Alternative Voting Systems Creative Project
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CSE 493

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Abstract

The Electoral College, the current electoral system in the U.S., operates on a Winner-Take-All or First Past the Post (FPTP) principle, where the candidate with the most votes wins. Despite the Electoral College being the current system, it is problematic. According to Lani Guinier in *Tyranny of the Majority*, "the winner-take-all principle invariably wastes some votes" (121). This means that the majority group gets ALL of the power in an election while the votes of the minority groups are completely wasted and hold little to no significance. Additionally, FPTP systems reinforce a two-party system in which neither candidate from either party could satisfy the majority of the electorate's needs and issues, yet forces them to choose between the two dominant parties. Moreover, voting for a third party candidate only hurts the voter since it takes votes away from the dominant party they might support and gives the victory to the dominant party they prefer the least, ensuring that the two party system is inescapable. Therefore, a winner-take-all system does not provide the electorate with fair or proportional representation and creates voter disenfranchisement: it offers them very few choices that appeal to their needs and forces them to choose a candidate they dislike. There are, however, alternative voting systems that exist that remedy these issues, such as a Ranked voting system, in which voters can rank their candidate choices in the order they prefer them, or a Proportional voting system, in which a political party acquires a number of seats based on the proportion of votes they receive from the voter base. Given these alternatives, we will implement simulations of these systems to demonstrate how they work in contrast to FPTP systems, and therefore provide evidence of how these alternative systems could work in practice and in place of the current electoral system.

References

Guinier, Lani. "Groups, Representation, and Race Conscious Districting." *Tyranny of the Majority*. 1994

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PART ONE: Literature Review

Introduction

In this review, we explore different types of voting systems alternative to the electoral college to show how these alternatives offer an effective, democratic, and representative system of voting. We will begin by discussing and analyzing the criteria for a "fair" and "representative" voting system, and will then discuss the current major voting system used in the United States, and each alternative voting system we found in our research. Following this, we explain our decision to replace the current system with Proportional Representation (PR) for legislative elections and Ranked Voting for executive elections based on these criteria and analysis.

Representation

The main idea behind alternative voting system proposals is to find a system that is more representative, by which we mean more accurately reflects the voters' varying opinions, identities, and choices in an election. In the United States, representation centers around the idea that the government's actions must be based upon the consent of the governed. Representation is how that consent is achieved, and in the Madisonian model of democracy, representation must be derived from the "bedrock" principle of majority rule but is subject to the principle that minorities must be protected from the excesses of majority factionalism (Tucker 2002, 364-365). So, we have two main criteria for what is "representative," those being majority rule and minority protections. Majority rule is simply where winning a majority of the popular vote means winning the election, but how to ensure minority representation (both political and racial) is not so simple. The Electoral College supposedly works to ensure minority representation of *states* in only presidential elections, but it can violate majority rule in doing so and allowing a president to be elected by a majority of states but a minority of the populace. Furthermore, there is the issue of minority voters having representation. Originally, this was achieved with majority racial districts, which minorities used to stop themselves from being outvoted by whites in every district and prevent themselves from receiving no representation at all (Tucker 2002, 358). This practice was ended when the Supreme Court case *Shaw v Reno* found that racially gerrymandered districting violated the equal protection clause of the 14th Amendment (Oyez 2020). This is where alternative voting systems are necessary. If a minority group makes up some percentage of the populace, they and their opinions should receive a proportional amount of representation in order to be protected. Yet, how do we ensure that when a minority group, by definition, will never reach the threshold for majority rule and will never win a simple majority election?

Based on our research, but mostly from Arrington's 1998 paper, the following are our ideal criteria for an alternative voting system: It provides for majority rule when there is a majority faction; It provides for minority representation; The system is acceptable to the public, primarily in that it shouldn't be too complicated; There is a constitutional way to implement it and the system itself is constitutional; It is stable enough to be accepted with no adjustments or

tinkering; It can be practically implemented with the current election infrastructure administration systems, which saves costs; It is acceptable to the current political parties, namely in that it accommodates the existing party competition with straight ticket voting; It promotes competition; It is an open voting system (allows voters to determine their own interests and choices); and, it can accommodate changing changing social/economic conditions and allow emerging issues to be reflected in new communities of interest. It is unlikely that any voting system could satisfy all of these criteria, but an alternative voting system should satisfy more criteria than the current system does and more than other alternative proposals do.

Current Voting Systems in the US: First Past the Post (FPTP) and the Electoral College

First, we must discuss the current U.S. voting system, which includes the Electoral College, which selects the President, and First-Past-The-Post (FPTP), which is used in congressional elections. In his thesis, "Reforming America's Out-Dated Voting System," Andrew Burke discusses both. The Electoral College was created, as Burke explains, to balance the states' representation and protect from tyranny of the majority. The U.S. founders feared the instability of direct democracies and wanted presidential candidates to appeal to a wide range of states, not just voters in the most populous states. Therefore, a presidential candidate wins a majority of *states* instead of a majority of *popular votes,* and rural areas of the country get allocated more electoral votes for their proportion of the population (Burke 2016, 4). Burke concedes that the Electoral College has maintained the stability of the voting process for 200-plus years, but that it does have flaws and is causing issues. Instead of focusing on a wide range of states, candidates focus on "battleground states" that may go to either candidate due to the College's Winner-Take-All system. Notably, half of candidate visits and advertising dollars are spent in just Florida, Pennsylvania, Virginia, Ohio (Burke 2016, 4).

For some context on what Winner-Take-All entails, in *Tyranny of the Majority*, Guinier presents the prevalent issue of wasted votes in systems that manifest the Winner-Take-All principle. The Winner-Take-All principle describes how certain majoritarian and plurality voting systems allow for candidates who receive only a fraction of the number of votes from an electorate and end up representing 100% of that electorate and receive 100% of the position(s) and power being contested instead of a proportional amount (Guinier 1994, 121-123). These systems lead to wasted votes as those who voted for other candidates to represent them are now represented by someone who does not hold their interests and values (Guinier 1994, 129).

