

Ranked Voting Guidelines

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Summary

This document specifies guidelines for the conduct of ranked voting elections, where ranked voting includes both instant runoff voting (IRV) for single-winner contests and choice voting for multiple-winner contests. This document includes ballot, tabulation, reporting, manual audit, and recount guidelines. The guidelines for computer tabulation and hand tabulation are treated separately where appropriate.

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1 Introduction

1.1 Overview

Instant runoff voting (IRV) and choice voting are ranked voting methods designed to maximize representation of voters. This document provides procedural guidelines for conducting elections using these ranked voting methods. In California, these guidelines are consistent with the IRV roadmap of Alameda County [AC] and the ranked voting provisions in the charters of Oakland [Oak] and San Francisco [SF]. However, any jurisdiction may adopt these procedures.

1.2 Instant runoff voting

Instant runoff voting is used for single seat contests. In the United States, jurisdictions including Oakland and San Francisco refer to IRV as “ranked choice voting.” Internationally, some countries call IRV “the alternative vote,” and others call it “preferential voting.”

IRV is a majoritarian voting method because, in the end, over 50% of participating voters elect the winner. IRV simulates a series of runoff elections in a single election. In each round of the “instant runoff,” last place candidates with no chance of winning are eliminated. Voters for those candidates have their ballot count towards their next choice in the following round.

1.3 Choice voting

Choice voting is used for multiple seat contests. Choice voting is also known as “the single transferable vote” (STV) and preference voting. Choice voting is a proportional method because all of the winners are elected with approximately equal percentages of the total vote. The percentage a candidate needs to win (called the “winning threshold”) is the fewest number of votes that only the winning number of candidates can win. For example, a candidate in a 3-seat choice voting contest needs just over 25% to win. Together, the three winners of such a contest represent over 75% of the participating voters. Choice voting is designed to have as many voters as possible have their one vote count towards the election of a candidate.

2 Ranked Voting Elections

2.1 General provisions

Ranked voting elections to fill one or more seats shall conform to the guidelines in this document wherever possible.

2.2 Definitions

The following definitions shall apply to this document.

- (1) “**Ballot group**” means a subset of ballots cast in an election, such as all ballots cast by voters in one precinct, or all ballots cast on one direct recording electronic (DRE) voting machine (cf. [EC]). Election officials use ballot groups for hand tabulation, auditing, reporting, and recount purposes.
- (2) “**Choice voting**” means ranked voting for multiple-winner contests.
- (3) “**Continuing candidate**” means a candidate who has not been eliminated.
- (4) “**Continuing total**” means the sum of all continuing candidate totals.
- (5) “**Instant runoff voting**” means ranked voting for single-winner contests.
- (6) “**Ranked vote,**” or simply vote, means the selections made by a voter at every available ranking for a single ranked voting contest.
- (7) “**Round**” means a stage of the tabulation of a ranked voting contest in which votes may be transferred and counted, and candidates elected or eliminated.

3 Ballots

3.1 Voter instructions

Ballot instructions shall direct voters to rank candidates in order of preference by choosing a first choice candidate, a different candidate for the second choice, a different candidate for the third choice, and so on. The instructions shall say that voters can rank as few or as many candidates as they want, up to the allowed limit. The instructions should convey that ranking additional choices will not hurt a voter’s higher-ranked choices.

3.2 Number of rankings

The ballot format should allow voters to rank all the candidates appearing on the ballot for that contest. In addition, the ballot format should allow voters to rank a number of qualified write-in candidates equal to at least two or the number of seats, whichever is greater.

3.3 Exceptions for equipment limitations

If the voting equipment or procedures available to the jurisdiction cannot feasibly accommodate the number of rankings in [Section 3.2](#), the number of rankings and write-in rankings may be limited to the maximum number feasible. However, the total number of rankings per ranked voting contest shall never be less than three, and voters shall always be allowed to rank at least two qualified write-in candidates per ranked voting contest.

3.4 Uniformity across ballot types

If more than one type of voting equipment or ballot will be used in a ranked voting contest, all equipment and ballot types used shall provide substantially similar instructions and shall allow voters to rank the same number of candidates and write-ins.

4 General Tabulation Provisions

4.1 Determination of winners

To determine the winners of a ranked voting contest, apply to the ballots the tabulation method of [Section 5](#) or [Section 6](#), depending on whether the number of seats to fill is one or more than one, respectively.

4.2 Summary reports

Election officials shall make available to the public a summary report for each ranked voting contest. The report shall display, in grid form, the following for each round: the winning threshold; the candidate totals; the continuing total; and the undervote, overvote, and exhausted vote totals. The summary report may also display, for each round, the net change of each of these values from the previous round. The summary report may also display, beside each candidate total, the candidate total as a percentage of the continuing total. Election officials shall release preliminary summary reports and are encouraged to update them regularly as more ballots are processed. Election officials should make the first preliminary summary report available on election day, if possible.

