
How Likely Are Two Voting Rules Different?

Abstract

We characterize the maximum likelihood that two voting rule outcomes are different and that the winner of one voting rule is the loser of another (implying that they are *drastically different*) on positional scoring rules, Condorcet winner/loser, Copeland, Ranked Pairs, and STV (Single Transferable Vote) under any fixed number of alternatives. The most famous problem in this scope is strong Borda’s paradox, in which the winner of the plurality rule is the Condorcet loser. Under mild assumptions, we show that the maximum likelihood that different rules are drastically different is $\Theta(1)$ except for a few special cases, demonstrating the difference between these rules. We also prove that two scoring rules with linear independent scoring vectors have different winners with probability $\Theta(1)$, no matter how similar they are. Our analysis adopts the *smoothed social choice framework* ? and can be applied to a variety of statistical models, including the standard impartial culture (IC).

1 INTRODUCTION

UAI 2025 papers have to be prepared using L^AT_EX. To start writing your paper, copy `uai2025-template.tex` and replace title, authorship, and content with your own.

The UAI 2025 paper style is based on a custom `uai2025` class. The class file sets the page geometry and visual style.¹ The class file also loads basic text fonts.² *You may*

¹The class uses the packages `adjustbox`, `environ`, `letltxmacro`, `geometry`, `footmisc`, `caption`, `textcase`, `titlesec`, `titling`, `authblk`, `enumitem`, `microtype`, `lastpage`, and `kvoptions`.

²Fonts loaded are `times (roman)`, `helvet (sanserif)`, `courier (fixed-width)`, and `textcomp (common symbols)`.

not modify the geometry or style in any way, for example, to squeeze out a little bit of extra space. (Also do not use `\vspace` for this.) Feel free to use convenience functionality of loaded packages such as `enumitem`. The class enables hyperlinking by loading the `hyperref` package.

You are free to load any packages available in T_EXLive 2020 that are compatible with the UAI class.³ (MikT_EX and MacT_EX generally contain the same packages.) Do not load conflicting packages you will get an error message, as this complicates creating the proceedings. Please avoid using obsolete commands, such as `\rm`, and obsolete packages, such as `epsfig`.⁴

Feel free to include your own macros in the header of your source file.

2 GENERAL FORMATTING INSTRUCTIONS

As a general rule: *follow the template*.

2.1 AUTHORSHIP

Reviewing is double-blind. However, you can already fill in your author names and affiliations in the `\author` block in the preamble following the example of the template because the class will remove it as long as the option `accepted` is not passed to the class. Nevertheless, make sure any other information in the paper does not disclose your identity, for example URLs to supplementary material.

2.2 SECTIONING

Three numbered sectioning commands are provided: `\section`, `\subsection`, and `\subsubsection`.

³In case this template or your submission does not compile, always first make sure your T_EX installation is up-to-date.

⁴See <https://ctan.org/pkg/l2tabu>.

Please respect their order, so do not put a `\subsubsection` directly beneath a `\section`. One unnumbered sectioning command is provided, `\paragraph`. It can be used directly below any numbered section level. Do not use any other sectioning commands.

2.2.1 Typing the Section Titles

The `\section` and `\subsection` titles are uppercased by the class. Please type them in title case. (This is used in the PDF bookmarks.) Please also write the `\subsubsection` titles in title case.

What is title case? Wikipedia explains:

Title case or headline case is a style of capitalization used for rendering the titles of published works or works of art in English. When using title case, all words are capitalized except for minor words (typically articles, short prepositions, and some conjunctions) unless they are the first or last word of the title.

2.3 REFERENCES, CITATIONS, FOOTNOTES

2.3.1 Cross-Referencing

Always use `\label` and `\ref` for a command with a similar effect when cross-referencing. For example, this subsection is Section 2.3.

2.3.2 Citations

Citations should include the author's last name and year. They should be part of the sentence. An example parenthetical citation: Good introductions to the topic are available [?]. An example textual citation: ? discusses electrodynamics of moving bodies. Do not use a parenthetical citation where a textual one is appropriate. An example of what *not* to do: [?] discusses electrodynamics of moving bodies.

We strongly advise to use reference list software such as BibTeX and a citation package such as natbib. The reference style you use should be compatible with the author-year citations. Both the citation style and reference style used should be consistent.

For the original submission, take care not to reveal the authors' identity through the manner in which one's own previous work is cited. For example, writing I discussed electrodynamics of moving bodies before [?]. would be inappropriate, as it reveals the author's identity. Instead, write ? discussed electrodynamics of moving bodies.

2.3.3 Footnotes

You can include footnotes in your text.⁵ The footnote mark should follow the fragment to which it refers, so a footnote⁶ for a word has a footnote mark attached to that word and a footnote for a phrase or sentence has a footnote mark attached to the closing punctuation.

