Software Requirements Specification

for

Voting System

Version 1.0 approved

Prepared by Noreen, Jon, Lane, Pyrenees

University of Minnesota – Twin Cities

16 February 2023

Table of Contents

Revision History

Name	Date	Reason For Changes	Version

1. Introduction

1.1 Purpose

Voting officials require a robust voting tally system to automate the counting process for a given election type. The election types relevant to the system include Instant Runoff Voting and Closed Party List Voting. The implementation of these include candidate elimination, allocation of seats, potential tiebreaks, and the generation of an audit file as a record of the tally process.

1.2 Document Conventions

Every requirement statement has its own priority.

1.3 Intended Audience and Reading Suggestions

This document is intended for voting officials, system testers, and the development team. The rest of this document contains information concerning the implementation of the voting system, interface and nonfunctional requirements, and system features. The document is intended to be read in sequential order. Developers and testers may wish to pay special attention to the system features section, while users may find the overall description of the system helpful to reference when interacting with the product.

1.4 Product Scope

The system will calculate winners of the election based on a file containing all the information and votes needed. Results will be displayed in an audit file. Benefits of this includes:

- The voting itself will be independent from the calculation of the winners (low coupling is always good)
- Voting officials don't need to tediously tally votes anymore
- Voting process becomes less prone to human error
- The fate of elections would be decided by unbiased software
- Results of elections may be less prone to uncertainty
-

1.5 References

Documents used to write this document includes:

- "Project1_Waterfall_VotingSRS_Spring2023.docx" found on the class canvas page
- "CSCI5801_Spring2023_SRS_Rubric.pdf" also found on the canvas page
- "srs_template-ieee.doc"
- "Example-of-Use-Cases.jpg" used as reference for the use cases

2. Overall Description

2.1 Product Perspective

Voting System v1 is a new, self-contained system designed from scratch to assist voting officials with the task of processing election data.

2.2 Product Functions

User Interactions:

- Input an election file
- Provide information when prompted

Voting System Capabilities:

- Generate an audit file
- Read in file specified by user
- Display results of an election to terminal
- Conduct Instant Runoff Voting
- Handle all edge cases related to IR Voting
- Conduct Closed Party Voting
- Handle all edge cases related to CPL Voting
- Break a Tie/Ties for votes

2.3 User Classes and Characteristics

This system is designed to be used by voting officials and software testers. Voting officials will use this program for the purpose of processing voting data, in order to get election results or produce an election audit file.

Software testers will use this program to find bugs within the program, in order to improve the system and reduce risk of inadequate functionality.

2.4 Operating Environment

This software is designed to operate on University of Minnesota CSElabs machines, which is a linux environment.

2.5 Design and Implementation Constraints

The program must be able to process 100,000 ballots per 4 minutes.

2.6 User Documentation

There are no current user documentation components.

2.7 Assumptions and Dependencies

The Voting System is implemented with Java (JDK 17). The user must have Java installed on the user's system. The Voting System must run on CSELab machines. Currently, there are no software components that are intended for reuse.

3. External Interface Requirements

3.1 User Interfaces

The system will be operated on via terminal, which will prompt the user (most likely a voting official) for any information that the voting file does not have, such as the date and time of execution. Lastly, the prompt will ask the user for the input/voting file, which once given, the election calculations will run and the information will be displayed in an audit file.

3.2 Hardware Interfaces

2x Intel® Xeon® CPU E5-2695 v3 @ 2.30GHz

16 GB RAM

https://cse.umn.edu/cseit/classrooms-labs/servers

3.3 Software Interfaces

The software will be sure to work on a CSE-machine, which is of the linux operating system (Ubuntu). This system will only need to interact with itself, using basic Java Input/Output to read from voting files and write to audit files. Our "voting data" for the audit file should be stored as a txt file.

3.4 Communications Interfaces

Transferring of data from the data part of the system to the logic part will be done through basic Java.io.

4. System Features

4.1 Passing a File Into the Program

4.1.1 Description

A user can pass an election file (.csv format) into the program. This is of High priority, as this feature is required in order to conduct an election.

4.1.2 Stimulus/Response Sequences

1. A user is prompted by the system to enter the name of a file.
2. If the user chose to run the program with the filename through the command line instead, then accept the file through this manner.
3. If there is an error in opening the file, the system should notify the user about the error with details. The system should then re-prompt the user for the filename and return the user to step 1, unless the user has already been prompted 3 times – in which case the program should exit.