Furthermore, this Winner-Take-All system and uneven allocation of Electoral College votes allow for the College to subvert the popular vote and the principle of majority rule. This has happened four times in its history, and two times in the last two decades. Additionally, while the Founders wanted presidents to be elected by the states rather than a popular majority, Burke points out that they did not anticipate the increase in size the United States has had over its history. Now, the largest 11 of the 50 states could elect the president, meaning that such a president would not even represent a majority of states (Burke 2016, 4). Thus, the Electoral

College has served American democracy well enough in the past, but more and more the flaws Burke addresses are producing unsatisfactory and unpopular electoral results, and we agree with Burke in that assessment.

Beyond the Electoral College and Presidential elections, the United States uses First-Past-The-Post for the "vast majority" of its elections (Burke 2016, 5). Burke explains how FPTP contributes to the highly polarized and hyper-partisan nature of U.S. politics and enforces a two-party system. FPTP is a plurality system that "requires a voter to indicate their most preferred candidate on the ballot using a single vote" and then the candidate with the most votes wins (Burke 2016, 5). At face value, this seems rather fair, but the end result of FPTP limits voters' choices. A political theory, called Duverger's Law, holds that FPTP with single member districts will trend towards a two-party system since its structural biases force voters to abandon third parties. In general, this occurs because smaller parties can gain a better chance of winning by merging with a larger, ideologically similar party and, likewise, voters can abandon their preferred parties for larger ones that share only some ideological similarities to get a better chance of being represented (Burke 2016, 5). Additionally, these structural biases can best be seen in the *spoiler effect*. In simple terms, the spoiler effect is essentially why voting for a third party is seen as throwing your vote away. More specifically, the spoiler effect is why it is nearly impossible to form a third party and why third parties are punished for not merging with another party because when one forms, it "steals" votes from the ideologically closest of the main two parties and hands the election to the opposing main party (Burke 2016, 7). Once the two-party status quo is established, which FPTP inherently trends towards and facilitates, it is nearly impossible to break away from it because of the spoiler effect. Then, voters become disinterested in voting due to the two party system. Voters who want to support a third party (and according to a Gallup poll 57% of Americans want there to be a third party) feel their vote doesn't matter and voters living in a district already dominated by a single party also feel their vote doesn't matter and they cannot change the results (Burke 2016, 5-6). Lastly, another issue with FPTP is that it is susceptible to gerrymandering. The political party currently in power can redraw districts to increase their chances of winning elections and reduce the impact of their opponent's voter base (Burke 2016, 6). In summary, the flaws of FPTP severely limit voter representation and the ability of voters to choose candidates or parties that they want to reflect their interests.

Alternative Voting Systems

Ranked Voting or Instant Run-off Voting (IRV)

We will begin our discussion on alternative voting systems with the Ranked Voting or Instant Run-off Voting system. In the Ranked Voting system (Instant Run-off), voters rank candidates according to their preferences. The candidate with the lowest number of votes is eliminated and those votes that went towards that candidate are then distributed to the remaining candidates according to the voter's next preferred candidate. This process repeats until a candidate receives more than 50% of the votes (Burke 2016, 13). The pros of this system include

that it eliminates the spoiler effect, allows for third-party candidates to participate in elections, and discourages tactical voting by eliminating a voter's fear of wasting their third-party vote and benefiting their opposition (as opposed to voting tactically for the ideologically closest major party in order to prevent the main opposing party from winning, even if they prefer a third party more). Moreover, for candidates to win, they need broad approval from the electorate and are encouraged to cooperate with other candidates, and are discouraged from negative campaigning (Burke 2016, 13-14). Maine has already implemented ranked voting for its Congressional elections and has been used in Australia since 1918, where it has "helped increase political cooperation and minority party involvement" (Burke 2016, 14). Therefore, Burke argues that the Alternative Vote is an "attractive option" for electoral reform in the U.S. since the results would be "very recognizable to the American electorate" and would lead to the creation of new, widely supported political parties (2016, 15).

However, the cons of this system include that it is complicated and the process itself takes place over multiple rounds which makes the result difficult to predict. Additionally, Ranked Voting introduces the Favorite Betrayal Criteria phenomenon, which allows for the rival main party to win in the situation where a third party overtakes and eliminates the other main party closest to its values and ideals (Burke 2016, 15). Also, in Australia, the results of ranked voting are "widely the same" as in FPTP, since "the major parties have thus won 99.4 percent of all House of Representatives contests since 1949" even though there have been three "reasonably strong" minor parties (Burke 2016, 14). However, this may not necessarily be a con because voters may still prefer the majority parties they most recognize. Finally, another con with the Ranked Voting system is that each round in the voting process does not account for total popularity and only considers the ranking of individual candidates. This means that a candidate can receive many second ranked votes and still be eliminated in the first round for not receiving enough first ranked votes, despite being rather popular (Burke 2016, 17).

Proportional Representation

Another alternative voting system is proportional representation. The general idea here is that a political party should be allocated the number of seats that is in proportion to the number of votes it received (Zimmerman 1994, 676). In other words, the goal is to narrow the gap in representation that often occurs between the percentage of the vote a party receives and the percentage of seats it wins. Therefore, to be able to divide the seats up for election in proportion to the votes received, proportional representation requires multi-member districts where multiple seats are up for election at once (Burke 2016, 18).