4.3 Skipped rankings

When a skipped ranking is encountered on a ballot during the tabulation of a ranked voting contest, that ballot shall count towards the next non-skipped ranking.

4.4 Undervotes, overvotes, and exhausted votes

The following rules shall be applied during the tabulation of a ranked voting contest. In the event that a ranked vote has no candidates selected at any ranking, that ballot shall

count as an “undervote.” In the event that a ranked vote advances to a ranking with more than one candidate selected, that ballot shall count as an “overvote.” In the event that a ranked vote is neither an undervote, overvote, nor counting towards a candidate, that ballot shall count as an “exhausted vote.” Any ballot counting as an undervote, overvote, or exhausted vote shall remain so and shall not count towards any candidate in that round or in subsequent rounds.

4.5 Resolving ties

4.5.1 Standard method

In the event that a tie occurs during the tabulation of a ranked voting contest, the tie shall be resolved in public by lot.

4.5.2 Alternative method*

The following method may be used in place of the method above to resolve those ties not covered by state law that may occur during the tabulation of a ranked voting contest. Prior to election day, election officials shall draw the names of all candidates and qualified write-in candidates at random during a public ceremony. Election officials shall make the drawn order public prior to election day. In the event that a tie occurs during the tabulation, election officials shall resolve the tie in favor of the candidates appearing earliest on the publicized list. **[We do not know if the method described in this paragraph is a legal way to resolve ties under state law. This needs to be checked before including this paragraph.]*

4.6 Publicizing tabulation procedures

In advance of the election, election officials shall make available to the public a description of the tabulation procedures for each ranked voting contest. The description shall be precise enough to permit the creation of a computer program that implements the tabulation algorithm actually used. Alternatively, the public description may include a computer program with source code that carries out the tabulation algorithm actually used.

5 Instant runoff voting

5.1 Overview

Instant runoff voting is a majoritarian voting method designed to accommodate more than two candidates seeking a single seat. The ballots are counted in a series of rounds. Every voter has one vote in each round of counting, but can rank more than one candidate. The weakest candidate is eliminated after each round of counting, and each ballot cast for that candidate is counted in the next round for the candidate ranked next on that ballot. Once the field is reduced to two, the candidate with more votes is declared the winner.

5.2 Tabulation method

Election officials shall tabulate the ballots in rounds, according to the following steps.

(1) **Initial counting.**

Begin round one.

Count each ballot as a vote for the first choice candidate on that ballot.

(2) **Determine if there is a winner.**

If there are exactly two continuing candidates, declare the candidate with the larger total the winner and end the tabulation.

Otherwise, begin a new round and proceed to the next step.

(3) **Eliminate last-place candidate.**

Eliminate the continuing candidate with the smallest total. For each ballot that counted towards the eliminated candidate, count it towards the vote total of the highest-ranking continuing candidate on that ballot.

(4) **Subsequent counting.**

Go to Step (2), and continue counting ballots in this fashion, transferring votes from eliminated candidates, round after round, until only two candidates remain and the candidate with the larger vote total is declared the winner.

5.3 Elimination of more than one candidate at a time

In order to reduce the occurrence of ties that need to be broken, candidates who have no mathematical chance of winning shall be eliminated simultaneously as follows. Before Step (3), in the event that any candidate total exceeds the sum of the totals of all continuing candidates with a smaller total, eliminate all the candidates with a smaller total, count those ballots as in Step (3), and proceed to Step (4). When applying simultaneous elimination, eliminate the largest group possible that leaves at least two continuing candidates.

5.4 Voting equipment accommodation

Tabulation equipment, including software, that terminates the count as soon as one candidate has a majority of the continuing total shall be considered to be in substantial compliance with these procedures for the purposes of [Section 10](#). However, continuing the tabulation until only two candidates remain is encouraged.

6 Choice voting

6.1 Overview

Choice voting is a proportional voting method for contests with more than one seat. The ballots are counted in a series of rounds. Every voter has one vote in each round of counting, but can rank more than one candidate. Candidates win if they reach a winning threshold. In each round, votes in excess of the winning threshold are called surplus votes and are later counted at a fractional value towards the next choices on those ballots. Moreover, in each round, the candidates that cannot win are eliminated, and each ballot cast for those candidates is counted in the next round for the candidate ranked next on that ballot.

6.2 Definitions

The following definitions shall apply to this section.

- (1) “**Candidate surplus**” means the candidate total minus the winning threshold if the candidate has been declared a winner.
- (2) “**Surplus total**” means the sum of all candidate surpluses.
- (3) “**Winning threshold**” means the smallest whole number larger than the result obtained by dividing the sum of all candidate totals (the continuing total) by one more than the number of seats. For example, if the number of seats is two and the continuing total is 900, then the winning threshold is 301.

