LEGISLATIVE ASSEMBLY
FOR THE AUSTRALIAN CAPITAL TERRITORY

STANDING COMMITTEE ON JUSTICE AND COMMUNITY SAFETY
Mr Jeremy Hanson MLA (Chair), Dr Marisa Paterson (Deputy Chair), Ms Jo Clay MLA

# Submission Cover Sheet

## Inquiry into 2020 ACT Election and the Electoral Act

**Submission Number:** 026

**Date Authorised for Publication:** 6 May 2021

# Preferential Linear Electoral Ranking System

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

CONTENTS



## INTRODUCTION

The Preferential Linear Electoral Ranking System is an electoral process that is suitable for all situations, large and small, political and non political. It provides significant cost savings due to the simplicity of the process, which in-turn reduces the potential for error and time taken to conclude a result.

Most importantly it provides a consensus result based on the preferential choice of the voter.


Erik Jochimsen B.Eng.

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

## DESCRIPTION

Overview:

The Preferential Linear Electoral Ranking System (PLERS) is a means of achieving the benefits of preferential voting, without its complexity and shortcomings.

The voter simply numbers the candidates in order of preference sequentially, from first till either all candidates are numbered or until there are no further candidates the voter wishes to give preference to. As a result of the cumulative preference from all voters, the candidates are then ranked in order, with most preferred at the top and least preferred at the bottom.

With the candidate ranking complete, the vacancies are filled from the most preferred candidate down, until there are no further vacancies.

Method:

The resulting vote for candidates is the number of first preferences, plus cumulative proportions of preference above the last possible preference.

A first preference vote results in a one (1) for that candidate and a last possible preference vote results in a zero (0) for that candidate.

All votes between first and last possible will result in a fraction of one that is proportional to their preferential position. (See proportional preference formula [PPF].)

All candidates for whom no preference has been given by a voter shall be considered equally last, which will result in zero (0) for those candidates.

For each candidate the sum of first preference and proportional fractions shall be totalled and considered the vote for that candidate. The candidates are then ranked with the highest vote at the top and the lowest at the bottom.

These numerical actions can be automated using a spreadsheet or done manually.

Ties should be rare using this system but when they occur can be resolved by comparing the count of preferences from first to second last. The first of these counts to differ shall give the highest rank to the greater count. This plus further resolution methods and options are detailed in the chapter TIES.

PPF = (Number of candidates - Preference)/(Number of candidates - 1)

The last possible preference is where the preference equals the number of candidates.

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

## EXPLANATION and EXAMPLES

The name Preferential Linear Electoral Ranking System (PLERS) is intended to describe how it functions. Using the preferential choice of the voters, a linear method is used to rank the election candidates.

To the voter it appears the same as optional preferential voting. The voter numbers their preference from first to last or until there are no further candidates the voter wishes to give preference to. All candidates that are not validly preferenced are considered equally last for that vote.

| Candidate | Preference |
|---|---|
| Cand_A | 2 |
| Cand_B | 1 |
| Cand_C | 3 |

Example 1. In this example the voter has given the first preference to candidate B, second preference to candidate A and third preference to candidate C.

| Candidate | Preference |
|---|---|
| Cand_A | |
| Cand_B | 2 |
| Cand_C | |
| Cand_D | 1 |
| Cand_E | 3 |
| Cand_F | 4 |

Example 2. In this example the voter has given first preference to candidate D, then B, E and F. Candidates A and C have not been given a preference, so are considered equally last.

For a vote to be valid, there must be a single clear first preference. Further preferences are valid provided they are a sequential progression from the previous preference and it is clear that only one candidate is given that preference. If a preference is determined to be invalid that preference and all subsequent preferences are disregarded for that vote.

Examples 1 and 2 are valid votes as in both cases there is a single clear first preference. The subsequent preferences are also valid as they are all a sequential progression from the previous preference without duplication.

| Candidate | Preference |
|---|---|
| Cand_A | 3 |
| Cand_B | 2 |
| Cand_C | |

Example 3. This is an invalid vote, as there is no first preference.

| Candidate | Preference |
|---|---|
| Cand_A | 1 |
| Cand_B | Not You |
| Cand_C | 4 |
| Cand_D | 3 |
| Cand_E | 3 |
| Cand_F | 2 |

Example 4. This is a valid vote, as candidates A and F are valid first and second preferences. However for the third preference there is duplication, with candidates D and E. So these and the subsequent candidate C are invalid and considered equally last. The comment made against candidate B is an invalid preference, so B is also considered equally last.