The benefits of proportional representation are greater minority party representation and less wasting of votes. Burke gives an example where the majority party receives 51% of the vote and the minority party receives 49%. In a winner-take-all, single-member district system like First-Past-The-Post, the minority party receives absolutely no representation at all despite winning practically half of the votes. The 49% of people who voted for them also receive no representation in government and their votes are wasted. However, if it were a proportional,

multi-member district the threshold number of votes for a party to gain representation would be the reciprocal of the number of seats (i.e. if there are 3 seats, then the threshold is ⅓ or 33%). This way, proportional representation wastes fewer votes, which encourages greater participation as voters feel they have a better chance of gaining representation, and would greatly increase minority party representation in government (Burke 2016, 18).

However, like any voting system, proportional representation does have flaws and implementation challenges. Firstly, there is the risk of legislative gridlock brought on by coalition governments, like the coalitions we see used in proportional parliamentary systems elsewhere in the world. A party that is very close to having a majority of the seats can turn to a smaller, more extremist party to form a coalition. This gives the extremist party a disproportionately large amount of influence, which it can use to effectively hold its coalition partner hostage. Then, because of this coalition building, it can be hard to remove substantially sized parties from power, which also risks conflict and gridlock (Burke 2016, 19). However, we would argue that this already happens in current U.S. politics with FPTP when majorities in the House or Senate are very close, so the benefits of proportional representation would still be greater than in FPTP.

Secondly, implementing proportional representation in the United States is not impossible, but would require a lot of changes. Many countries that use proportional representation have parliamentary systems of government, with the legislative and executive branches combined, instead of a federal system like in the United States. To change the U.S. to a parliamentary system would require massive changes to the Constitution, the branches of government, and separation of powers. That would, as Burke argues by referencing Federalist no. 51, contradict the Founders' idea of separation of powers. Switching to a unicameral legislature would also contradict the check against "reactionary democracy" that the Senate has over the House of Representatives (Burke 2016, 20-21). However, Burke also points out that we don't have to go so far as switching to a parliamentary system to implement proportional representation. The U.S. could instead be a federalist and presidential system "where citizens used proportional representation to vote for the legislature but still voted directly for the president," which is similar to what "Mexico, as well as other Central and South American countries" do (Burke 2016, 21). Even so, such a system would still require combining single-member districts across the country into fewer and larger multi-member districts. FairVote, which is a "non-partisan, non-profit that advocates for the adoption of fairer voting methods across the United States," already has hypothetical plans for implementing proportional representation at different levels of government, including one for California's State Assembly that would replace its 80 single-member districts with 16 larger ones with 5 representatives each (Burke 2016, 19). FairVote has already concluded that this would create more balanced election results that more accurately represents voters. So, while implementing proportional representation in the United States would require many legal and logistical changes, hypothetical plans already exist and the benefits for representation are great.

Other Alternative Systems

The following systems we researched below are more niche and obscure systems or variations of the systems discussed up above, and we have determined from our research that these systems would likely not be good candidates for an alternative voting system and have grouped them in a separate section.

Approval and Negative Voting

The Approval voting system works where each voter presents a list of candidates up for election that they approve of, or alternatively, a list of candidates that they do not approve of. In Negative voting, the voter must determine one candidate they least approve of among the candidates up for election and vote for all candidates but the one they approve least of. These systems are very easy to understand and are used in many academic and professional organizations, and serve to potentially eliminate the spoiler effect and allow for more third-party candidates the opportunity to enter the political arena (Dellis 2013, 265-266). The cons of these systems include that these voting systems obfuscate the voters' preferable choice and do not allow them to pick a particular candidate they favor most.

Borda Count

In the Borda Count voting system, voters rank their candidate choices in the order in which they prefer the candidate to others. The candidate last on their ranked list would receive no votes, while the candidate next up on the list receives one vote, and so on until the top of the list is reached. Borda count is used in many academic and professional organizations and allows voters to specify a range of candidates that they prefer in the order that they prefer them. However, some disadvantages of the Borda Count include that it allows for the spoiler effect and encourages a two party system (Dellis 2013, 265-266).

At-large Plurality Voting without Preferences

In At-large Plurality Voting without Preferences, voters can vote for as many officials as there are positions available to fill. The advantages of the system include that it has been shown to promote representation that accurately reflects the voters and their issues, such as providing women with representation since they would be able to vote in more female candidates. The cons for this system include that it can ignore small minority communities and allow for white majorities to determine elections (Zimmerman 1994, 675).

Combined Single Member At-Large

The Combined Single Member At-large voting system is similar to the At-large system discussed earlier but it restricts the voter's vote to their respective residences. This way, white majorities cannot determine the election for small minority communities. Moreover, voters cannot vote for as many officials as there are positions available to fill. The cons for this system

include that this system makes reaching the number of votes required to win harder for small minority communities to reach (Zimmerman 1994, 675).

Limited Voting

       The Limited Voting system allows each voter a number of ballot votes that is less than the number of seats being voted on and the candidates are elected at-large or from multi-member districts. The pros of this system include that it is meant to provide direct representation for minority communities. However, the cons of this system include that Limited Voting cannot prevent a disciplined majority from winning all seats by evenly dividing their votes while minority communities are unable to reach minimum thresholds to achieve representation (Tucker 2002). Additionally, Limited Voting does not guarantee that all voter groups will receive proportional representation and it would also allow for a minority group to determine the election if the electorate happens to be divided among many candidates (Zimmerman 1994, 675).

Cumulative Voting

       The Cumulative voting system allows a voter a number of ballot votes equal to the number of seats that are to be filled in an election. Voters are given the choice of how to distribute their votes among the candidates by either casting all of them for a particular candidate or splitting them up among multiple candidates (Tucker 2002). According to Zimmerman, this system can be beneficial for minority groups as it allows them the winning strategy of pooling all of their individual votes together to cast them for a particular candidate (Zimmerman 1994, 675-676). The cons of this system include that it introduces vote splitting, which is the phenomenon where voters split their ballot votes among multiple candidates from one party, potentially causing all of those candidates to lose. This may lead to voters losing their representation and leads parties to limit the number of candidates they nominate (FairVote).