6.3 Precision

All vote totals shall have the same number of digits after the decimal point. This number of digits shall be determined prior to the election and made public in accordance with [Section 4.6](#).

6.4 Tabulation method

Election officials shall tabulate the ballots in rounds, according to the following steps.

- (1) **Initial counting.**

Begin round one.

Count each ballot as one vote for the first choice candidate on that ballot.

Compute the winning threshold.

(2) Determine if there are winners.

Declare as a winner any candidate whose total equals or exceeds the winning threshold. If the number of candidates declared winners equals the number of seats, end the tabulation.

Otherwise, begin a new round and proceed to the next step.

(3) Transfer surplus from winning candidate.

If some candidate has a surplus of votes above the winning threshold, then for each ballot counting towards the winning candidate with the largest surplus, count it towards the vote total of the highest-ranking continuing candidate on that ballot that has not been declared a winner. Count each ballot at a fractional amount equal to its current value times the surplus of the winning candidate divided by the total of the winning candidate.

(4) Eliminate last-place candidate.

If no candidate has a surplus, then eliminate the candidate with the smallest vote total. For each ballot that counted towards the eliminated candidate, count it towards the vote total of the highest-ranking continuing candidate on that ballot that has not been declared a winner. Count each ballot at its current value. If at least one candidate has already been declared as a winner, keep the winning threshold the same. Otherwise, recompute the winning threshold to account for the new continuing total.

(5) Subsequent counting.

Go to Step (2), and continue counting ballots in this fashion, transferring surplus votes of winning candidates followed by votes from eliminated candidates, round after round, until all seats are filled.

6.5 Elimination of more than one candidate at a time

6.5.1 To reduce the occurrence of ties

In order to reduce the occurrence of ties that need to be broken, candidates who have no mathematical chance of winning shall be eliminated simultaneously as follows. Before Step (4), in the event that no candidate has a surplus and some candidate total exceeds the sum of the totals of all continuing candidates with a smaller total, eliminate all the candidates with a smaller total, count those ballots as in Step (4), and proceed to Step (5). When applying simultaneous elimination, eliminate the largest group possible that leaves at least as many continuing candidates as there are seats.

6.5.2 For easier tabulation

In order to keep votes whole as much as possible, simultaneous eliminations may be performed as follows. Before Step (3), in the event that any candidate total exceeds the

surplus total plus the sum of the totals of all continuing candidates with a smaller total, eliminate all the candidates with a smaller total, count those ballots as in Step (4), and proceed to Step (5). When applying simultaneous elimination, eliminate the largest group possible that leaves at least as many continuing candidates as there are seats.

6.6 Order of winners

The candidates declared as winners in Step (3) of [Section 6.4](#) shall be declared winners in order of their vote totals, with candidates having the largest totals declared winners first.

6.7 Termination of tabulation

In Step (2) of [Section 6.4](#), if the number of continuing candidates equals the number of seats, then declare all continuing candidates as winners. If the number of continuing candidates equals one more than the number of seats, then declare all continuing candidates as winners except for the continuing candidate with the smallest vote total.

7 Computer Tabulation Provisions

7.1 General provisions

This section shall apply only to ranked voting contests tabulated by computer.

7.2 Definitions

The following definitions shall apply to this section.

- (1) **“Image,”** or ranked vote image, means any alpha-numeric representation of a ranked vote.
- (2) **“Raw image”** means an image captured from a ranked vote, recorded, and tallied during the tabulation.

7.3 Automatically captured ranked votes

Raw images captured from ranked votes using only automatic means, such as by optically scanning a cast paper ballot, shall indicate all candidate selections at each ranking, including skipped rankings, multiple selections of the same candidate, and multiple selections of candidates at a single ranking.

7.4 Basis for tabulation

The list of raw images shall be used as the basis for the tabulation of a ranked voting contest. The list of raw images shall be preserved on a digital medium at least until after the end of the terms of the offices being elected, and until after the end of the statute of limitation for any civil or criminal action that may arise from conduct related to casting or tabulating votes in the election, or longer, as may be provided by law.

7.5 Ranked vote image reports

7.5.1 Time and mode of release

An image report for each ranked voting contest shall be made available to the public via the Internet and by other means. Preliminary image reports shall be released and updated regularly as more ballots are processed. The first image report shall be made available on election night, if feasible. Each image report shall be accompanied by a preliminary summary report obtained by tabulating the ranked votes corresponding to the images in the image report.

