

Conduct your own PR election!

1. What is Proportional Representation?

Proportional Representation (PR) is a method of vote counting used for electorates where multiple candidates need to be elected at the same time. Proportional Representation is designed to ensure that candidates are elected in proportion to the support they receive in the electorate.

In Victoria, it is used to elect members of the Upper House (the State Legislative Council). It is also used to elect municipal councillors in wards with more than one vacancy and in unsubdivided municipalities.

This guide describes a slightly simplified version of the system currently used in Victoria.

2. Voting: How do I fill in my ballot paper?

Voters complete a ballot paper by numbering all candidates in their order of preference, starting with 1 for their most preferred candidate.

Example

Here, the voter should number the boxes from 1 to 5.

Ballot Paper		Ballot Paper
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.		Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.
<input type="checkbox"/> Ali	→	<input type="checkbox"/> 3 Ali
<input type="checkbox"/> Ben		<input type="checkbox"/> 2 Ben
<input type="checkbox"/> Caroline		<input type="checkbox"/> 1 Caroline
<input type="checkbox"/> Danny		<input type="checkbox"/> 4 Danny
<input type="checkbox"/> Emma		<input type="checkbox"/> 5 Emma

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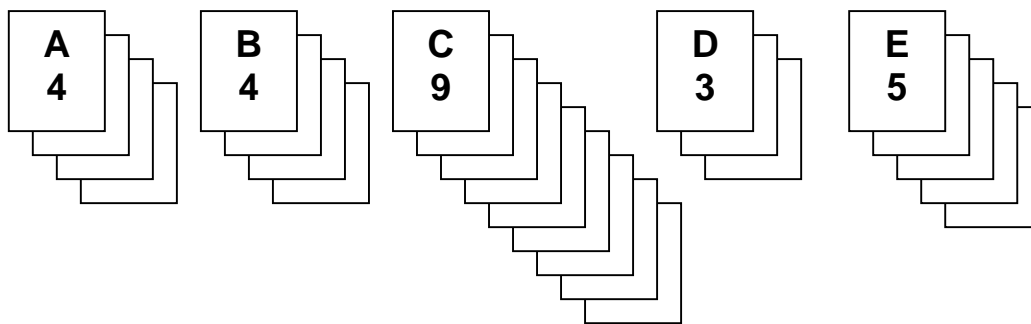
3. First Preferences

All votes have been cast. What happens now?

The first step in any election is to count the first preferences. This is where the number of "1s" each candidate has received is counted. The first preferences are then recorded in a spreadsheet.

Example

You have received 25 ballot papers like the example shown on page 1, with different preferences. Sort the papers to the first preferences (the "1s") of each candidate. Once this is done, count each stack:



And record the results in a spreadsheet:

	Ali	Ben	Caroline	Danny	Emma	Total
First Preferences	4	4	9	3	5	25

4. Quota

The first preferences have been counted. Does anybody get elected at this point?

When the first preferences have been counted, a check is made to see if any of the candidates has achieved the quota.

The quota is the minimum number of votes a candidate must get to be elected. To be successful in a PR election, each candidate must reach the quota.

The quota is different for every election. It is the smallest number that guarantees that the number of candidates who reach the quota cannot

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exceed the number of vacancies. The number of vacancies is the number of seats to fill for the election.

The quota is calculated by dividing the number of votes by the number of vacancies + 1, then adding 1 and disregarding any remainders.

$$\begin{array}{r} \text{Number of formal votes} \\ \text{-----} \\ \text{Number of vacancies} + 1 \end{array} + 1 = \text{Quota}$$

Example

You have 25 votes. Let's suppose that you have 3 vacancies to fill for your election – that is, out of Ali, Ben, Caroline, Danny and Emma, only 3 will be elected. The equation would be:

$$\begin{array}{r} 25 \\ \text{-----} \\ 3 + 1 \end{array} + 1 = 7$$

For your election, the quota is 7, which means that a candidate needs to get at least 7 votes to be elected.

At this point, consult your first preference results to see if any candidate has achieved or exceeded the quota. Here, Caroline has received 9 votes: she is elected.