Single Transferable Vote

       The Single Transferable Vote system is fundamentally a ranked voting system in which candidates who receive enough votes to meet a certain threshold are elected. This process will continue for all candidates until all seats are filled. In the situation in which candidates receive more ballot votes than are required to meet the threshold, those votes are redistributed to the voter's next preferred candidate. In the situation where no candidate receives enough votes to meet the required threshold, then the candidate with the least number of ballot votes is eliminated and those votes that went to the eliminated candidate are redistributed to the next preferred candidates (Tucker 2002). The pros of this system include that it shares most of the same advantages with Proportional Representation, as well as allowing the opportunity for third party candidates to participate in the election process as STV focuses more on the individual candidate than on their respective parties. The cons of this system include that the election process is rather mathematically involved and complicated, making it difficult to adopt (Ace Project 2021).

Conclusion

  Based on the criteria and research above, we have selected Proportional Representation (PR) for legislative elections and Ranked Voting for executive elections as our alternative voting systems of choice as they fulfill most of the criteria laid out earlier in this paper. While this criteria list is quite long, the most important of these criteria, in our opinion, are that the system provides majority representation, minority representation, greater voter choice, and is not overly complex or difficult to implement. Proportional Representation does provide for majority rule and minority party representation because of how it proportionally allocates seats. Additionally, PR allows for greater voter choice as it prevents wasted votes and encourages third parties to participate in elections. Lastly, Proportional Representation is a fairly straightforward system that does not involve a series of complex and tedious calculations to determine the winner, making it easier to implement than some of the other systems discussed, such as the Single-Transferable Vote, and therefore more acceptable to the electorate. However, it would currently be unconstitutional to use Proportional Representation with presidential or executive elections, without abolishing the Electoral College, and would be simpler to only use PR for legislative elections and another system for executive elections. Additionally, while PR is not overly complicated, its implementation would require many logistical changes because every state would need to switch to multi-member electoral districts. This can be done by combining single-member congressional districts into larger multi-member districts, just as FairVote advocates for. For executive elections, we chose Ranked Voting, also known as Instant Run-Off Voting or the Alternative Vote. This could be implemented by abolishing the Electoral College and using a national popular vote with Ranked Voting to directly elect the President. On the other hand, Ranked Voting can be implemented at a state level as Maine has done, where a statewide ranked vote determines how the state allocates its Electoral College votes in the presidential election. It would be easier to implement Ranked Voting at the state level, but doing so would keep the disadvantages of the Electoral College at the national level. Nonetheless, Ranked Voting does have a majority requirement, provides for minority representation by facilitating the creation of minority third parties, and allows for more voter choice by preventing issues like the spoiler effect and tactical voting. However, Ranked Voting does present some challenges with complexity in that the process takes place over multiple rounds. Furthermore, it does not provide minority representation on the level of proportional representation as minority groups are not guaranteed representation, only a better chance at representation than that provided by FPTP systems. In conclusion, while all voting systems have their shortcomings, both the PR and Ranked Voting systems are superior in providing representation than that of FPTP systems and are less complicated and more straightforward than other alternative systems discussed in this paper.

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PART TWO: Voting Simulation Application

Software Requirements Specifications

Purpose

Demonstrate that ranked and proportional voting systems are fairer and more representative than the United States' current executive and legislative voting system, including the Electoral College and First-Past-The-Post (FPTP), by simulating an election scenario.

Intended Audience

Voters in the United States.

Requirements

1. Users will see a simulated election scenario that contrasts a Ranked voting system with the current First-Past-The-Post system for Arizona's electoral votes in a Presidential Election.
   a. Election scenario results will be displayed in pie charts.
2. Users will see a simulated election scenario that contrasts a Proportional voting system with the First-Past-The-Post, winner-take-all system for an individual state's (TBD) Congressional House of Representatives elections, based on FairVote's California proposal.
   a. Election scenario results will be displayed in pie charts or bar charts.
3. Upon opening the application, the user should see the option to select which scenario to simulate. The user must be able to select one and only one of the options between the Ranked vs FPTP and Proportional vs FPTP scenarios.
4. Upon selecting the option to see a Ranked voting system scenario users will be taken to a page where they are prompted to enter the election data (e.g. the candidates and percentage of votes they received) for an Arizona Presidential Election.
   a. The same will occur for the Proportional voting system scenario, but for an individual state (TBD) based on FairVote's proposal for the State of California instead of the entire country.
   b. For ranked voting, following this page, the Users will be taken to an additional page where they may specify the 2nd and 3rd choices for voters of all the candidates. The User may also not specify any choices, or only a 2nd choice, by entering a blank. We will use a simplified version where Users specify the next ranked choices for all the voters of a candidate as a single block, instead of specifying what the choices are for each individual voter. For example, the User would be able to specify that the percentage of votes for Candidate 1 should go to

Candidate 2 when Candidate 1 is eliminated. This is how the "Politics in the Animal Kingdom Part II" example by CGP Grey portrays ranked voting [1].

    c. Users cannot specify that a ranked choice of a candidate is that same candidate.

    d. For proportional voting, users must enter at minimum a number of candidates equal to the number of seats (TBD). At maximum (TBD). We may limit the scope of the simulation to one electoral district in one state to avoid making the User fill out several different elections at once.

5. For ranked voting, Users will be able to select a button that fills in data for a predetermined historical election(s) (i.e. the Arizona 2016 and 2020 Presidential Elections).

    a. Users will then be able to specify the second and third ranked choices for the candidates from these elections.

