FAS Senate
AN ELECTED BODY OF THE FACULTY OF ARTS AND SCIENCES **YALE UNIVERSITY**

Report of the Elections Committee
FAS Senate
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1. Overview

The first five FAS Senate elections have been possible due to the hard work of the FASS Implementation Committee, chaired by Steven Wilkinson, who set up the rules for Senate elections, and because of the hard work of Jay Emerson, Matt Regan, Alexander Coppock, and others who have designed a process for carrying out the elections in a manner consistent with those rules.

The current process consists of designing ballots, creating a Qualtrics questionnaire for collecting ballots, writing and testing several R-scripts for checking and extracting the ballots from the raw CSV file produced by Qualtrics, and running a version of the Single Transferable Vote ballot-counting method implemented locally in the R-language.

Ballot Collection

Qualtrics is not designed for on-line voting, and while it can function adequately to collect votes, it also collects much personal information about the voter such as Yale NetID, date and time of voting, IP address used, and so forth that should remain private. However, some of this information is needed to check for voting anomalies such as duplicate ballots, voting in the wrong division, blank ballots, and so forth.

It falls upon the election monitors to massage the raw data and produce a file of cleaned-up anonymized ballots to be subsequently counted. The raw data file itself contains much sensitive information and must be adequately protected, not something that most Yale faculty outside of the Medical School are used to doing. It also precludes independent verification of the correctness of the anonymized ballots without further release of the raw data.

Ballot Counting

Ballot counting is done using the Single Transferable Vote (STV) counting method, described in Appendix B of the implementation committee report. The STV counting method is designed to fill a set of undifferentiated seats with a set of candidates that reflects diversity in the voting population and gives each voter their fair share of influence over the election outcome. It is not designed to rank-order the candidates, and it is not designed to ensure that pre-specified seat restrictions are also

satisfied. Local modifications to STV can and do have unintended consequences, and they preclude using a commercial online election site that does not support those particular changes.

The STV-counting method is currently carried out using a custom-designed program written in the R-programming language, a widely-used language for statistical data analysis. R features rapid prototyping and powerful statistical routines. Section 1.1 of the online book, "An Introduction to R", states

> "R is very much a vehicle for newly developing methods of interactive data analysis. It has developed rapidly, and has been extended by a large collection of packages. However, most programs written in R are essentially ephemeral, written for a single piece of data analysis."

From a computer science point of view, the weaknesses of R for a sustainable election system are its reliance on interactivity to handle exceptional cases, its dependence on many external packages of unknown reliability and incompletely specified semantics, the non-modularity of the code, and the lack of a type system to reveal hidden bugs.

Seat Reservations

The FAS Senate bylaws have provisions to ensure that membership is broadly representative across the FAS, both across divisions and across the academic ranks.

1. The FAS Senate consists of 22 members, with six at-large representatives and the other sixteen members distributed according to the proportion of ladder faculty in each division:
    - 6 senators elected from the Division of Humanities.
    - 6 senators elected from the Division of Biological Sciences, Physical Sciences, and Engineering.
    - 4 senators elected from the Division of Social Sciences.
    - 6 senators elected at-large.
2. One seat is reserved for an untenured member of the ladder faculty in each of the three divisions.
3. One seat is reserved for a non-ladder faculty member in the at-large category.

The implementation committee report requires four separate ballots, one for each of the three divisions and one for the at-large seats. It specifies that the at-large ballots should be counted first. Winners of at-large seats are then removed from the divisional ballots before counting to determine the winners of the divisional seats. It is possible that so many divisional candidates are removed from a divisional pool that insufficiently many candidates remain to fill the open divisional slots. The bylaws are also unclear exactly how the restricted seats (2) and (3) should be filled.

2. Recommendations

The Elections Committee recommends a number of changes in the election procedures to make them simpler, more understandable, and less dependent on specific expertise of volunteers.

Item 1. Vote Counting Order

Recommendation: Vote-counting should proceed in the order of filling the most restricted open seats first and the least restricted last. This means that:

   (a) the reserved seats for each division and for the at-large election are filled first from among the qualified candidates in their respective candidate lists;

   (b) the unfilled divisional seats are filled next from among the eligible candidates in the corresponding division who remain after removing successful candidates from step (a).