	Ali	Ben	Caroline	Danny	Emma	Total	Elected
First Pref.	4	4	9	3	5	25	Caroline

One vacancy out of three is now filled.

What if...

- **What if all vacancies have been filled after counting the first preferences (i.e. if the number of people reaching or exceeding the quota is equal to the number of vacancies)?**
You have completed the election! The process stops here.
- **What if no candidate has reached the quota?**
You will need to exclude a candidate: go to step 7.
- **What if one or more candidates were elected with more votes than the quota?**
You will need to distribute the surplus of each candidate in turn: go to step 5.

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- **What if one or more candidates were elected right on quota, but none received more votes than the quota?**
You will need to exclude a candidate: go to step 7.

5. Surplus Distribution

Not all vacancies have been filled after the first preferences have been counted. What now?

This is where PR differs from other vote counting systems.

The next thing to do under a PR election is to check if any candidate has a surplus.

Candidates have a surplus if they have received more votes than the quota. The surplus is the excess votes that the candidate has received.

The surplus needs to be distributed according to the next preferences on the ballot papers (here, the 2s).

For example, if the quota is 900 and a candidate has received 1000 votes, a surplus of 100 votes needs to be distributed. However, how can we know which 100 votes of the total 1000 to distribute? If we chose those papers at random, the result of the election would greatly vary depending on which papers were selected.

Therefore, under the form of PR used in Victoria, all the candidates' papers are transferred, but at a reduced value (called the transfer value), so that they are equivalent to the surplus. In other words, all of the 1000 papers would be distributed to the candidates with the second preferences on the ballot papers, but at a value of 1/10, so that the total value of votes distributed equals the surplus of 100.

The transfer value is calculated using the following formula:

$$\frac{\text{Surplus}}{\text{Candidate's total number of papers}} = \text{Transfer Value}$$

- ✓ If more than one candidate has a surplus, you should distribute the surplus of the candidate who has the highest number of votes first.
- ✓ Note that votes cannot be distributed to elected candidates. When distributing ballot papers, if the next preference on the ballot paper goes to an elected candidate, this preference is skipped and the paper

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is distributed to the next preferred candidate (e.g. the "2" is skipped and the ballot paper goes straight to the candidate with the "3").

Example

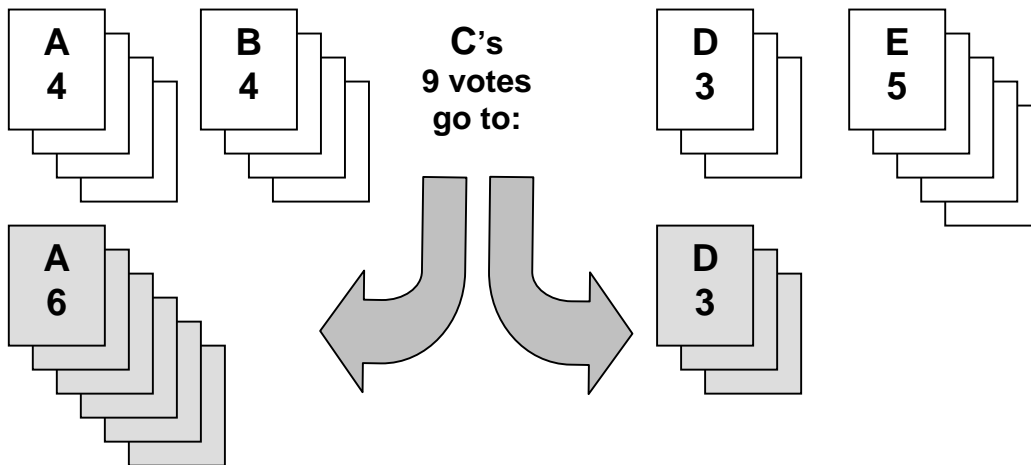
Caroline has been elected with 9 votes. The quota is 7 votes, so her surplus is 2 votes. The surplus needs to be distributed to the candidates with the next preference (here, to the candidates who received a "2" on the ballot papers).