4.1.3 Functional Requirements

REQ-1: User should be able to use either the command line to enter the name of the file when starting the program or enter the name of the file through a prompt from the system.

REQ-2: System should validate whether the file can be accessed or not, such as whether the file has the appropriate permissions set.

REQ-3: In case of error, system should notify the user of the nature of the error and re-prompt the user for information. The system should exit if the user has been prompted 3 times already.

4.1.4. Associated Use Case

Name	Pass file into the program
ID	UC_001
Description	The user inputs the csv file into the program to count votes for a given election.
Actors	Election official, testers
Triggers	The actor starts the program.
Preconditions	The file cannot have file errors. The file is within the working directory.

Postconditions	The file has been opened.
Main Course	1. System prompts the user to enter the name of a file (see AC1). 2. System takes the input and validates whether the file can be accessed (see EX1).
Alternate Courses	AC1 User runs program with the filename through the command line. 1. Return to Main Course Step 2.
Exceptions	EX1 Failure to open file. 1. System notifies the user that an error has occurred with details about the error. 2. Reprompt user for filename and return user to Main Course step 1. If user has already been prompted 3 times, exit the program.

4.2 Conduct Algorithm Based on IR Voting Specifications

4.2.1 Description

While the number of candidates is greater than 2, and no candidate possesses a majority vote total, the algorithm follows a recursive process. The total votes are tallied, and the conditions for exiting the recursive process are checked, and if not met, the candidate with the lowest total votes shall be eliminated. If there is a tie among candidates with the lowest amount of votes, a tiebreaker shall determine who shall be eliminated. A similar tie-breaking process is initiated in determining the winner once there are 2 candidates remaining if there is a tie. This is of high priority as officials must be able to process votes and determine a winner.

4.2.2 Stimulus/Response Sequences

1. After the user's input file is processed and stored and the system determines that the election is of type IR Voting, the system shall proceed with the IR Voting algorithm.
2. The singular winner of the election is returned.

4.2.3 Functional Requirements

REQ-1: The system must be able to tally the number of first-choice votes for a candidate, meaning that the information regarding the candidate's names and ballot information was processed beforehand.

REQ-2: The system must be able to flip a coin in the event of a tie(s) in an unbiased way to determine which candidate gets eliminated or who wins the election in special circumstances.

4.2.4. Associated Use Case

Name	Conduct Algorithm Based on IR Voting Specifications
ID	UC_002
Description	System processes election data based on IRV specifications.
Organizational Benefits	This allows for voting officials to run an IR voting election and process votes. Users can see the winner of an IR voting election through this system without having to tabulate and calculate the results manually.
Frequency of Use	Every Instant Runoff Election
Actors	Voting Official, Testers, Voting System
Triggers	IRV specifier has been read in UC_009
Preconditions	Election Data regarding the number of contestants, contestant identifiers, number of ballots, and ballot information, all exist inside the file. An audit file has been created.
Postconditions	Election Winner has been chosen.
Main Course	1. The first-choice votes are tallied for each candidate (see AC1). 2. Decide if a candidate has won a majority by using the result of this tallying process (see AC2). 3. The winner of the election is returned.
Alternate Courses	AC1 A candidate has already been eliminated when tallying votes. 1. Check all ballots where the eliminated candidate was top choice, and based on the next choice assign votes to a new candidate if the ballot had ranked a next choice candidate. 2. Return to Main Course Step 2. AC2 There is no candidate who has won a majority of the votes. 1. If there is a tie between the last two candidates, flip a coin and break the tie to determine the winner (see “Break a Tie” Use Case). Return to Main Course Step 3. 2. If there is no tie between the last two candidates, then the candidate who received a higher number of votes is the winner. Return to Main Course Step 3. 3. If there are more than 2 candidates remaining, take the candidate(s) with the least amount of votes and break ties until exactly one candidate is eliminated (see “Break a Tie”

	Use Case). Check all ballots where the eliminated candidate was top choice, and based on the next choice assign votes to a new candidate if the ballot had ranked a next choice candidate. Return to Main Course Step 1.
Exceptions	None

4.3 Display Results to Terminal

4.3.1 Description

After the votes are tallied, print the results to the user in the command line.