   (c) the at-large seats are filled last from among the at-large candidates remaining after removing successful candidates from steps (a) and (b).

Rationale: This order guarantees that every open seat gets filled with a qualified candidate, if possible. It tends to minimize strategic voting and other attempts to "game" the system. It gives the divisional electors the power to choose who they feel best represents their division, as opposing to choosing between the "leftover" candidates. It gives the at-large electors the power to choose among the borderline candidates. Further support is given in the Appendix to the assertion that the counting order aspect of the current ballot tabulation procedures is badly broken and should be fixed now before addressing the broader issues concerning the STV method that are raised in Item 5.

Item 2. Unfilled Seats

Recommendation: In the event that the election fails to fill all open seats with qualified candidates, the unfilled seats are left vacant and eligible to be filled according to the rules for filling vacancies.

Rationale: Unfilled seats can only occur if the original candidate pool lacks sufficiently many qualified candidates for the restricted seats, or if candidates on the ballot drop out of the race during the election. In either case, there seems to be no reason to have separate procedures for filling a vacant seat that depends on whether the seat becomes vacant *before* or *after* the election results are announced.

Item 3. Filling Vacancies

Existing procedures for filling vacant Senate seats are complicated and not clearly specified in the bylaws.

Recommendations: In the interests of not further complicating the election procedures, the Senate should simplify the process of filling vacancies:
   (a) Those parts of the bylaws regarding use of lists of defeated candidates from previous years' elections should be deleted.

(b) The Executive Committee will nominate a candidate for the vacant seat from the pool of past Senators and previous nominations, or if necessary in order to find a qualified candidate, from the full FAS. This candidate must then be ratified by the full Senate.

(c) The replacement Senator will fill the seat until the next election. A side-effect of this rule might be an imbalance in the number of open seats during an election. We defer the question of maintaining balance to a full review of the FASS election procedures proposed in Item 5.

Rationale:

(a) STV does not rank defeated candidates, so "the highest polling" candidate in each category, mentioned in the bylaws, is not well defined. Even if it were, information from prior years' elections may be stale and no longer reflect voters' sentiment or the candidate's ability or willingness to serve on the Senate at a later time.

(b) The rationale for the length of the term is to allow the full FAS to fill the seat as soon as possible, given the current election cycle.

Item 4. Proportional Representation Across Divisions and the Size of the Senate

The FAS Senate bylaws require the Elections Committee to look at the composition of the Senate every five years:

> "Recognizing that the size and distribution of the FAS faculty may change over time, the committee on elections (see below) shall review and if necessary recommend adjustments to the proportional representation across divisions and the size of the Senate every five years. Such decisions shall be subject to the approval of the FAS faculty."

Recommendation: We find no need to adjust the size or proportional representation across divisions at this time.

Rationale: The current sizes and distribution of the FAS faculty are shown in the table below. The "Fair Share Seats" column shows the proportional allocation of the 16 divisional seats to each of the division. No division is over or under represented by more than 0.31 of a full seat, and the fair share allocation for each division rounds to the current allocation for that division

Divisions	FTE Ladder Faculty	Percentage of FAS	Fair Share Seats	Current Divisional Seats
Humanities	244.5	36%	5.69	6
Social Sciences	174.0	25%	4.05	4
Sciences	268.5	39%	6.25	6
Totals	**687.0**	**100%**	**16.00**	**16**

Item 5. Review of Election Procedures

Findings:

1. The current election process is labor-intensive and requires considerable expertise in both Qualtrics and R. It also places a burden on the vote-counting team to maintain the confidentiality of the voters and the ballots. People make errors, and options for independent verification of the election outcomes are limited.
    We wish to ensure that the Senate elections are sustainable into the future, even if the volunteers who have served so ably in the past become unavailable for any reason. One approach is to shift much of the burden of running and maintaining the election software to a commercial election site. One such site to consider is OpaVote.com. It is both relatively inexpensive and supports a large number of different ranked-voting tabulation methods.