Since it would be unfair to decide which 2 ballot papers would be the ones to be distributed, you need to distribute all of Caroline's votes. However, Caroline's votes should be distributed at a reduced value:

$$\frac{2}{9} = 2/9$$

To distribute the surplus fairly, each of Caroline's papers is now worth 2/9 of a vote. This way, the total value of the papers distributed will be equal to the surplus (9 times 2/9 = 2).

Let's suppose that out of Caroline's 9 votes, 3 had the second preference going to Danny, and 6 had the second preference going to Ali. Distribute Caroline's ballot papers as follows:



Note that it is important to keep the first preferences stacks and the surplus distribution stacks separate.

The number of ballot papers distributed to Danny would be 3 and to Ali would be 6. However, the value of those papers would be 6/9 for Danny and 12/9 (which is 1 3/9) for Ali. Record this distribution in your spreadsheet:

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		Ali	Ben	Caroline	Danny	Emma	Total	Elected
First Pref.		4	4	9	3	5	25	Caroline
Distribution of Caroline's surplus	Nbr of Papers	6		-9	3			
	Value	1 $\frac{3}{9}$		-2	$\frac{6}{9}$			
	Total	5 $\frac{3}{9}$	4	7	3 $\frac{6}{9}$	5	25	

Here, you distributed all of Caroline's votes (-9) at a value of $\frac{2}{9}$ each, so only the surplus was distributed (-2), leaving Caroline with the exact number of votes she needs to be elected (7).

Caroline's surplus has now been distributed to the candidates who received the second preferences. Ali's total number of votes is now 5 $\frac{3}{9}$, and Danny's is 3 $\frac{6}{9}$.

- ✓ *Remember that for a surplus distribution, when calculating the total number of votes received for each candidate, you should not take the **number** of ballot papers received into account. Only the **value** of the ballot papers received is to be calculated, as shown in the result spreadsheet above.*
- ✓ *Don't forget to calculate the total number of votes at every distribution (which is 25 in this example). This total should always stay the same throughout the count. By checking this at each step, you are ensuring that no votes have been forgotten and that your calculation is correct.*

6. Results Check After Surplus Distribution

The surplus has been distributed. What happens now?

The next step is to check if any candidate has reached the quota after the surplus has been distributed.

Example

Consult your results spreadsheet to see if any candidate has reached the quota of 7 votes after Caroline's surplus has been distributed. After the surplus distribution, Ali has now received a total of 5 $\frac{3}{9}$ votes, and Danny's total has gone up to 3 $\frac{6}{9}$ votes. Ben and Emma's totals have not changed.

Nobody has reached the quota after Caroline's surplus has been distributed. There are still two vacancies out of three left to fill.

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What if...

- **What if there are other candidates with a surplus?**
You need to distribute all surpluses before to go to the next step. Go back to step 5.
- **What if there are no other candidates with a surplus?**
You need to exclude a candidate: go to step 7.
- **What if all vacancies have been filled?**
You have completed the election! The process stops here.

7. Candidate Exclusion

The surplus has been distributed, but there are still some vacancies to fill. What is the next step?

If there are no more candidates with a surplus to distribute, and there is still at least one vacancy left to fill, the next step is to exclude a candidate.

Excluding a candidate means distributing the papers of the candidate who has received the least votes. When a candidate is excluded, each ballot paper is transferred to the candidate with the next preference listed on it.

Ballot papers are transferred at the value at which the candidate received them. This means that if the papers you are distributing from the excluded candidate have been received from a surplus distribution, they will keep their reduced value (e.g. 2/9). If the papers you are distributing from the excluded candidate are first preference votes, they will keep their full value (1 each).