4.3.2 Stimulus/Response Sequences

1. After determining the results, the system displays them to the user.

4.3.3 Functional Requirements

REQ-1: The system must be able to complete the vote tally for both the closed party list election and instant run-off voting types of election.

REQ-2: The system must be able to determine a winner in the case of a tie for both types of elections.

4.3.4 Associated Use Case

Name	Display Results To Terminal
ID	UC_003
Description	Basic information about the election is outputted to the terminal. This information includes the number of votes, the winner, number of votes received per candidate, and more.
Organizational Benefits	Displaying the output provides a concise summary of the most important information about an election. This allows for users to understand the results of an election without needing to study a more complex audit file.
Frequency of Use	Every election
Actors	Voting Official, Testers, Voting System
Triggers	The election has run to completion, i.e. the winner(s) have been decided.
Preconditions	Related information to be outputted, such as the number of votes

	per candidate/party, was able to be properly tabulated and stored.
Postconditions	The information about the election is outputted to the terminal.
Main Course	1. The following information shall be retrieved (see AC1): a. Number of ballots cast b. Number of votes received per candidate c. Election type d. Winner 2. The information shall be printed to be displayed on the screen.
Alternate Courses	AC1 Differing election data is needed (the election type is Closed Party Voting). 1. The number of votes received per party, the winners, the percentage of seats received per party, and the candidates associated with a party in proper order shall be collected in addition to the election type and number of ballots cast. 2. Return to Main Course Step 2.
Exceptions	EX1 Failure to obtain information 1. Display as much of the information listed in Main Course Step 1 as is feasible. 2. Notify user that some information is missing.

4.4 Process File for IR Election Data

4.4.1 Description

Reads data from IR election file based on IR file format specifications, and stores data in the program. Data is stored in a way that allows the system to complete the IR election algorithm within runtime requirements.

4.4.2 Stimulus/Response Sequences

1. File has been input into program
2. File data has been processed and stored

4.4.3 Functional Requirements

REQ-1: Valid CSV file has been opened.
REQ-2: First line of file has been processed and matched with IR election specifier
REQ-3: Must be able to handle errors in closing a file by displaying an informative message to the user and exiting out of the program

4.4.4. Associated Use Case

Name	Process file for Election Data
ID	UC_015
Description	Reads in number of contestants (party for CPL, individual for IRV), contestant identifiers, number of ballots, ballot information, from file. Stores all data inside the system.
Organizational Benefit	Stores election data in program allowing it to be processed
Actors	Voting System, Testers
Triggers	Election type has been specified
Preconditions	Open file exists for reading
Postconditions	1. All data necessary to calculate election results and create valid audit file now exists in program
Main Course	1. System reads in the number of contestants, contestant identifiers such as contestant name, number of total ballots, and ballot information such as the the vote(s) listed on each ballot based on specified format, and stores data in variables inside the program that can be referred to during the rest of the course of the program. 2. Once end of file has been reached, system closes file (see EX1).
Alternate Courses	None
Exceptions	EX1: Error occurs when closing file 1. In the event of this occurrence the program will print out an informative error message and exit the program.

4.5 Process File for CPL Election Data

4.4.1 Description

Reads data from CPL election file based on CPL file format specifications. Data is then stored efficiently, allowing for the CPL election algorithm to meet runtime requirements.

4.4.2 Stimulus/Response Sequences

1. CPL File is input into system.
2. System processes input file for data

4.4.3 Functional Requirements

REQ-1: Valid CSV file input into system
REQ-2: First line of file processed and matched with CPL election specifier
REQ-3: Must be able to handle errors in closing a file by displaying an informative message to the user and exiting out of the program

4.4.4. Associated Use Case

Name	Process file for Election Data
ID	UC_015
Description	Reads in number of contestants (party for CPL, individual for IRV), contestant identifiers, number of ballots, ballot information, from file. Stores all data inside system.
Organizational Benefit	Stores election data in program allowing it to be processed
Actors	Voting System, Testers
Triggers	Election type has been specified
Preconditions	Open file exists for reading
Postconditions	2. All data necessary to calculate election results and create valid audit file now exists in program
Main Course	3. System reads in the number of contestants, contestant identifiers such as contestant name, number of total ballots, and ballot information such as the the vote(s) listed on each ballot based on specified format, and stores data in variables inside the program that can be referred to during the rest of the course of the program. 4. Once end of file has been reached, system closes file (see EX1).
Alternate Courses	None
Exceptions	EX1: Error occurs when closing file 2. In the event of this occurrence the program will print out an informative error message and exit the program.