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

## **EXPLANATION and EXAMPLES** continued

To the candidate first preferenced by the voter a one (1) vote is awarded. All subsequent candidates are awarded vote values proportional to their preference, with the last possible candidate being awarded a zero (0).

The last possible preference is where the preference equals the number of candidates. If for example there were 11 candidates standing and a voter correctly preferenced all 11, then the 11$^{th}$ preference would be the last possible.

The degradation of vote value between first and last possible is linear and determined by the proportional preference formula (PPF).

PPF = (Number of candidates - Preference)/(Number of candidates - 1)

The following table shows the linear vote value degradation using PPF, for elections with between 2 and 11 candidates.

| Number of Candidates | Vote Value awarded determined by PPF | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1$^{st}$ | 2$^{nd}$ | 3$^{rd}$ | 4$^{th}$ | 5$^{th}$ | 6$^{th}$ | 7$^{th}$ | 8$^{th}$ | 9$^{th}$ | 10$^{th}$ | 11$^{th}$ |
| 2 | 1 | 0 | | | | | | | | | |
| 3 | 1 | 1/2 | 0 | | | | | | | | |
| 4 | 1 | 2/3 | 1/3 | 0 | | | | | | | |
| 5 | 1 | 3/4 | 2/4 | 1/4 | 0 | | | | | | |
| 6 | 1 | 4/5 | 3/5 | 2/5 | 1/5 | 0 | | | | | |
| 7 | 1 | 5/6 | 4/6 | 3/6 | 2/6 | 1/6 | 0 | | | | |
| 8 | 1 | 6/7 | 5/7 | 4/7 | 3/7 | 2/7 | 1/7 | 0 | | | |
| 9 | 1 | 7/8 | 6/8 | 5/8 | 4/8 | 3/8 | 2/8 | 1/8 | 0 | | |
| 10 | 1 | 8/9 | 7/9 | 6/9 | 5/9 | 4/9 | 3/9 | 2/9 | 1/9 | 0 | |
| 11 | 1 | 9/10 | 8/10 | 7/10 | 6/10 | 5/10 | 4/10 | 3/10 | 2/10 | 1/10 | 0 |

Attributing these values to example 1.

| Candidate | Preference | Vote Value |
|---|---|---|
| Cand_A | 2 | 1/2 = 0.5 |
| Cand_B | 1 | 1 |
| Cand_C | 3 | 0 |

For this example C is awarded zero, as it is the last possible candidate.

Attributing these values to example 2.

| Candidate | Preference | Vote Value |
|---|---|---|
| Cand_A | | 0 |
| Cand_B | 2 | 4/5 = 0.8 |
| Cand_C | | 0 |
| Cand_D | 1 | 1 |
| Cand_E | 3 | 3/5 = 0.6 |
| Cand_F | 4 | 2/5 = 0.4 |

For this example A and C are awarded zero as they are not preferenced, so they are regarded as equally last.

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

## **EXPLANATION and EXAMPLES** continued

For candidates, the cumulative total awarded to them from all voters is the total vote for that candidate.

Example 5. In this example there were 5 candidates and 41 voters. The total vote is shown as the result.

| Candidate | 1st Pref | 2nd Pref | 3rd Pref | 4th Pref | 5th Pref | Results |
|---|---|---|---|---|---|---|
| Cand_A | 9 | 4 | 4 | 0 | 6 | 14.00 |
| Cand_B | 7 | 4 | 6 | 9 | 0 | 15.25 |
| Cand_C | 4 | 15 | 11 | 4 | 0 | 21.75 |
| Cand_D | 10 | 11 | 9 | 4 | 0 | 23.75 |
| Cand_E | 11 | 7 | 4 | 6 | 8 | 19.75 |

The candidates are then ranked according to their vote, with the greatest vote at the top to the lowest at the bottom.

