

CSCE 475/875 Multiagent Systems  
**Game Day 2: Voting Day**  
Assigned: February 27, 2020    Game Day: March 10, 2020

**Introduction**

On Voting Day, students are required to practice different voting mechanisms as agents. Remember that voting is a key coordination mechanism for social decisions. For this game day, you are to learn about the different voting mechanisms and gain insights into their strengths and weaknesses.

The objectives of Voting Day are to familiarize students with voting, social decision making processes in general, and multiagent coordination mechanisms. More specifically, you will learn about plurality voting, cumulative voting, approval voting, plurality with elimination, Borda voting, and pairwise elimination. You will also learn about voting paradoxes such as the Condorcet condition, spoiler in Borda voting, and elimination order that enables a Pareto-dominated candidate to win.

Recall the following from our lectures:

**Definition 9.3.1 (Plurality voting):** *Each voter casts a single vote. The candidate with the most votes is selected. (Round 1)*

**Definition 9.3.2 (Cumulative voting):** *Each voter is given  $k$  votes, which can be cast arbitrarily (e.g., several votes could be cast for one candidate, with the remainder of the votes being distributed across other candidates). The candidate with the most votes is selected. (Round 2)*

**Definition 9.3.3 (Approval voting):** *Each voter can cast a single vote for as many of the candidates as he or she wishes; the candidate with the most votes is selected. (Round 3)*

**Definition 9.3.5 (Borda voting):** *Each voter submits a full ordering on the candidates. This ordering contributes points to each candidate; if there are  $n$  candidates, it contributes  $n - 1$  points to the highest ranked candidate,  $n - 2$  points to the second highest, and so on; it contributes no points to the lowest ranked candidate. The winners are those whose total sum of points from all the voters is maximal. (Round 4)*

**Definition 9.3.4 (Plurality with elimination):** *Each voter casts a single vote for their most-preferred candidate. The candidate with the fewest votes is eliminated. Each voter who cast a vote for the eliminated candidate casts a **new** vote for the candidate he or she most prefers among the candidates that have not been eliminated. This process is repeated until only one candidate remains. (Round 5)*

**Definition 9.3.6 (Pairwise elimination):** *In advance, voters are given a schedule for the order in which pairs of candidates will be compared. Given two candidates (and based on each voter's preference ordering) determine the candidate that each voter prefers. The candidate who is preferred by a minority of voters is eliminated, and the next pair of non-eliminated candidates in the schedule is considered. Continue until only one candidate remains. (Round 6)*

## Setup

There will be a list of items for each student to vote on. The voting is secret. There will be several rounds of voting. Each round will use a particular voting mechanism. For each round, after voting is done, the votes will be revealed anonymously. And each team is required to compute the preference order of the items based on the votes and submit the result to the Game Day monitor(s). Each student will be scored based on first the correctness of their computed preference order and then the time stamp of the receipt of the result by the monitor(s). Each student is also required to be consistent in their voting throughout all rounds.

For some rounds, we will pose additional questions such as:

1. Is the Condorcet condition satisfied?
2. Is there a spoiler item such that its removal from the list would cause significant changes to the preference ordering? If yes, prove it. If no, explain.
3. Is there a pairwise elimination order that would cause an item that Pareto-dominates another item to finish behind the said dominated item? If yes, prove it. If no, explain.

You will submit your response to the above questions on your worksheets.

Because of the time constraint, each round will be limited to a few minutes. If a student is not able to provide an answer within the allotted time, the student will receive 0 points for that round.

Note that you are required to be consistent with your votes. For example, if in Round 1, you prefer  $a > b$ , then in all other rounds, you must also prefer  $a > b$ .

On Game Day, the rounds will be revealed to you as part of the Game Day package.

**Special Note: The scores of the two students in each team will be tallied and counted towards the Game Day 2 ranking together as a team.**

## Requirements

Each student group is required to turn in three reports: pre-game strategies, mid-game strategies, and post-game lessons learned.

- Pre-game strategies are to be handed in before the Game Day starts.
- The report on mid-game strategies consists of your observations noted down on your worksheets during the Game Day
- Post-game lessons learned are handed in at the end of the Game Day.

Some ideas on what should be included in the reports: your strategies for each round of multiagent voting, your reflections on the voting mechanisms and processes, any insights as to the strengths and weaknesses of the different voting mechanisms, and finally your conclusion.

Your participation on Voting Day will be graded based on:

- 50% Game Day Report (pre-game and mid-game strategies, post-game lessons learned, worksheets)
- 50% Voting

The Voting Score will be graded based on your in-class participation on Voting Day, and on your team's performance.