6. Users will not be able to enter negative numbers or leave required fields blank.

Notes

        We will implement the Ranked Voting vs Electoral College scenario first as implementing Proportional will be more complicated and we have limited time. We feel that Ranked is more important to demonstrate since it is more feasible to implement, has already been implemented in a few places in the country (e.g. Maine), and therefore we think it will probably be more acceptable and familiar to the American public than the Proportional voting system. Also, in the conclusion of our Literature Review, we mentioned that there were two ways to implement Ranked Voting in the U.S.: by abolishing the Electoral College and having a national ranked popular vote, or by keeping the Electoral College and having individual states use Ranked Voting to allocate their electoral votes. We chose the latter because it is simpler and more feasible to implement, both as a software application and as a legal change to the U.S. electoral system.
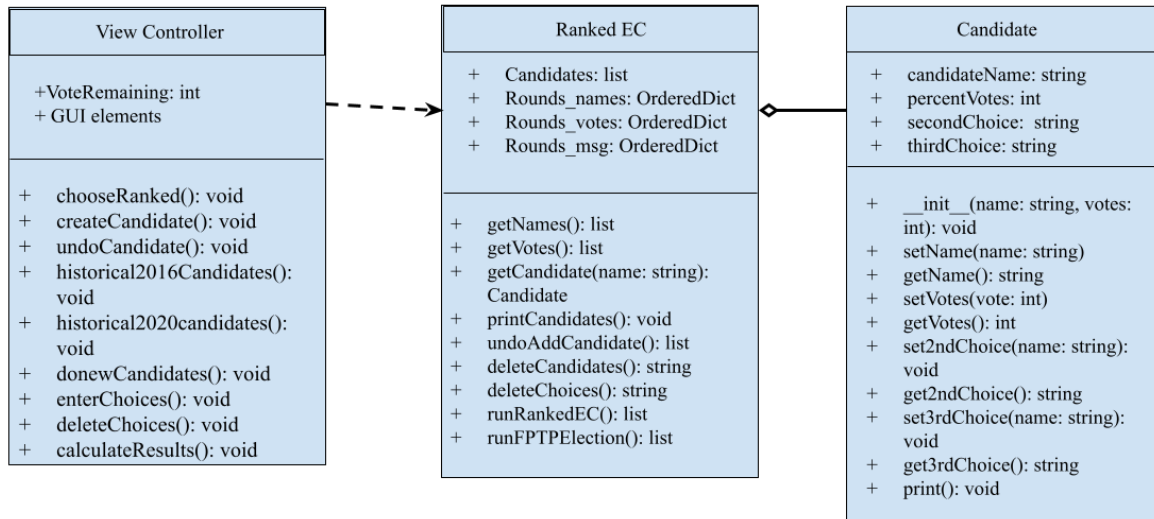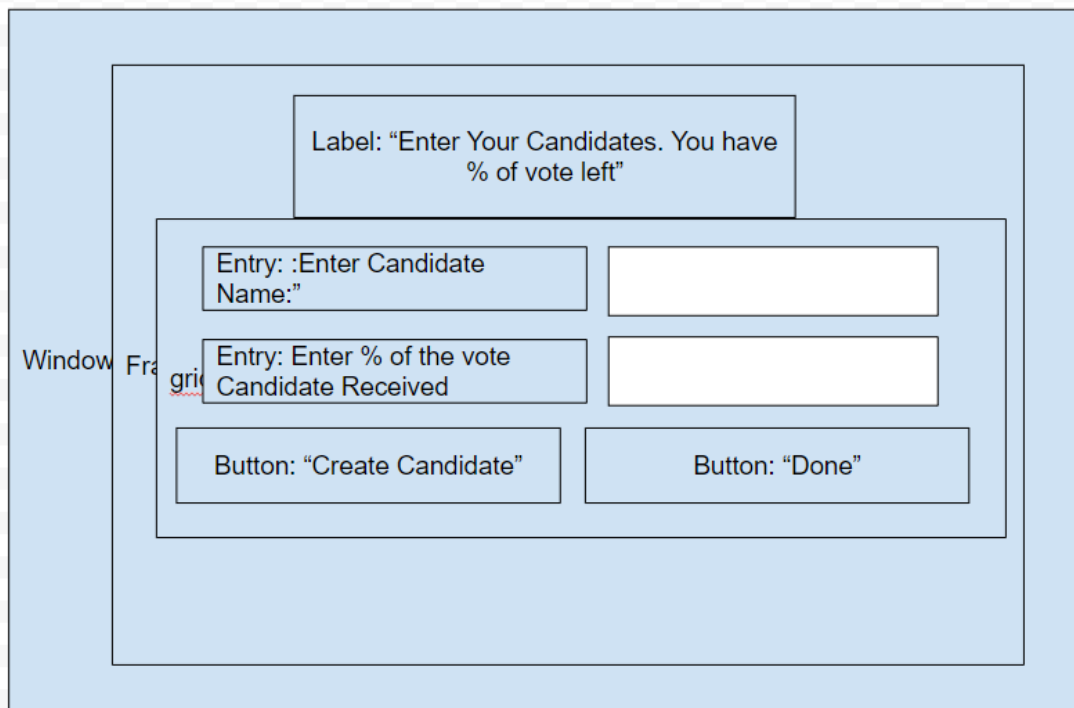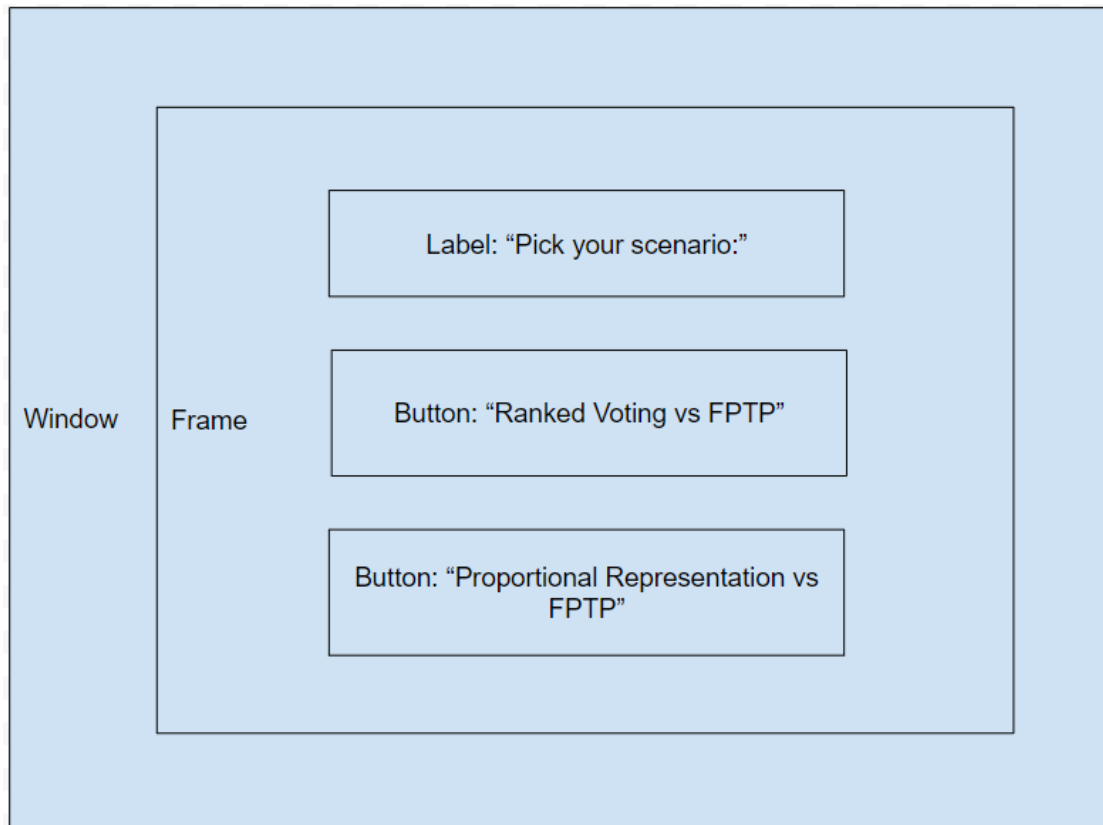
Resources and Examples

