Stat 296 Fall 2007

Elections to the provincial legislature, as with all provincial and federal elections in Canada, are decided by a method of voting known as first-past-the-post. The province is divided into a number of constituencies (currently there are 58) and in each consitutency voters can vote for their local Member of the Legislative Assembly (MLA). The party who elects the most MLAs is then asked to form government. One common critique of the FPTP system is that is leads to an unfair advantage for the "winning" party. That is, in comparison with their percentage of popular vote, they control a disproportionately high percentage of the seats. Therefore, we will attempt to address the following question:

How does percentage of popular vote in Saskatchewan elections translate into percentage of seats in the provincial legislature?

The data were collected from: `http://www.elections.sk.ca/history.php`

Twenty-Fifth Provincial General Election (November 5, 2003)

Party	% of vote	# elected
Liberal	14.18	0
New Democratic Party	44.68	30
Saskatchewan Party	39.35	28

Twenty-Fourth Provincial General Election (September 16, 1999)

Party	% of vote	# elected
Liberal	20.15	4
New Democratic Party	38.73	29
Saskatchewan Party	39.61	25

Twenty-Third Provincial General Election (June 21, 1995)

Party	% of vote	# elected
Liberal	34.70	11
New Democratic Party	47.21	42
Progressive Conservative	17.92	5

Twenty-Second Provincial General Election (October 21, 1991)

Party	% of vote	# elected
Liberal	23.29	1
New Democratic Party	51.05	55
Progressive Conservative	25.54	10

Twenty-First Provincial General Election (October 20, 1986)

Party	% of vote	# elected
Liberal	9.99	1
New Democratic Party	45.20	25
Progressive Conservative	44.61	38

Twentieth Provincial General Election (April 26, 1982)

Party	% of vote	# elected
Liberal	4.51	0
New Democratic Party	37.64	9
Progressive Conservative	54.07	55
Western Canada Concept	3.26	0

Nineteenth Provincial General Election (October 18, 1978)

Party	% of vote	# elected
New Democratic Party	48.12	44
Progressive Conservative	38.08	17
Liberal	13.78	0

Eighteenth Provincial General Election (June 11, 1975)

Party	% of vote	# elected
New Democratic Party	40.07	39
Liberal	31.67	15
Progressive Conservative	27.62	7

Seventeenth Provincial General Election (June 23, 1971)

Party	% of vote	# elected
New Democratic Party	55.00	45
Liberal	42.82	15
Progressive Conservative	2.13	0

Sixteenth Provincial General Election (October 11, 1967)

Party	% of vote	# elected
Liberal	45.57	35
New Democratic Party	44.35	24
Progressive Conservative	9.78	0

Fifteenth Provincial General Election (April 22, 1964)

Party	% of vote	# elected
Liberal	40.40	32
Co-operative Commonwealth Federation	40.30	25
Progressive Conservative	18.90	1

Fourteenth Provincial General Election (June 8, 1960)

Party	% of vote	# elected
Co-operative Commonwealth Federation	40.76	37
Liberal	32.67	17
Progressive Conservative	13.95	0
Social Credit	12.35	0

The table below summarizes the percentages of the winning parties.

Governing Party	% of vote	fraction elected	% elected
New Democratic Party	44.68	30/58	51.72
New Democratic Party	38.73	29/58	50.00
New Democratic Party	47.21	42/58	72.41
New Democratic Party	51.05	55/66	83.33
Progressive Conservative	44.61	38/64	59.38
Progressive Conservative	54.07	55/64	85.94
New Democratic Party	48.12	44/61	72.13
New Democratic Party	40.07	39/61	63.93
New Democratic Party	55.00	45/60	75.00
Liberal	45.57	35/59	59.32
Liberal	40.40	32/58	55.17
Co-operative Commonwealth Federation	40.76	37/54	68.52

Using SAS, we find the Spearman rank correlation is $r_s = 0.7972$ and the exact p-value for the one-sided test of H_0: no association against H_A: positive association is 0.0015. This is overwhelming evidence against H_0.