7.5.2 Content

Each image report shall contain a vote image for each ballot processed up to that point. Each image in the report shall be accompanied by a label indicating whether the image was created using automatic means, such as by optically scanning a cast paper ballot, or using manual means, and by labels sufficient to designate the ballot group of that ballot, which may include labels for the precinct of origin, whether the ballot was cast absentee, and labels for any other characteristics necessary for the conduct of the public manual audit. It shall be possible to generate the summary report by tabulating the images contained therein using the tabulation method publicized in accordance with [Section 4.6](#).

7.5.3 Ballot secrecy

The order in which images are listed in each image report shall not be related to the order in which the corresponding ballots were cast. To ensure ballot secrecy, each image in an image report can, but need not, be identical to its corresponding raw image tabulated in accordance with [Section 7.4](#).

7.5.4 Format

Each image report shall be made available in a human-readable plain-text format. The format shall be consistent and easily described, such as comma-delimited. To permit the preparation of a computer program that can process the images in each image report, a precise description of the format of the image report shall be made available to the public in advance of the election.

7.5.5 Rules for converting ranked votes

The rules for converting ranked votes to images presentable to the public in an image report shall be made available to the public in advance of the election. The rules shall cover manually and automatically-captured images, as well as the treatment of remade ballots. The rules shall include the transcription rules for marks for write-in candidates, rankings containing more than one mark, write-in marks for ballot-qualified candidates, and other special cases. The rules shall also include any transformation rules used to protect ballot secrecy.

7.6 Public manual audit

The final image report shall be released prior to the random selection of ballots for the public manual audit. The public manual audit shall check that the images in the final image report match the ranked votes for the ballots in the randomly selected ballot groups, after applying the rules of [Section 7.5.5](#) as necessary.

7.7 Recounts

A full or partial recount shall proceed by recreating the raw images from the original ranked votes in all of, or a designated portion of, the ballot groups. The images for these ballot groups shall be replaced in the list of raw images, and the list of raw images shall be retabulated. Image reports and summary reports shall be rereleased for these retabulations using the same procedures as for the original count.

7.8 Statement of votes cast

The statement of votes cast for a ranked voting contest shall include a summary report and the tabulation method description. An electronic statement of votes cast shall also include the final image report.

8 Hand Tabulation Provisions

8.1 General provisions

This section shall apply only to ranked voting contests tabulated by hand.

8.2 Comprehensive reports

Election officials shall make available to the public, via the Internet and by other means, a comprehensive report for each ranked voting contest. The comprehensive report shall list, for each round, the total vote from each ballot group counting towards each candidate total and counting towards the undervote total, overvote total, and exhausted vote total.

8.3 Public manual audit

For the public manual audit, election officials shall generate a comprehensive report and make it available to the public prior to the random selection of ballot groups to be checked by the public manual audit. The public manual audit shall verify for the randomly selected ballot groups the vote totals reported in the comprehensive report.

8.4 Recounts

A recount shall proceed by recounting the totals reported in the comprehensive report for all of, or a designated portion of, the ballot groups, beginning with the first round totals and continuing with later round totals as necessary.

8.5 Statement of votes cast

A statement of votes cast for a ranked voting contest shall include a summary report, a comprehensive report, and the tabulation method description.

9 Voter Education

Any jurisdiction using ranked voting shall conduct a voter education campaign to familiarize voters with ranked voting. Voter education shall include outreach to speakers of all languages used on ballots in the jurisdiction.

10 Changes to Procedures

Election officials may change the procedures described in this document to accommodate the voting equipment available, provided that the new procedures are in substantial compliance with the procedures described here, the smallest feasible number of changes is made, and the changes to the tabulation procedures are made public in accordance with [Section 4.6](#).

11 Voting Integrity and Ballot Secrecy

The procedures described in this document provide a robust audit framework that supports software independence and maximum transparency, while still protecting ballot secrecy. One component of this audit framework is to make both the tabulation algorithm and input to that algorithm public, for computer-tabulated elections. This allows anyone to verify that the computer is carrying out the tabulation algorithm correctly. The input data made public is called an image report. The second component of this framework is to randomly audit the final image report in a public manual process. The manual audit directly checks that

the publicly released data matches the original paper ballots and/or voter-verified paper audit trails (VVPATs). Taken together, these steps ensure election integrity. The third component protects ballot secrecy. The notions of raw and publicly reported images in [Section 7](#) ensure that votes can always remain anonymous.

References

- [EC] California Elections Code, Section 15360, as of March 2007.
- [Oak] “The Charter of the City of Oakland,” Article XI: Elections, following passage of Measure O charter amendment in November 2006 entitled “Ranked Choice / Instant Runoff Voting.”
- [SF] “City and County of San Francisco 1996 Charter,” Article XIII: Elections, Sec. 13.102. Instant Runoff Elections, as of March 2007.
- [AC] “Final Draft IRV Roadmap,” Alameda County Acting Registrar of Voters Elaine Ginnold and Alameda County Instant Runoff Voting Task Force, August 12, 2005.