4.6 Create an Audit File

4.6.1 Description

The system takes the input file and generates a file for auditing the vote tally with the title as the election type and date.

4.6.2 Stimulus/Response Sequences

1. The user inputs the file either through the system or passed into the command line when the program is run.
2. The system reads the type of election and generates an audit file to be written as the votes are tallied.

4.6.3 Functional Requirements

REQ-1: The input file must exist.

4.6.4 Associated Use Case

Name	Create an Audit File
ID	UC_006
Description	The system processes the header of the voting file to create an audit file named for the election type and date.
Organizational Benefits	Audit file can be used to ensure integrity of election process, allowing for public trust in Voting System.
Frequency of Use	Every election
Actors	Voting System, Election Official, Testers
Triggers	The system opens the user's file.
Preconditions	A user has input the file for processing.
Postconditions	An audit file is created to begin recording the vote tally process.
Main Course	1. System reads the first line of the input file to determine the election type. 2. System assigns system date to date variable in program 3. System creates an audit file named for the election type and the date of when the election occurred in the format, "MM_DD_YYYY_VOTINGTYPE.txt", where the VOTINGTYPE represents the type of voting for the election file processed and MM_DD_YYYY signifies the format of the election's date. This audit file is created to be immutable with read-only permissions.
Alternate Courses	None
Exceptions	None

4.7 Break a Tie

4.7.1 Description

Break a tie between two or more candidates/parties.

4.7.2 Stimulus/Response Sequences

1. Once there is a tie at any point in time, a tie shall be broken.
2. Use case eliminates N contestants based on M inputs, using a round-robin random coin toss procedure. For 2 contestants this would be a single coin flip, for 3 or more contestants this would result in each contestant flipping a coin against every other contestant, with the worst performing contestant eliminated, in a recursive process until N contestants are eliminated.
3. Return the remaining contestants.

4.7.3 Functional Requirements

REQ-1: The system must be able to simulate a completely random, unbiased, and fair coin toss.

4.7.4 Associated Use Case

Name	Break a Tie
ID	UC_007
Description	The system flips a coin to determine a winner when two parties have the same allocation of seats in CPL or when two candidates have the same amount of votes or the same rank in CPL and IRV respectively.
Organizational Benefits	Allows for completely unbiased determination of seats or a winner in election, which boosts election's credibility
Actors	Voting System, Election Official, Testers
Triggers	There are four possible triggers for breaking a tie: 1. There is a tie between two or more candidates for elimination in IR voting. 2. There is a tie between the final two candidates in IR Voting. 3. There is a tie in CPL voting where two or more parties tie for the number of seats they may obtain, but there are not enough available seats to hand out equally. 4. In CPL voting, there is a situation where a party wins more seats than the number of candidates they have listed. In the event of this, unclaimed seats will be distributed to other parties via a random lottery.

Preconditions	There exists a tie between two or more candidates or parties.
Postconditions	Tie-breaking results are determined and returned.
Main Course	1. Use case eliminates N contestants based on M inputs, using a round-robin random coin toss procedure. For 2 contestants this would be a single coin flip, for 3 or more contestants this would result in each contestant flipping a coin against every other contestant, with the worst performing contestant eliminated, in a recursive process until N contestants are eliminated. 2. Return the remaining contestants.
Alternate Courses	None
Exceptions	None

4.8 Conduct Algorithm Based on CPL Voting Specifications

4.8.1 Description

System accesses vote counts for each party, determines a quote by dividing the total vote count by the number of seats to allocate, and allocates seats to parties based on their vote total divided by quota value.

If any seats remain, vote remainder is calculated for each party as total vote count - seats assigned * quota. This remainder is then used to allocate remaining seats and assign them to parties.

If any party is unable to claim their full seat allocation, due to possessing fewer candidates than allocated seats, the seats that cannot be claimed shall be distributed via a lottery. See assign seats via lottery system feature for additional information.