Using SAS, we also find the Pearson correlation coefficient is $r = 0.7869$. This suggests a strong linear relationship. In fact, the exact p-value for the one-sided test of H_0: no linear association against H_A: positive linear association is 0.0016. This is overwhelming evidence against H_0.

The equation of the regression line is given by

$$\% \text{ elected} = 1.70059(\% \text{ of vote}) - 11.57761.$$

In particular, we can make a prediction for the outcome of the Twenty-Sixth Provincial General Election on November 7, 2007. Based on the Sigma Analytics poll released on November 1, 2007, and published in the Regina Leader-Post, the Saskatchewan Party has the support of 54.20% of decided respondents, compared to 33.7% for the NDP and 8% for the Liberals. To quote from this article:

> ... telephone survey of 1,318 interviews conducted between Oct. 26 to 30 ... One in five respondents, or 20.3 per cent, were undecided in the poll that has a plus or minus 2.7 per cent margin of error 19 times out of 20. Although election results vary based on how a party's votes are distributed, a party drawing more than half of the vote has traditionally meant a "landslide" in Saskatchewan, Cooper noted, pointing to sizable victories by the NDP in 1971 and 1991 and for the Conservatives in 1982, elections where the winning parties pulled in more than 50 per cent of the vote.

For a link to the complete article, see our course homepage. Substituting 54.20 into the equation of the regression line gives

$$\% \text{ elected} = 1.70059(54.20) - 11.57761 = 80.59437.$$

Since there are 58 seats to be contested, this suggests that the Saskatchewan party will win $0.8059437 \times 58 = 46.7$, or 47 seats.

```
data election;
input x y;
datalines;
44.68 51.72
38.73 50.00
47.21 72.41
51.05 83.33
44.61 59.38
54.07 85.94
48.12 72.13
40.07 63.93
55.00 75.00
45.57 59.32
40.40 55.17
40.76 68.52
;

proc reg data=election;
model y=x;
run;

proc freq data=election;
tables x*y / measures cl noprint;
exact measures;         /* Use /mc option to randomly sample the permuations */
test measures;
run;
```

The REG Procedure
Model: MODEL1
Dependent Variable: y

Number of Observations Read	12
Number of Observations Used	12

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	948.66373	948.66373	16.26	0.0024
Error	10	583.26296	58.32630		
Corrected Total	11	1531.92669			

Root MSE	7.63717	R-Square	0.6193
Dependent Mean	66.40417	Adj R-Sq	0.5812
Coeff Var	11.50103		

The REG Procedure
Model: MODEL1
Dependent Variable: y

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	-11.57761	19.46139	-0.59	0.5651
x	1	1.70059	0.42167	4.03	0.0024

The FREQ Procedure

Statistics for Table of x by y

Kendall's Tau-b

Tau-b	0.6061
ASE	0.1411
95% Lower Conf Limit	0.3296
95% Upper Conf Limit	0.8825

Test of H0: Tau-b = 0

ASE under H0	0.1411
Z	4.2967
One-sided Pr > Z	<.0001
Two-sided Pr > |Z|	<.0001

The FREQ Procedure

Statistics for Table of x by y

Pearson Correlation Coefficient

Correlation (r)	0.7869
ASE	0.0900
95% Lower Conf Limit	0.6104
95% Upper Conf Limit	0.9634

Test of H0: Correlation = 0

ASE under H0	0.2527
Z	3.1145
One-sided Pr > Z	0.0009
Two-sided Pr > |Z|	0.0018

Exact Test

One-sided Pr >= r	0.0016
Two-sided Pr >= |r|	0.0028

The FREQ Procedure

Statistics for Table of x by y

Spearman Correlation Coefficient

Correlation (r)	0.7972
ASE	0.1357
95% Lower Conf Limit	0.5312
95% Upper Conf Limit	1.0000

Test of H0: Correlation = 0

ASE under H0	0.1357
Z	5.8732
One-sided Pr > Z	<.0001
Two-sided Pr > |Z|	<.0001

Exact Test

One-sided Pr >= r	0.0015
Two-sided Pr >= |r|	0.0029

Sample Size = 12