Example 6. This shows example 5 following ranking determined by the result.

| Candidate | 1st Pref | 2nd Pref | 3rd Pref | 4th Pref | 5th Pref | Results |
|---|---|---|---|---|---|---|
| Cand_D | 10 | 11 | 9 | 4 | 0 | 23.75 |
| Cand_C | 4 | 15 | 11 | 4 | 0 | 21.75 |
| Cand_E | 11 | 7 | 4 | 6 | 8 | 19.75 |
| Cand_B | 7 | 4 | 6 | 9 | 0 | 15.25 |
| Cand_A | 9 | 4 | 4 | 0 | 6 | 14.00 |

In the example shown candidate E, despite having the greatest first preference, did not take the highest rank. Candidate D with a slightly lower first preference overtook E due to strong second and third preferences. Candidate C despite a low first preference took the second ranking due to very strong second and third preferences.

With ranking complete the vacancies are filled from the highest ranked candidate.

If, in the case of example 6, there were two vacancies then they would be filled by candidates D and C.

This example is a demonstration of the consensus view of the voters overruling the largest group. However if a candidate receives a significant enough majority of first preferences then lower preferences for other candidates cannot generate a higher result.

If a candidate receives every first preference then the result for that candidate would equal the number of voters, which is the maximum possible result.

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

## TIES

As stated in the description, ties should be rare using this system.

Expanding on resolution methods from the description, the first of the following methods that resolves the tie should be used:

1. By comparing the count of preferences from first to second last, the first of these counts to differ shall give the highest rank to the greater count.

2. By comparing the count of last possible preference, the lowest rank shall be given to the greater count.

3. If the number of positions to be filled includes all of the tied ranks then the result should be left as a tie.

4. If the number of positions to be filled includes none of the tied ranks then the result should be left as a tie until a casual vacancy requires resolution of the tie.

5. Mutual agreement of the tied contestants.

This is the limit of tie breaking methods available from the election result. Beyond this the following options may be acceptable to some organisations.

If any of these options are adopted it is imperative that the decision is documented prior to use. It may be appropriate to modify the options to suite the organisation.

Further options:

6. The candidate with the greatest length of experience in the contested position, in electoral terms or portions of, shall be given the highest rank.

7. The candidate with the greatest length of service of the organisation shall be given the highest rank.

8. The candidate with the greatest length of membership of the organisation shall be given the highest rank.

9. Other successful candidates should determine the ranking.

10. A further election is held to determine the ranking of the tied candidates.

Further explanation and examples of tie resolution are detailed in the following chapter TIE EXAMPLES.

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

## TIE EXAMPLES

Following are examples and explanations for each of the tie resolution methods and options:

1. By comparing the count of preferences from first to second last, the first of these counts to differ shall give the highest rank to the greater count.

| Candidate | 1st Pref | 2nd Pref | 3rd Pref | 4th Pref | 5th Pref | Results |
|---|---|---|---|---|---|---|
| Cand_A | 10 | 16 | 7 | 0 | 0 | 25.5 |
| Cand_B | 10 | 17 | 5 | 1 | 0 | 25.5 |
| Cand_C | 5 | 0 | 21 | 0 | 7 | 15.5 |
| Cand_D | 7 | 0 | 0 | 20 | 5 | 12 |
| Cand_E | 1 | 0 | 0 | 12 | 10 | 4 |

In this example candidates A and B have a result tie. In comparing the preference counts the 1st preference is also a tie but in the 2nd preference candidate B has the greater count. So candidate B has the higher rank taking the 1st position, with candidate A taking the 2nd.

2. By comparing the count of last possible preference, the lowest rank shall be given to the greater count.

| Candidate | 1st Pref | 2nd Pref | 3rd Pref | 4th Pref | 5th Pref | Results |
|---|---|---|---|---|---|---|
| Cand_A | 10 | 0 | 1 | 1 | 1 | 10.75 |
| Cand_B | 3 | 3 | 0 | 3 | 3 | 6 |
| Cand_C | 3 | 3 | 0 | 3 | 2 | 6 |
| Cand_D | 0 | 2 | 6 | 0 | 0 | 4.5 |
| Cand_E | 0 | 4 | 2 | 1 | 0 | 4.25 |

In this case candidate A obviously takes 1st position but candidates B and C have result ties for 2nd and 3rd. Using rule 1 does not resolve the tie, as comparing the preference counts from first to second last result in no difference. Now comparing the count of last possible candidate B has the greater count, thus is given the lower position.