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Software Design

Unified Modeling Language (UML) Diagrams

View Controller
+VoteRemaining: int + GUI elements
+ chooseRanked(): void + createCandidate(): void + undoCandidate(): void + historical2016Candidates(): void + historical2020candidates(): void + donewCandidates(): void + enterChoices(): void + deleteChoices(): void + calculateResults(): void

Ranked EC
+ Candidates: list + Rounds_names: OrderedDict + Rounds_votes: OrderedDict + Rounds_msg: OrderedDict
+ getNames(): list + getVotes(): list + getCandidate(name: string): Candidate + printCandidates(): void + undoAddCandidate(): list + deleteCandidates(): string + deleteChoices(): string + runRankedEC(): list + runFPTPElection(): list

Candidate
+ candidateName: string + percentVotes: int + secondChoice: string + thirdChoice: string
+ __init__(name: string, votes: int): void + setName(name: string) + getName(): string + setVotes(vote: int) + getVotes(): int + set2ndChoice(name: string): void + get2ndChoice(): string + set3rdChoice(name: string): void + get3rdChoice(): string + print(): void

Graphical User Interface (GUI) Prototypes

Window | Frame

Label: "Pick your scenario:"

Button: "Ranked Voting vs FPTP"

Button: "Proportional Representation vs FPTP"

Window | Frame | grid

Label: "Enter Your Candidates. You have % of vote left"

Entry: :Enter Candidate Name:"

Entry: Enter % of the vote Candidate Received

Button: "Create Candidate"

Button: "Done"

Error: You have not entered choices for every Candidate

Label: "Enter the second and third choice
for each candidate:"

Window Fran

gri

Dropdown/spinbox:
"Candidate: "

Dropdown: "2nd Choice:"

Dropdown: "3rd Choice:"

Button: "Create Choices"

Button: "Calculate Results"

Label: Ranked Voting Simulation

label: f"Winner: {Candidate_Name},
with {votes} votes after
{num_of_rounds} rounds won
Arizona's 11 EC votes."

Frame: "Winner: Candidate_Name"

G

Wind

Pie chart

Label: FPTP Voting Simulation

label: f"Winner: Candidate_Name with
{votes} votes won Arizona's 11 EC
votes."