4.8.2 Stimulus/Response Sequences

1. The user passes the input file and the system determines the election type as CPL.
2. File data is stored inside system in efficient manner
3. The system conducts CPL election algorithm on data

4.8.3 Functional Requirements

REQ-1: The system must be able to process the input file.
REQ-2: The audit file must be named.
REQ-3: Election data must be present inside system

4.8.4 Associated Use Case

Name	Process Closed Party List Data

ID	UC_008
Description	System allocates seats to parties based on CPL election algorithm specifications
Organizational Benefits	Adds CPL election functionality, allowing the system to meet CPL Election handling requirements
Actors	Voting System, Election Official, Testers
Triggers	The input file is processed and the system determines the election type is CPL.
Preconditions	The audit file has been created, and all necessary data should exist within the program.
Postconditions	The results are determined, meaning that seats are properly allocated to parties.
Main Course	1. The total number of votes is divided by the number of seats to fill to obtain the quota. 2. The number of votes each party received is divided by the quota to determine the first allocation of seats (see AC1). 3. The remainder for each party is calculated, and the second round of seat allocation is determined by the number of seats left to fill and the parties which have the largest remainder of votes 4. The results are determined and the seats are properly allocated to the parties.
Alternate Courses	AC1: Two or more parties have the same number of allocated seats and there are not enough seats to split equally. 1. Break a tie(s) between the involved parties until each party can get an appropriate number of seats according to the results of the tie break (see “Break a Tie” UC_007). AC2: A party is allocated more seats than they are able to accept. 1. Assign excess seats to remaining parties via lottery (see Assign Seats via Lottery UC)
Exceptions	None

4.9 Determine Election Type

4.9.1 Description

The election type is specified via the first line of the input file. This line must be read and parsed to determine which data input process and election algorithm must be conducted.

4.9.2 Stimulus/Response Sequences

1. The user inputs the file into the program.
2. The system determines the election type by reading and processing the first line of the input file.

4.9.3 Functional Requirements

REQ-1: Input file has been opened by the program.
REQ-2: Input file has been processed by the program.

4.9.4 Associated Use Case

Name	Determine Election Type from File
ID	UC_009
Description	Reads in the first line of the opened file and matches it to election type
Organizational Benefits	Allows System to proceed with either IR or CPL voting in a streamlined process, making program flow easier to follow, and allowing the program to be more efficient and logical.
Actors	Voting system, testers, election officials
Triggers	File has been successfully opened
Preconditions	Open file exists to read
Postconditions	System executes election processing logic in accordance with specified Election Type
Main Course	1. System scans first line of open file 2. System places first line into String variable 3. System compares String to the two Election format specifiers 4. System proceeds with rest of program logic in accordance with the string comparison
Exceptions	None

4.10 Write to the Audit File

4.10.1 Description

To ensure the integrity and validity of the results, an audit file must be generated. This audit file shall contain all information present in the input file, information documenting the process and path of the election algorithm, and the final results of the election. This data will be written to the file throughout the election calculation process.

4.10.2 Stimulus/Response Sequences

1. The user inputs the election file.
2. As the system processes the election, the records are written to the audit file.

4.10.3 Functional Requirements

REQ-1: Valid input file must exist
REQ-2: Election algorithm must proceed without error
REQ-3: Audit file must be successfully opened
REQ-4: If an error occurs when attempting to write to audit file, system must be able to return an error and exit the program.

4.10.4 Associated Use Case

Name	Write To Audit File
ID	UC_011
Description	The system will write to an audit file information on the elections, throughout the entire process starting from when the information within the file is processed and stored.
Organizational benefits	Having and writing to an audit file allows testers and election officials to see clearly what happened throughout the election process, allowing them to potentially verify if they are unsure of the results. Or if they trust the results, having an audit file is great to just know the results of an election
Actors	Voting System, Election Official, Testers
Triggers	The program arrives at a point where it needs to record information, which can occur at multiple moments. Some of these triggers include: 1. Processing and storing the data within the file has begun 1. One round of IR Voting has completed 2. One allocation of CPL has completed 3. A tie is broken 4. Processing of an election has concluded 5. A single step in either election type has been completed, such as transferring ballots when a candidate in an IR Voting election has been eliminated
Preconditions	The audit file has been successfully created. Reading of the voting file, processing of the voting file, and conduction of elections are fully functional such that the system goes through its entire process and records information.
Postconditions	The audit file is finalized with all necessary information and is viewable. The program has run to completion.