So using rule 2, candidate C takes the 2nd position and candidate B takes 3rd.

This ruling is justified on the grounds that giving a candidate the last possible preference is a more definite statement of last than equally last by default, when no preference is given.

Tie rules 1 and 2 can be performed using a spreadsheet sort routine, which can be part of the initial sort to determine ranking.

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

## **TIE EXAMPLES** continued

3. If the number of positions to be filled includes all of the tied ranks then the result should be left as a tie.

| Candidate | 1st Pref | 2nd Pref | 3rd Pref | 4th Pref | 5th Pref | Results |
|---|---|---|---|---|---|---|
| Cand_A | 9 | 0 | 0 | 11 | 0 | 11.75 |
| Cand_B | 5 | 7 | 9 | 0 | 2 | 14.75 |
| Cand_C | 1 | 8 | 11 | 0 | 0 | 12.5 |
| Cand_D | 5 | 7 | 9 | 0 | 2 | 14.75 |
| Cand_E | 10 | 8 | 0 | 0 | 0 | 16 |

In this election there are three positions to fill. Candidate E has the highest rank so clearly takes the 1st position. Candidates B and D are then tied by results that cannot be resolved by rule 1 or 2. By rule 3 this is simply left as a tie and candidates E, B and D fill the three positions. This rule assumes all positions are of equal standing.

4. If the number of positions to be filled includes none of the tied ranks then the result should be left as a tie until a casual vacancy requires resolution of the tie.

| Candidate | 1st Pref | 2nd Pref | 3rd Pref | 4th Pref | 5th Pref | Results |
|---|---|---|---|---|---|---|
| Cand_A | 4 | 10 | 4 | 1 | 0 | 13.75 |
| Cand_B | 4 | 4 | 5 | 4 | 2 | 10.5 |
| Cand_C | 4 | 4 | 5 | 4 | 2 | 10.5 |
| Cand_D | 11 | 5 | 0 | 4 | 0 | 15.75 |
| Cand_E | 5 | 5 | 9 | 0 | 4 | 13.25 |

As with the previous case, there are three positions to fill. In this case the three positions are filled by candidates D, A and E in that order. Candidates B and C are tied such that cannot be resolved by rule 1 or 2. However as there are no further positions to be filled, by rule 4 the result can be left as a tie. If and only if, prior to the next election one casual vacancy occurs the tie will need to be resolved.

5. Mutual agreement of the tied contestants.

If a tie occurs that cannot be resolved by rules 1 to 4 then the situation can be resolved by mutual agreement between the tied candidates.

This is the limit of tie breaking methods available from the election result. Beyond this the following options may be acceptable to some organisations.

If any of these options are adopted it is imperative that the decision is documented prior to use. It may be appropriate to modify the options to suite the organisation.

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

## TIE EXAMPLES continued

Further options:

6. The candidate with the greatest length of experience in the contested position, in electoral terms or portions of, shall be given the highest rank.

If any of the tied candidates have previously held the position to which they are contesting then that length of experience can be used to break the tie.

For example: of two tied contestants one had served in the position before and the other had not then the former would take the higher rank.

If both had held the position then the one with the greater number of electoral terms or portions of would take the higher rank.

Two terms would count as 2.

One term and 6 months of a 12-month term would count as 1.5.

Three terms and 4 months of a 10-month term would count as 3.4.

7. The candidate with the greatest length of service of the organisation shall be given the highest rank.

This would commonly be the holding of a voluntary position or performing some task considered important to the organisation.

8. The candidate with the greatest length of membership of the organisation shall be given the highest rank.

For organisations with members this is simply the time they have been members. For things such as local councils this could be rewritten to be the length of time the candidates have resided in that council district.

9. Other successful candidates should determine the ranking.

If for example 5 vacancies are to be filled and the results are clear for the first 4 but positions 5 and 6 are tied then the successful 4 should resolve the tie.

10. A further election is held to determine the ranking of the tied candidates.

Given the cost involved this should, for most organisations, be the last resort. But as previously stated with PLERS ties should be very rare.