2. The current version of STV has some undesirable properties that can on occasion lead to bad outcomes. One is that a voter who ranks an unpopular candidate in first place has no further influence on the outcome of the election until such time as the unpopular candidate gets eliminated. Another is that candidates are eliminated based only on the number of first-place votes they have at the time of elimination. A candidate ranked #2 by all voters will therefore be among the first to be eliminated. These and other problems with STV were likely behind the recommendation from the previous Election Committee that an alternative elimination rule be adopted.

3. The current bylaws do not include provisions for addressing an imbalance in the number of open seats that could arise due to the filling of vacancies.

Recommendation:

a) We recommend the formation of an ad hoc committee to review the FASS election procedures.

b) This committee should draw from members of prior election committee members, members of the FASS Implementation committee as well as faculty members whose research deals with different election systems and outside experts.

Rationale: Prior election committees as well as our review have highlighted issues and weaknesses in our current election system, but there is not enough time to fully explore the ramifications of some of the proposed changes. A review will need to consider both the original intent of the election procedures, the past performance of the system, and the latest scholarship on the strengths and weaknesses of various election systems. Some of our preliminary findings are given in the Appendix.

Appendix

Why the Current Vote-Counting System is Broken

A simple example suffices to show that the current vote-tabulation procedures can lead to the wrong people winning Senate seats in even the clearest case *where all voters are unanimous in their opinions*.

Simplifying Assumptions:

- Only two divisions, A and B.
- Three open seats, one in each of the two divisions and one at-large.
- Four candidates: A1 and A2 in division A, B1 and B2 in division B.
- Agreement among all voters about candidate rankings: A1 > B1 > B2 > A2.

Under these conditions, it seems obvious that the three open seats should rightfully go to A1, B1, B2.

Here's what happens under the current counting rules:

1. The at-large seat gets filled by A1.
2. The division A seat gets filled by A2 (since A1 has been removed from the division A pool, leaving A2 as the only remaining candidate in division A).
3. The division B seat gets filled by the preferred candidate B1.

Result: the three open seats go to A1, B1, A2. In effect, A2 gets pushed ahead of B2 by riding on A1's coattails.

Here's what happens under the proposed counting rules:

1. The division A seat gets filled by A1.
2. The division B seat gets filled by B1.
3. The at-large seat gets filled by B2 (since both A1 and A2 have been removed from the at-large pool by this time, and the voters prefer B2 to A2).

Result: the three open seats go to the three most popular candidates, A1, B1, B2, as desired. The candidate who gets the third seat (B2) is determined by the preferences of the at-large voters, not by an artifact of the counting rules.

Note that this problem has nothing to do with the use of STV since the same would happen with any reasonable voting system when all voters agree on their rankings. Rather, the problem is with the multiple rounds of counting and the way they interact with each other. Because this problem arises whenever the ballots are counted in the current order of at-large first and can lead to a blatantly wrong

outcome, we recommend that Item 1 be implemented now and not deferred to the larger review of STV proposed in Item 5.

The Value of Transparency and Simplicity

An Artificial Intelligence (AI) is an algorithm whose outcome we cannot validate, so we must accept its decisions on faith. The current FAS ballot tabulation system is such an algorithm. Voters mark their ballots without fully understanding how their rankings will affect the election results. The ballots are then fed into the tabulation procedures and the computer chooses the winners.

The FASS bylaws fail to specify what the goals of the election system are, other than to get all of the seats filled with qualified candidates. Without a clear statement of goals, one cannot distinguish a good outcome from a bad outcome. Without access to the raw ballots, one cannot know whether the outcome correctly reflects voter intent, nor can one verify that the code correctly implements the prescribed algorithm. Rather, one has no choice but trust what the AI tells us, much as people over the centuries have trusted lotteries, oracles and ouija boards to make their decisions for them.

Because of the importance of trust and fairness in the FAS Senate elections, we urge the proposed review committee in Item 5 to look for election procedures that favor transparency and simplicity over more complex methods with purportedly desirable but unstated and unverifiable properties.

Elimination Rules in STV

The 2018-2019 Elections Committee recognized that the candidate elimination rule in our current version of STV would sometimes eliminate a candidate during the ballot counting that arguably should win one of the remaining seats. They recommended that alternative elimination rules be studied. This should be considered within the broader review of the voting system recommended in Item 5.