3 MATH

The class file does not load any math support package like `amsmath`⁷. We advise using the `mathtools`⁸ package, which extends `amsmath` with fixes and even more useful commands. Feel free to load other support packages for symbols, theorems, etc.

Use the `amsmath` environments for displayed equations. So, specifically, use the `equation` environment instead of `$$...$$` and the `align` environment instead of `eqnarray`.⁹ An equation:

$$0 = 1 - 1. \tag{1}$$

Two `align`'ed equations:

$$\begin{aligned} 1 + 2 &= 3, \\ 1 - 2 &= -1. \end{aligned}$$

Equations can also be put inline, of course. For example, Equation (1): $0 = 1 + 1$. (Notice that both inline and displayed math are part of the sentence, so punctuation should be added to displayed math.)

The `amsmath` and `mathtools` packages provide a lot of nice functionality, such as many common math operators, e.g., `\sin` and `\max`, and also commands for defining new ones.

4 FLOATS

Floats, such as figures, tables and algorithms, are moving objects and are supposed to float to the nearest convenient location. Please do not force them to go in the middle of a paragraph. They must respect the column width.

Two-column floats are possible. They appear at the top of the next page, so strategic placement may be necessary. For an example, see Figure 1. They may not enter the margins.

⁵Use footnotes sparingly, as they can be distracting, having readers skip back and forth between the main text and the foot of the page.

⁶A footnote is material put at the foot of a page.

⁷See the `amsmath` documentation at <https://ctan.org/pkg/amsmath> for further details.

⁸See the `mathtools` documentation at <https://ctan.org/pkg/mathtools> for further details.

⁹For reasons why you should not use the obsolete `eqnarray` environment, see Lars Madsen, *Avoid eqnarray!* TUGboat 33(1):21–25, 2012.

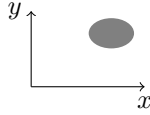


Figure 1: A Nice Filled Ellipse with a Pair of Coordinate Axes.

All material in floats should be legible and of good quality. So avoid very small or large text and pixelated or fuzzy lines.

4.1 FIGURES

Figures should go in the `figure` environment and be centered therein. The caption should go below the figure. Use `\includegraphics` for external graphics files but omit the file extension. Supported formats are `pdf` (preferred for vector drawings and diagrams), `png` (preferred for screenshots), and `jpeg` (preferred for photographs). Do not use `\epsfig` or `\psfig`. If you want to scale the image, it is better to use a fraction of the line width rather than an explicit length. For example, see Figure 2.



Figure 2: A View of a Nice City.

Do not use `\graphicspath`. If the images are contained in a subdirectory, specify this when you include the image, for example `\includegraphics{figures/mypic}`.

4.2 TABLES

Tables should go in the `table` environment and be centered therein. The caption should go above the table and be in title caps. For an example, see Table 1.

Table 1: An Interesting Table.

Dataset	Result
Data1	0.12345
Data2	0.67890
Data3	0.54321
Data4	0.09876

4.3 ALGORITHMS

You can load your favorite algorithm package, such as `algorithm2e`¹⁰. Use the environment defined in the package to create a centered float with an algorithm inside.

5 BACK MATTER

There are a some final, special sections that come at the back of the paper, in the following order:

- Author Contributions (optional)
- Acknowledgements (optional)
- References

They all use an unnumbered `\subsubsection`.

For the first two special environments are provided. (These sections are automatically removed for the anonymous submission version of your paper.) The third is the References section. (See below.)

(This Back Matter section itself should not be included in your paper.)

¹⁰See the `algorithm2e` documentation at <https://ctan.org/pkg/algorithm2e>.

Title in Title Case

(Supplementary Material)

This Supplementary Material should be submitted together with the main paper.

A ADDITIONAL SIMULATION RESULTS

Table 2 lists additional simulation results; see also ? for a comparison.

Table 2: An Interesting Table.

Dataset	Result
Data1	0.12345
Data2	0.67890
Data3	0.54321
Data4	0.09876

B MATH FONT EXPOSITION

How math looks in equations is important:

$$F_{\alpha,\beta}^{\eta}(z) = \Gamma(\tfrac{3}{2}) \prod_{\ell=1}^{\infty} \eta \frac{z^{\ell}}{\ell} + \frac{1}{2\pi} \int_{-\infty}^z \alpha \sum_{k=1}^{\infty} x^{\beta k} \mathrm{d}x.$$

However, one should not ignore how well math mixes with text: The frobble function f transforms zabbies z into yannies y . It is a polynomial $f(z) = \alpha z + \beta z^2$, where $-n < \alpha < \beta/n \leq \gamma$, with γ a positive real number.