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

## ACKNOWLEDGEMENTS and SYSTEM EVOLUTION

Considerable work has been done over millennia, developing and comparing, voting decision-making systems. PLERS fits into the family of Borda election methods. PLERS is a clearly defined normalised implementation of Borda count, with additional features to resolve ties, a presentation aligned to Australian preferential voting and a method to achieve proportional representation.

Borda count (BC) was developed independently: in 1435 by Nicholas of Cusa, then again in 1770 by Jean-Charles de Borda, from whom the methodology is named. The Roman Senate used a variant of BC after 105 AD.

In 1971 the Dowdall system was introduced for Nauru elections due to the influence of Nauru's then Secretary for Justice, Desmond Dowdall. This can be considered a non-linear modification to BC, however I found no evidence of BC being known to Dowdall.

BC, as described by Borda, is linear. Implementations of it vary in appearance and process but will normally end up with the same or similar ranking result, especially for the top of the ranking.

Despite BC being described as consensus-based and an ideal electoral system, its use is not common in any form. BC systems are numerically complex compared to first past the post (FPP) and even preferential voting. Prior to the evolution of electronic computing the use of a BC system, for large scale voting, would have entailed a massive computation task that most electoral authorities would have considered overwhelming.

Today it would be rare, in developed countries, for votes not to be entered onto a computerised system, either directly by the voter or subsequently by electoral staff. This complexity barrier to BC voting systems is no longer justified.

I designed PLERS due to my dissatisfaction with the manner elections functioned in a society I was a member of. The elections were very competitive using a block vote system to fill multiple vacancies. The process evolved in my mind over about ten years. After documenting my design, I researched what had previously been done and discovered the work of Borda and others.

Of the examples of BC systems in use, I found none aligned precisely with PLERS. However given the number of regular election and decision making procedures that would currently occur throughout the planet and over time, it could not be assumed that PLERS, or something similar, does not or has not existed under another name.

PLERS should be used with a spreadsheet for smaller elections or a more flexible database for larger elections, but can be done manually. The first election using PLERS was held on 19 November 2019 for the ACT Heritage Rail Holdings Board election. Four candidates stood for three positions. 38 members voted by post or email. The votes were entered into the prepared spreadsheet in about 20 minutes and the result was immediate.

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

## PLERS SIMPLIFIED

For many situations a pure implementation of PLERS may be more complex than necessary. This may be true for small organisations, for which it is not convenient to manage a spreadsheet and also for elections where the number of candidates greatly outnumbers vacancies.

The purpose of PLERS is to rank candidates in an order determined by preferences of the voters. This can be achieved with a simplified version of PLERS by using a greater degradation of preference value. A convenient preference needs to be chosen at which point the vote value becomes zero (0) and also for subsequent preferences.

From this point PLERS Simplified will be referred to with the acronym PLERS-S.

The most convenient implementation of PLERS-S would be aligned to that of having 11 candidates for PLERS. In this situation the vote value becomes zero (0) at the 11$^{th}$ preference and there is a 1/10$^{th}$ vote value separation between higher preferences.

From here the zero point will be referred to as Z(p); where 'p' is the preference at which the vote value becomes zero (0). For the previous paragraph this would be Z11 and the implementation would be referred to as PLERS-SZ11.

| Vote Value for PLERS-SZ11 Preferences | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Preference | 1$^{st}$ | 2$^{nd}$ | 3$^{rd}$ | 4$^{th}$ | 5$^{th}$ | 6$^{th}$ | 7$^{th}$ | 8$^{th}$ | 9$^{th}$ | 10$^{th}$ | 11$^{th}$ | 12$^{th}$ |
| Vote Value | 1 | 0.9 | 0.8 | 0.7 | 0.6 | 0.5 | 0.4 | 0.3 | 0.2 | 0.1 | 0 | 0 |

Using PLERS-SZ11 (or any zero point) the preferences would be totalled for each candidate and multiplied by the vote value fraction. Those values for each candidate would be totalled and used to determine the ranking, as previously described.

PLERS-SZ11 would be appropriate if the number of vacancies was up to 5 and the number of candidates 11 or greater.