Example

According to your current results, Danny is the candidate who has the lowest total of votes:

		Ali	Ben	Caroline	Danny	Emma	Total	Elected
First Pref.		4	4	9	3	5	25	Caroline
Distribution of Caroline's surplus	Nbr of Papers	6		-9	3			
	Value	1 3/9		-2	6/9			
	Total	5 3/9	4	7	3 6/9	5	25	

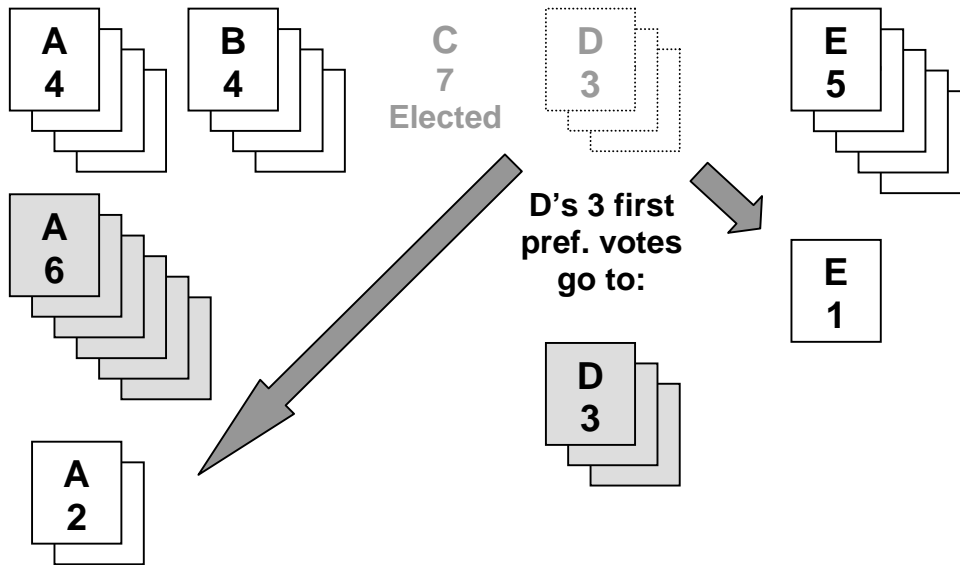
Danny is therefore the candidate to be excluded.

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You need to distribute Danny's papers to the candidates who received the next preference. Remember that votes cannot be distributed to an elected candidate. If the next preference goes to Caroline, skip this preference and move the ballot paper to the next preferred candidate.

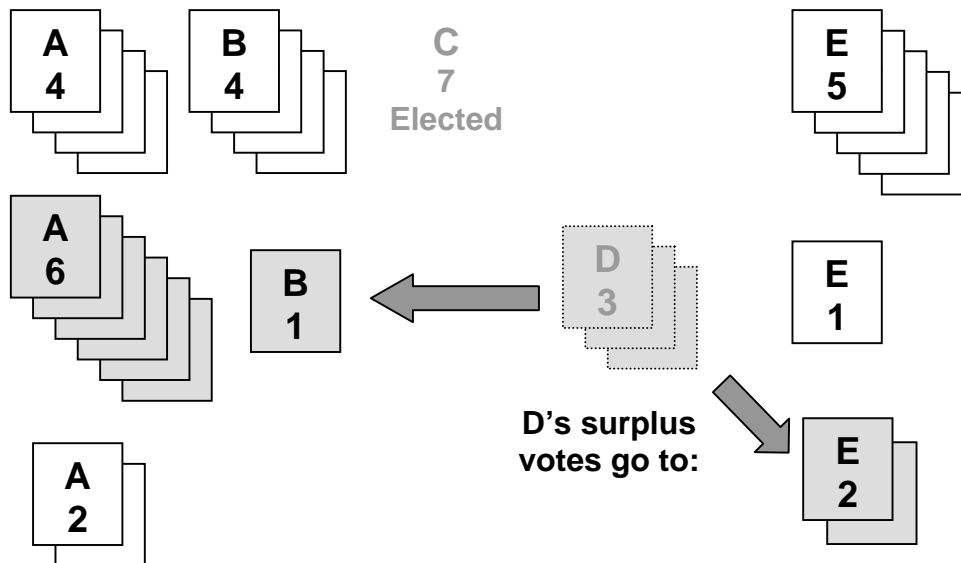
Each stack needs to be distributed separately. Therefore, Danny's exclusion should happen in 2 steps.