Main Course	1. System reads election type from voting file (see “Determine Election Type” Use Case) and records it in the audit file 2. System records the information stored by Use Case “Process File for CPL Election Data” or Use Case “Process File for IR Election Data” depending on the type of election, including items such as total number of votes. 3. System records information produced by “Conduct Algorithm Based on IR Voting Specifications” Use Case or “Conduct Algorithm Based on CPL Voting Specifications” Use Case accordingly 4. Once winner(s) have been decided depending on the election type, record results in the audit file
Alternate Courses	AC1: Closed Party Election encounters a tie 1. After step 3 but before step 4, record information about the results of the tie break. 2. Proceed to step 4 AC2: IR Election encounters no Majority 1. After step 3 but before step 4, record information on which candidate gets chosen as the winner. 2. Proceed to step 4 AC3: Candidate Elimination in IR 1. After step 3 but before step 4, record information on who got eliminated. 2. Proceed to step 4.
Exceptions	Failure to write to Audit File: 1. return an error and terminates the program

4.11 Assign Seats via Lottery

4.14.1 Description

In the event that a party wins more seats than candidates they have listed, all of the extraneous seats must be distributed via lottery. The lottery shall take in all parties except the party that originally won the seats and output a single winner. If multiple seats are to be distributed, multiple lotteries will take place.

4.14.2 Stimulus/Response Sequences

1. User Inputs CSV file of CPL Election type
2. System successfully performs CPL file data input and election algorithm

4.14.3 Functional Requirements

REQ-1: File has been successfully opened
REQ-2: File contains CPL election specifier at top of file
REQ-3: Seats have been allocated according to CPL election algorithm specifications

4.14.4 Associated Use Case

Name	Assign extra seats via lottery
ID	UC_050
Description	System assigns unclaimed CPL seats to remaining parties based on random lottery, which is created via use of tiebreaker function
Actors	System, Voting official
Triggers	A party in a CPL election has less candidates listed than the number of seats that they win
Preconditions	The main CPL election algorithm is has been completed. The number of seats each party is entitled to and the number of candidates each party has is already known.
Postconditions	Any extra seats have been randomly assigned
Main Course	1. Number of excess seats are calculated 2. All remaining parties are placed in the lottery. 3. Lottery operates until only one party is left 4. System checks if party has enough candidates listed to accept seat 5. System checks if any excess seats still need to be assigned, if yes system repeats step 2
Alternate Courses	1. Party that wins the lottery cannot accept the seat due to not enough candidates. 2. Lottery is repeated but with all remaining parties. 3. In case of 1 happening again, this process is repeated until seat is accepted, with parties that cannot accept seats being eliminated from lottery process with each iteration
Exceptions	None

5. Other Nonfunctional Requirements

5.1 Performance Requirements

For now, there are only runtime requirements – the system must be able to process 100,000 ballots in under 4 minutes on CSELab machines. This means that the system must be able to process a large number of votes quickly. The system should not expect only a small number of votes to be processed.

5.2 Safety Requirements

Currently, there are no notable requirements or policies related to safety.

5.3 Security Requirements

All election security is handled at individual voting centers. As such, there are no security requirements for the voting system.

5.4 Software Quality Attributes

The voting system must be adaptable, meaning that it must be possible to add new features into the voting system, such as potentially allowing write-in candidates or other pertinent information while maintaining correctness.

The voting system must be correct. For example, the results of both IR voting elections and closed party elections must be accurate and produce expected, unbiased results; in situations where ties are broken in the course of voting evaluation, the system must reflect fairness. For instance, if there were ever a tie or ties in an election, running an election 10,000 times should produce unbiased results that indicate that all candidates or parties involved in a tie have equal chances of advancing.

