong GRC: PAP 78%	SF 22%	
MacPherson SMC: PAP 63%	WP 36%	NSP 1%
Marine Parade GRC: PAP 65%	WP 35%	
Marsiling-Yew Tee GRC: PAP 69%	SDP 31%	
Mountbatten SMC: PAP 72%	SPP 28%	
Nee Soon GRC: PAP 67%	WP 33%	
Pasir Ris-Punggol GRC: PAP 73%	SDA 27%	
Pioneer SMC: PAP 78%	NSP 22%	
Potong Pasir SMC: PAP 68%	SPP 32%	
Punggol East SMC: PAP 51%	WP 49%	
Radin Mas SMC: PAP 77%	RP 14%	Indep 9%
Sembawang GRC: PAP 72%	NSP 28%	
Sengkang West SMC: PAP 63%	WP 37%	
Tampines GRC: PAP 72%	NSP 28%	
Tanjong Pagar GRC: PAP 78%	SF 22%	
West Coast GRC: PAP 78%	RP 22%	
Yu Hua SMC: PAP 72%	SDP 28%	

PAP %	Opp Party		±4%?
50.95	49.05		Yes
78.63%	21.37%		Yes
73.59%	26.41%		Yes
72.99%	26.40%	0.60%	Yes
68.38%	31.62%		Yes
76.89%	23.11%		Yes
60.73%	39.27%		Yes
57.52%	42.48%		Yes
66.62%	33.38%		Yes
74.76%	25.24%		Yes
42.31%	57.69%		Yes
67.73%	32.27%		Yes
79.28%	20.72%		Yes
65.58%	33.60%	0.82%	Yes
64.07%	35.96%		Yes
68.73%	31.27%		Yes
71.84%	28.16%		Yes
66.83%	33.17%		Yes
72.89%	27.11%		Yes
76.34%	23.66%		Yes
66.41%	33.59%		Yes
51.76%	48.24%		Yes
77.25%	12.71%	10.04%	Yes
72.28%	27.72%		Yes
62.11%	37.89%		Yes
72.06%	27.94%		Yes
77.71%	22.29%		Yes
78.57%	21.43%		Yes
73.54%	26.46%		Yes

4 constituencies with the greatest in the difference in %age:

Yu Hua: 1.54%; Potong Pasir: 1.59%; Pioneer: 1.66%; Mac Pherson: 2.58%

Interestingly, they are all from SMC, why?

	GE2015
Seats	89
Electoral Divisions	29
Group Representation Constituencies	16
Single Member Constituencies	13
Voters	2,460,977

Total votes cast	2,304,331	Voter turnout: 93.56% of eligible voters
Did not vote	158,595	There are 832 polling stations
Eligible voters	2,462,926	Number of voters per station $\frac{2,304,331}{832} = 2769.6$

The sample votes basically use the following unbiased estimate for population proportion:

$$\hat{p} = \sum_{r=1}^k \frac{n_r p_r}{N} \text{ where } N = \sum_{r=1}^k n_r$$

The confidence limits for population proportion is $\hat{p} \pm z \sqrt{\frac{\hat{p}(1-\hat{p})}{N}}$.

Let's assume that since there are 89 constituencies with 832 polling stations, each constituency has 9.35 polling stations. Hence each constituency is assumed to have $N = 935$ (sample size) since each polling station took 100 votes as sample.

The following calculation is meant for SMC:

To have a confidence interval limits of 0.08, taking $N = 935$ (9.35 polling centers) means that

$$z \sqrt{\frac{\hat{p}(1-\hat{p})}{935}} \leq 0.04 \text{ with simple quadratic knowledge, LHS is maximum when } \hat{p} = 0.5$$

Hence $z \leq 2.44622$. Basically for z value to assume 2.44622 will mean that this is a 98.556% confidence interval.

The following calculation is meant for GRC with 4 constituencies:

To have a confidence interval limits of 0.08, taking $N = 935 \times 4$ (9.35 \times 4 polling centers) means that

$$z \sqrt{\frac{\hat{p}(1-\hat{p})}{935 \times 4}} \leq 0.04 \text{ (with simple quadratic knowledge, LHS is maximum when } \hat{p} = 0.5)$$

Hence $z \leq 4.892443$. Basically for z value to assume 4.892443 will mean that this is a 99.9999% confidence interval.

Hence the bigger the GRC, the bigger the confidence interval we are looking at with 4% point margin of error.

This is another possible Mathematics Exploration for IB SL and HL Math students!