PLERS-SZ5 would be appropriate if there was only 1 vacancy. The vote value from 1$^{st}$ to 5$^{th}$ would be 1, 3/4, 1/2, 1/4 and 0. Using such convenient fractions would make processing the results, with pen and paper, very simple.

| Vote Value for PLERS-SZ5 Preferences | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Preference | 1$^{st}$ | 2$^{nd}$ | 3$^{rd}$ | 4$^{th}$ | 5$^{th}$ | 6$^{th}$ | 7$^{th}$ | 8$^{th}$ | 9$^{th}$ | 10$^{th}$ | 11$^{th}$ | 12$^{th}$ |
| Vote Value | 1 | 0.75 | 0.5 | 0.25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fraction | 1 | 3/4 | 1/2 | 1/4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

A significant advantage in using PLERS-S is that a consistent process can be used in consecutive elections, allowing voters to know the value of their vote preference from one election to the next, regardless of the number of candidates.

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

## PROPORTIONAL REPRESENTATION

PLERS naturally ranks candidates in order of their voters' preferences. Normally that would be appropriate but when groups are being elected, such as political parties, in a multi vacancy election, the most popular group is likely to unfairly dominate most of the vacancies. The same problem occurs with block vote and preferential voting (multi-member electorates).

This dominance of vacancies is likely to exceed their proportion of popularity, as determined by their group's first preferences. As such the group of the most favoured candidate will be over represented, which will result in an under representation of the alternative view and significant minorities.

This problem is resolved by limiting the number of candidates standing for election from each group, to a maximum of two-thirds of vacancies. This ensures the dominant group can only fill two of every three vacancies, achieving proportional representation without the shortcomings of current systems.

The following table shows the limit of candidates from groups (parties) to achieve two-thirds of vacancies. For all vacancy numbers other than 2 and 4, the most favoured group can win a majority of positions.

| Vacancies | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Limit 2/3 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 8 |

This allows the voter to select their preferred dominant group and encourages them to also select an alternative voice. In turn this will encourage emerging groups and provide a greater choice for the voter.

From this point PLERS for proportional representation, with a candidate limit, will be referred to with the acronym PLERS-PRL(c); where 'c' is the group candidate limit. For an Australian half-senate election, the states would comply with PLERS-PRL4.

A mechanism for replacement should be agreed to in the event of a mid term casual vacancy. This could be the next unsuccessful candidate from the same group. To cater for all candidates of a group being elected, potential replacements could be declared a prior to the election.

PLERS-PRL could be used following similar lines to established implementations of proportional representation. For both Australian Senate (like) and current Hare-Clark elections, beyond the two-third limit and use of PLERS for determination of successful candidates, all other aspects could continue, making the change seamless to the voter.

The ability of PLERS-PRL to perform proportional representation can be demonstrated by using data from previous elections. It is necessary to obtain totals of all preferences for all candidates, which is not readily available. For the ACT 2016 election, the required preferences were derived from ACT Electoral Commission data. The performance of PLERS-PRL3 was tested using this data and documented in the following chapter PLERS-PRL3 TESTED ON 2016 ACT ELECTION.

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

## PLERS-PRL3 TESTED ON ACT 2016 ELECTION

As previously stated, PLERS can be tested using data from previous elections. However it is necessary to obtain totals of all preferences for all candidates, which is not readily available. For the ACT 2016 election, the required preferences were derived from ACT Electoral Commission data.

For this election; the ACT Assembly had 5 electorates, each electing 5 members; using the Hare-Clark system to achieve proportional representation. All members elected were from the Labour (ALP), Liberal (Lib) and Green (Grn) parties. Of these the ALP and Grn usually form a coalition if required to form government. There were 141 candidates. The highest unsuccessful party obtained 7.9% and independent 5% of 1st preferences in their electorates.