First, you need to distribute Danny's 3 first preference ballot papers. Let's suppose that 2 of those go to Ali and 1 goes to Emma:



As we have seen before, first preference votes are worth 1 vote each. This means that Ali has received 2 votes and Emma, 1 vote.

Then, distribute the 3 ballot papers that Danny received from Caroline's surplus. Let's suppose that 2 of those go to Emma and 1 goes to Ben:



As we have seen before, those surplus votes are worth $2/9$ of a vote each. This means that Ben has received $2/9$ votes and Emma, $4/9$ votes.

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Record the outcome of your 2 distributions in your results spreadsheet:

			Ali	Ben	Caroline	Danny	Emma	Total	Elected
First Pref.			4	4	9	3	5	25	Caroline
Distrib. of Caroline's surplus		Nbr of Papers	6		-9	3			
		Value	1 $\frac{3}{9}$		-2	$\frac{6}{9}$			
		Total	5 $\frac{3}{9}$	4	7	3 $\frac{6}{9}$	5	25	
Exclusion of Danny	First Pref. papers	Nbr of Papers	2			- 3	1		
		Value	2			- 3	1		
	Progressive Total		7 $\frac{3}{9}$	4	7	$\frac{6}{9}$	6	25	
	Surplus papers	Nbr of Papers		1		- $\frac{6}{9}$	2		
		Value		$\frac{2}{9}$		- $\frac{6}{9}$	$\frac{4}{9}$		
		Total	7 $\frac{3}{9}$	4 $\frac{2}{9}$	7	0	6 $\frac{4}{9}$	25	Ali

Danny's exclusion brings Ali's total to 7 $\frac{3}{9}$ votes.

8. Results Check After Candidate Exclusion

A candidate has been excluded. What now?

The next step is to check if any candidate has reached the quota after the candidate has been excluded.

Example

Consult your results spreadsheet to see if any candidate has reached the quota of 7 votes after Danny has been excluded. After the distribution of Danny's papers, Ali's total has gone up to 7 $\frac{3}{9}$ votes. Ali is elected.

There is now 1 vacancy out of three left to fill.

9. A candidate has been excluded and there are still some vacancies to fill. What comes next?

What happens next is a repeat of steps 5 to 8 above.

First, a check is done to see if any candidate has a surplus. If so, the surplus will be distributed (as per step 5) and a check will be made to see if a candidate has reached the quota (as per step 6).

Then, if there is still at least one vacancy left to fill and no surplus left to distribute, the next candidate with the lowest total of votes will be excluded

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(as per step 7). A check will then be made to see if a candidate has reached the quota following the exclusion (as per step 8).

Those steps will be repeated until all vacancies are filled.

Example

The next step is to identify any surpluses. Danny's exclusion has caused Ali to be elected with a total number of votes of $7 \frac{3}{9}$. Since your quota is 7, Ali's surplus of $\frac{3}{9}$ needs to be distributed as explained in step 5.

After you have distributed Ali's surplus, check the total number of votes received by each candidate to see if anybody has reached the quota. If the distribution of Ali's surplus does not make another candidate reach quota, you will need to exclude another candidate, as explained in step 7.

Repeat those steps until all of your 3 vacancies all filled. Voilà!

Glossary

Exclusion

An exclusion is the distribution of the ballot papers of the candidate with the lowest number of votes received.

First Preferences

The first preferences are those marked '1' on the ballot papers. That is, the voter's first choice to be elected.

Quota

The quota is the minimum number of votes a candidate must get to be elected. To be successful in a PR election, each candidate must reach the quota.

Surplus

The surplus is the excess votes that the candidate has received. Candidates have a surplus if they have received more votes than the quota. When a candidate receives more votes than needed to be successful, a surplus distribution occurs.

Vacancy

A vacancy is a seat that needs to be filled by the means of an election. For example, an election with three vacancies means that three candidates need to be elected.

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Sample Ballot Papers

The following pages contain a set of sample ballot papers. These 25 papers will produce the result of the example detailed in this guide.