Frame

Pie chart
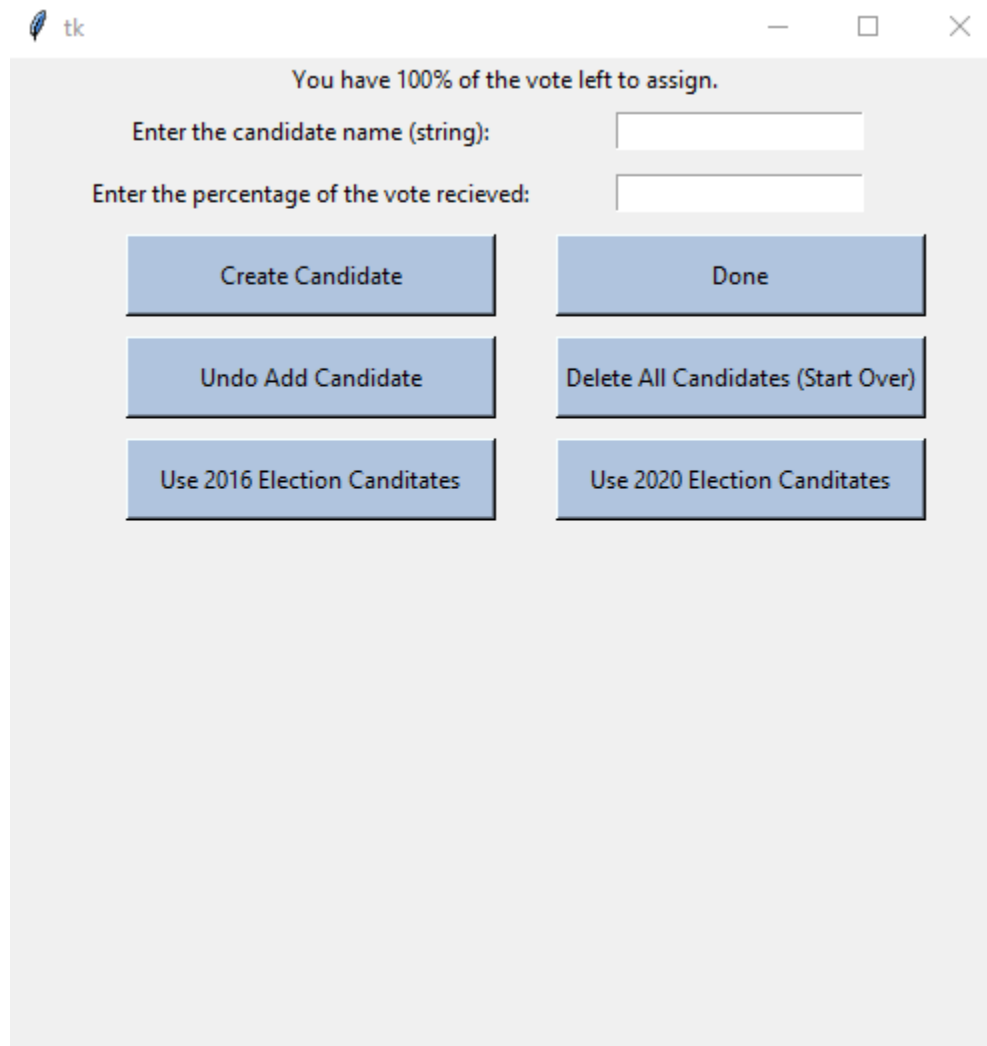
Button: "Return to Main Menu"

Final Application GUI
Select the Scenario
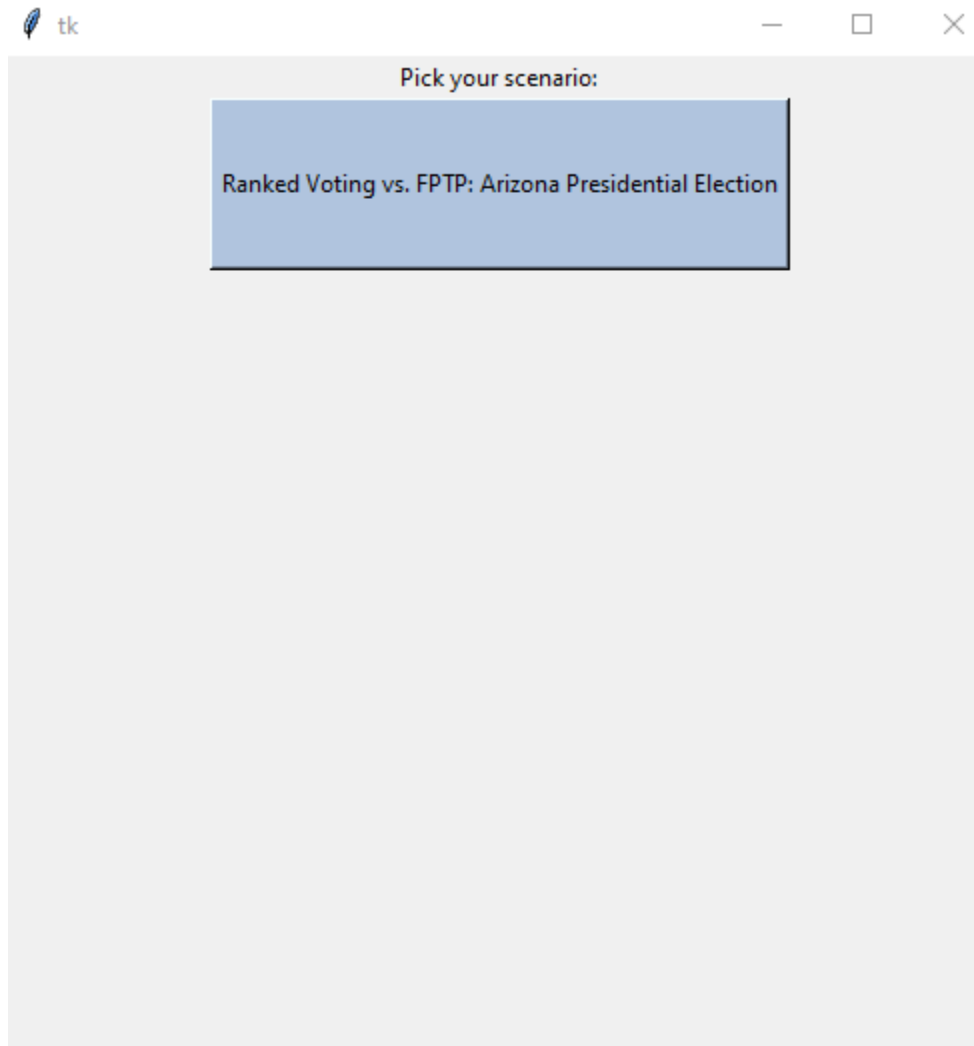
Entering the Candidates