For simplification only the 3 successful parties will be discussed. The following table shows the percentage of 1st preference votes for those 3 parties, in the 5 electorates.

| | 1st Preference Percentage | | | | | |
|---|---|---|---|---|---|---|
| Electorate | Brindab | Ginnind | Kurrajong | Murrumb | Yerrabi | Total |
| ALP | 33.6% | 41.4% | 38.5% | 34.5% | 43.9% | 38.4% |
| Grn | 5.1% | 9.7% | 18.8% | 10.6% | 7.1% | 10.3% |
| Lib | 41.9% | 32% | 31% | 42.8% | 35.8% | 36.7% |
| Total | 80.6% | 83.1% | 88.2% | 87.9% | 86.9% | 85.4% |

The following table is the election result using Hare Clark. The similarity between the 1st preference percentage and Hare Clark result can be seen.

| | Hare Clark Election Result in Seats | | | | | |
|---|---|---|---|---|---|---|
| Electorate | Brindab | Ginnind | Kurrajong | Murrumb | Yerrabi | Total |
| ALP | 2 | 3 | 2 | 2 | 3 | 12 |
| Grn | | | 1 | 1 | | 2 |
| Lib | 3 | 2 | 2 | 2 | 2 | 11 |

Using the generated preference data, basic PLERS produced the following results.

| | PLERS Result in Seats | | | | | |
|---|---|---|---|---|---|---|
| Electorate | Brindab | Ginnind | Kurrajong | Murrumb | Yerrabi | Total |
| ALP | | 5 | 4 | 2 | 4 | 15 |
| Grn | | | 1 | | | 1 |
| Lib | 5 | | | 3 | 1 | 9 |

As can be seen, the leading group in each electorate is usually over represented. Various methods of PLERS Simplified and other gradients were trialled in an attempt to achieve proportional representation. None succeeded in that objective but an interesting point was observed regarding the highest-ranking candidate. In every electorate the candidate 1st selected by Hare Clark was also the highest ranked by all versions of PLERS and Dowdall. This supports the concept that both basic PLERS and PLERS Simplified are appropriate for single vacancy elections, such as the Australian House of Representatives or state lower houses.

# PREFERENTIAL LINEAR ELECTORAL RANKING SYSTEM

## PLERS-PRL3 TESTED ON ACT 2016 ELECTION continued

This confirms that basic PLERS and proportional representation are mutually exclusive, as previous described. Now using the limit mechanism of PLERS-PRL. That is to limit the number of candidates from each party to 2/3 of vacancies. For this election that means 3 of the 5 seats in each electorate (PLERS-PRL3).

To test this concept, the test data needed to be reworked so as to assimilate what is likely to have occurred with this election control. The following steps were taken with each electorate set of preference results, in spreadsheet form:

1. Each candidate of each party, exceeding 3 candidates, was numbered from 1st to last, determined by their 1st preference count.
2. For candidates after the 3rd candidate: 1st, 2nd and 3rd preferences were evenly redistributed to the 1st, 2nd and 3rd candidates and then all remaining preferences were zeroed.
3. For parties with 4 candidates the cells for the 4th preference of candidates 1 to 3 were deleted, thus promoting the following preferences.
4. For parties with 5 candidates the cells for the 4th and 5th preferences of candidates 1 to 3 were deleted, thus promoting the following preferences.
5. All 4th and 5th candidates were removed from the candidate total for calculation purposes.
6. For all remaining candidates in the electorate, cells for preferences beyond the remaining number of candidates were deleted.

Now using PLERS-PRL3 a balanced result is achieved, as shown below.

| | PLERS-PRL3 Result in Seats | | | | | |
|---|---|---|---|---|---|---|
| Electorate | Brindab | Ginnind | Kurrajong | Murrumb | Yerrabi | Total |
| ALP | 2 | 3 | 3 | 2 | 3 | 13 |
| Grn | | | 1 | | | 1 |
| Lib | 3 | 2 | 1 | 3 | 2 | 11 |

From a seat number position there is little difference between the Hare Clarke and the PLERS-PRL3 result. 3 of the 5 electorates are the same. The government and opposition have the same total numbers.

This table shows the differences between PLERS-PRL3 and the Hare Clark results.

| | PLERS-PRL3 less Hare Clark Results in Seats | | | | | |
|---|---|---|---|---|---|---|
| Electorate | Brindab | Ginnind | Kurrajong | Murrumb | Yerrabi | Total |
| ALP | = | = | + 1 | = | = | + 1 |
| Grn | = | = | = | - 1 | = | - 1 |
| Lib | = | = | - 1 | + 1 | = | = |

It should be noted that some candidates did change their ranking within their party group, which in turn caused some changes to the candidates representing the party.