A page of blank ballot papers is also included. Use those to run your own election or vote on an issue of your choice. For example:

- Which two flavours of popcorn should be sold at the canteen?
- Which three bands should be selected to play at the year 10 formal?

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Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
1	<i>Ali</i>
2	<i>Ben</i>
4	Caroline
5	Danny
3	Emma

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
1	<i>Ali</i>
2	<i>Ben</i>
5	Caroline
4	Danny
3	Emma

✂

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
1	<i>Ali</i>
4	<i>Ben</i>
2	Caroline
3	Danny
5	Emma

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
1	<i>Ali</i>
5	<i>Ben</i>
2	Caroline
4	Danny
3	Emma

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Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
2	<i>Ali</i>
1	<i>Ben</i>
5	<i>Caroline</i>
4	<i>Danny</i>
3	<i>Emma</i>

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
3	<i>Ali</i>
1	<i>Ben</i>
4	<i>Caroline</i>
5	<i>Danny</i>
2	<i>Emma</i>

✂-----

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
5	<i>Ali</i>
1	<i>Ben</i>
2	<i>Caroline</i>
3	<i>Danny</i>
4	<i>Emma</i>

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
5	<i>Ali</i>
1	<i>Ben</i>
3	<i>Caroline</i>
4	<i>Danny</i>
2	<i>Emma</i>

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Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
5	<i>Ali</i>
4	<i>Ben</i>
3	<i>Caroline</i>
2	<i>Danny</i>
1	<i>Emma</i>

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
5	<i>Ali</i>
2	<i>Ben</i>
3	<i>Caroline</i>
2	<i>Danny</i>
1	<i>Emma</i>

✂-----

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
4	<i>Ali</i>
5	<i>Ben</i>
3	<i>Caroline</i>
2	<i>Danny</i>
1	<i>Emma</i>

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
4	<i>Ali</i>
5	<i>Ben</i>
3	<i>Caroline</i>
2	<i>Danny</i>
1	<i>Emma</i>

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Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
2	<i>Ali</i>
5	<i>Ben</i>
3	<i>Caroline</i>
4	<i>Danny</i>
1	<i>Emma</i>

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
4	<i>Ali</i>
5	<i>Ben</i>
1	<i>Caroline</i>
2	<i>Danny</i>
3	<i>Emma</i>

✂-----

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
4	<i>Ali</i>
5	<i>Ben</i>
1	<i>Caroline</i>
2	<i>Danny</i>
3	<i>Emma</i>

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
3	<i>Ali</i>
5	<i>Ben</i>
4	<i>Caroline</i>
1	<i>Danny</i>
2	<i>Emma</i>

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Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
5	<i>Ali</i>
3	<i>Ben</i>
1	Caroline
2	Danny
4	Emma

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
2	<i>Ali</i>
5	<i>Ben</i>
1	Caroline
4	Danny
3	Emma

✂-----

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
2	<i>Ali</i>
5	<i>Ben</i>
1	Caroline
3	Danny
4	Emma

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
2	<i>Ali</i>
4	<i>Ben</i>
1	Caroline
5	Danny
3	Emma

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Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
2	<i>Ali</i>
5	<i>Ben</i>
1	Caroline
3	Danny
4	Emma

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
2	<i>Ali</i>
4	<i>Ben</i>
1	Caroline
3	Danny
5	Emma

✂-----

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
2	<i>Ali</i>
5	<i>Ben</i>
1	Caroline
3	Danny
4	Emma

Ballot Paper	
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.	
2	<i>Ali</i>
5	<i>Ben</i>
3	Caroline
1	Danny
4	Emma

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Ballot Paper

Number the boxes 1 to 5 in
the order of your choice.
Number every box to make
your vote count.

2 *Ali*

5 *Ben*

3 **Caroline**

1 **Danny**

4 **Emma**

✂-----

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Ballot Paper
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

Ballot Paper
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>



Ballot Paper
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

Ballot Paper
Number the boxes 1 to 5 in the order of your choice. Number every box to make your vote count.
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>