Entering the Ranked Choices

Viewing the Results

Application Demonstration Video
https://youtu.be/kJUaOTUTidg

Implementation Notes

To build this application, we decided to use the Python language, along with the Tkinter, Matplotlib, Pyinstaller, OrderDict, and Webbrowser libraries. The reasons we chose to use the Python language include that we were familiar with the language and also wanted this project to be an opportunity to learn how to develop Graphical User Interfaces (GUIs) with Python. Additionally, we wanted to use Python because it gave us access to the Matplotlib and Pyinstaller libraries. Using Matplotlib [1], we could easily integrate charts and graphs into our GUI, which we would need to be able to display election data to the User. Using Pyinstaller, we could easily generate a standalone executable file for our application [2] that would allow anyone with access to the file to run our application on their system without needing to have Python or any libraries installed. The reason we decided to use the Tkinter library was because it is part of the Python standard library and is also the foremost GUI builder library that Python has to offer. To learn how to use Tkinter, we followed guides from Real Python [3] and Data to Fish [4] and used the Tkinter documentation [5]. We used the OrderedDict library because we thought normal dictionaries in Python are not ordered and we needed to store data generated by the ranked election algorithm in a dictionary and preserve the order of the data as it was stored in the dictionary. However, it turns out that normal dictionaries are ordered as of Python 3.7, so we switched to norma dictionaries [6]. Finally, we used the Webbrowser library as it allowed us to create a button that would open the GitHub webpage containing our README.md file so that the User can read the instructions for how to use the application [7].

Now we will discuss the design choices we made for the GUI of our application. Beginning in terms of the design choices for the algorithms, we decided to implement a

simulation of a ranked election by a percentage of votes received rather than of ballots cast as it is much easier for the user to enter this data by hand and to calculate the results using percentages. Moreover, we chose to assign ranked choices according to the candidate rather than according to an individual voter because this is a much more practical simulation implementation than simulating millions of voter decisions. Additionally, we chose to allow the user to enter up to a third choice for a candidate as this also simplifies the results calculation and the amount of data that the user must enter. Regarding the design choices for the GUI, we had the User enter the data for a candidate one at a time as this allowed the candidate entry to be simple and repeatable, and also be able to display to the User how much of the percentage of votes they have left to assign after creating a candidate object. Furthermore, we had the User enter the ranked choice assignments using dropdown menus as this would help the User to know which candidates they can select from and also prevent the user from selecting invalid candidate choices. For displaying the election results, we chose to use pie charts to display the election data and results as these are an effective way to show percentages of a whole, given that these percentages are votes received by a candidate. Also, we chose to display the ranked election as a series of pie charts with a scrollbar [8] to represent the results of each round in the election as this demonstrates to the User how the ranked election algorithm works. Additionally, we added functionality to allow the user to load historical election data so that the User could contrast Ranked Voting and FPTP for an actual election. This election data was sourced from David Leip's Atlas of U.S. Presidential Elections [9]. Lastly, we checked the Citizens Clean Elections Commission's website to verify how the Electoral College works in Arizona since both elections in our application simulate Presidential Elections for Arizona's Electoral College votes [10].

Finally, we will discuss the limitations of our application. Our GUI was inspired by the Model-View-Controller architecture, which is a convention by which to design GUI applications. However, our GUI does not have proper MVC architecture as it only has a Model (data and algorithms) and View (GUI), which has only some Controller-like functionality. Additionally, our GUI currently does not have the functionality that would allow a User to return to the main menu after running a simulation or go back to previous sections. Lastly, on the election results page, the length of the frames that contain the pie charts for both the ranked and the FPTP elections will vary according to the length of the label text on those frames, which makes the view of the election results awkward. All of these limitations have been delegated as future work.

GitHub Repository Link
https://github.com/jsummers1221/AlternativeVotingSystemsThesis

References

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[9] D. Leip. "United States Presidential Election Results." David Leip's Atlas of U.S.
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Future Work

Over the course of this project, we found that we would not have the time to complete an implementation of the Proportional voting system simulation in contrast to the FPTP system. Our current implementation already has the functionality that simulates a FPTP system, therefore all that would be required to implement the Proportional simulation would be to implement the system requirements stated above and along with the correct algorithm for the Proportional

system. Also due to time constraints and a lack of knowledge, we were unable to implement the functionality to save and store the election data (e.g. pie charts) generated by the simulation, to allow the user to return to the main menu after running a simulation or be able to go back to a previous section, design the application according to a true Model-View-Controller architecture, or implement the simulation as a web application. Furthermore, we were unable to refine the overall presentation of the GUI to make it less awkward and more polished. In the future, someone could implement a Proportional Representation vs FPTP simulation as another section in the app using our current code, research, and software requirements specifications as a starting point and refine the current application architecture to achieve a real MVC architecture. Additionally, as we have created more versions of our application, we have noticed that the Pyinstaller library created larger and larger executable files, making the file bloated and causing it to take longer (15 to 30 seconds) to load the actual application. Therefore, in the future, we would need a professional web developer who could transition the project to a hosted web application to eliminate the need for a User to have to install a large executable file to run. Also, this professional web developer would have the skills to make the GUI more polished and eliminate any awkwardness in the design.

Conclusion

The current electoral system in the U.S. presents many problems in terms of being a fair and representative election system. These problems include that it disregards minority groups, upholds a two-party system, and allows for the spoiler effect. There exist alternative voting systems that offer fairer and more representative election results than the current Electoral College with First-Past-The-Post, including the Ranked and Proportional Presentation voting systems. To be able to demonstrate how a Ranked election system would work in practice and in contrast to a FPTP election system, we have created a Ranked vs FPTP Election simulation application that allows a User to enter a historical election scenario or their own election scenario to the application and then analyze and contrast the results of both election systems. With this application, we hope to demonstrate the practicality and benefits of Ranked Voting in place of First-Past-The-Post.