5.5 Business Rules

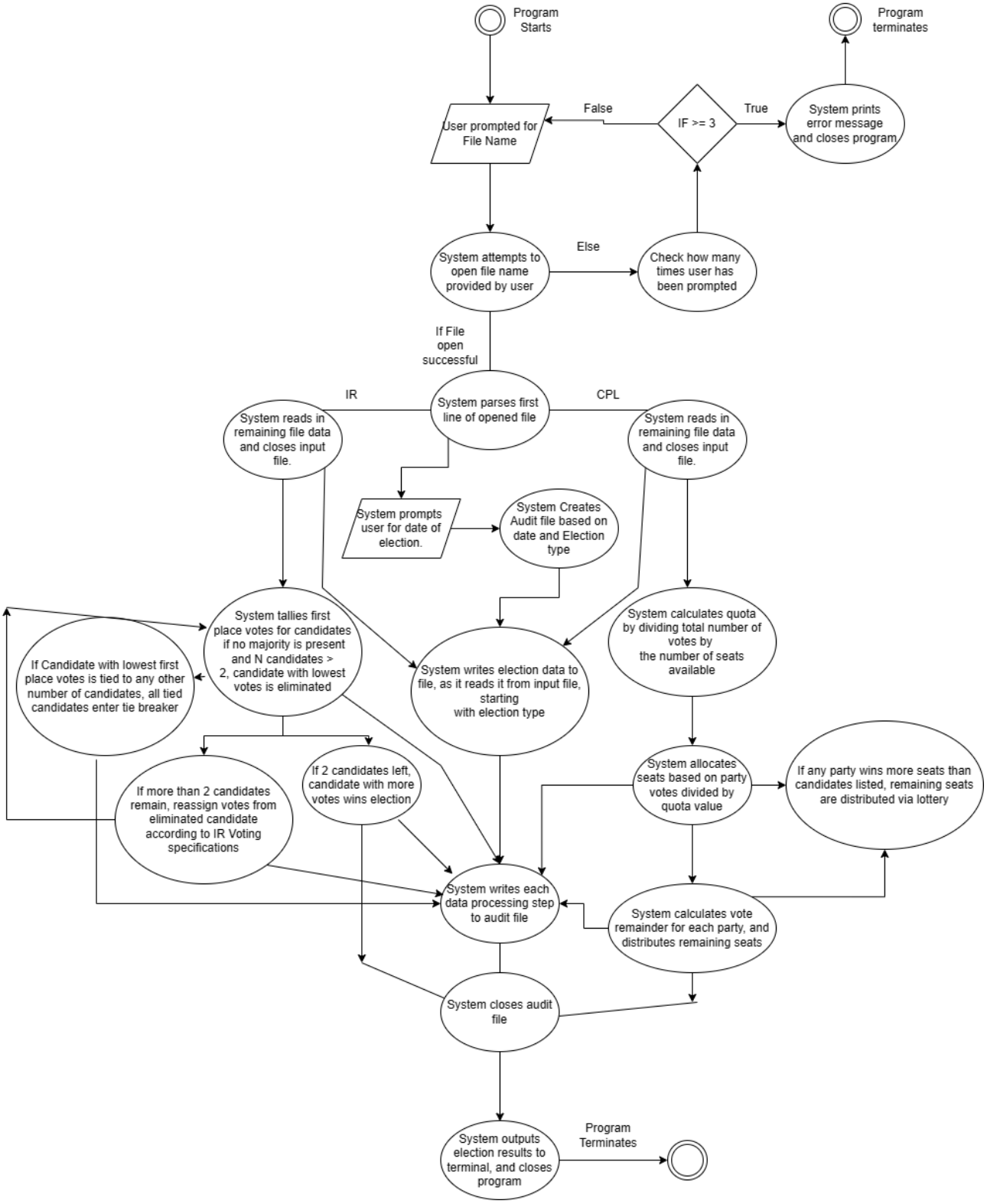
Voting officials can run the program, input a file, see output that summarizes key statistics in the election, and obtain an audit file. Similarly, testers may also perform the same functions. Use of the voting system is limited to voting officials and testers. Input files are in CSV format, output audit files are in txt format. Elections are called by government officials, results shall be displayed on the terminal.

6. Other Requirements

Appendix A: Glossary

Term	Definition
IR Voting/IR/IRV	A system of voting in which voters rank candidates on a ballot by preference. In this system, if a candidate has a majority of the votes, the candidate wins the election; if not, the candidate with the least number of votes is eliminated, and their votes are added to the next choice indicated by each voter. This repeats until there is a majority, or if all votes have been handed out, the winner is declared through popularity.
Closed Party Voting/CP Voting/CPL	A system in which voters choose a party, and based on the total votes that each party receives, and the total seats available in a given election, the seats are allocated among the parties.
Audit File	A file containing all information necessary to verify the election process and results.
Voting Official	An official who oversees an election and is involved with calculating the results of an election.
Tester	Somebody who runs tests on software to detect the presence of bugs.
Lottery	Random process with at least 2 participants and a single winner.

Appendix B: Analysis Models



Appendix C: To Be Determined List