

## Project 3 – Diego Sic

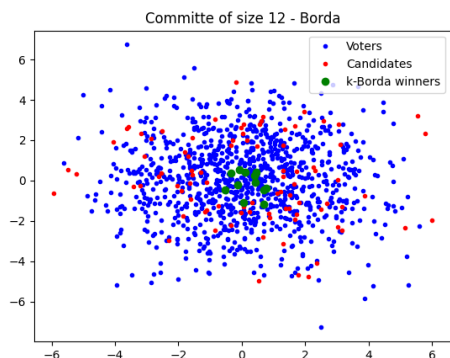


Figure 1

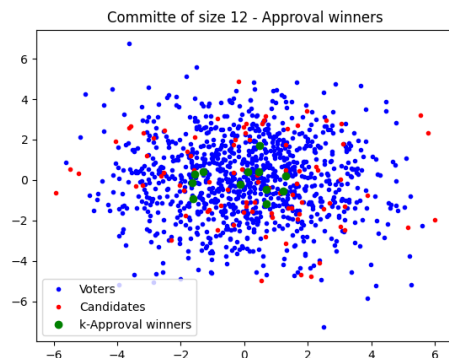


Figure 2

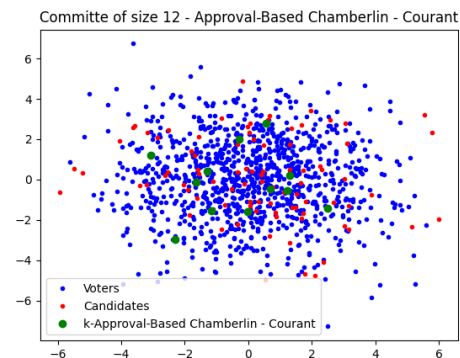


Figure 3

Recently in my Voting Theory Course, we analyzed and learned multi-winner voting rules. This multi-winner elections, better known as **committee elections**, can be designed to achieve certain types of goals. The two that we will analyze in this paper are **Excellence-Based Elections** and **Selecting a Diverse Committee**. The elections that are based on **Excellence** achieve to select the highest quality committee without considering whether all the committee members are similar. As a result, it will choose the “best” candidates. Unlike the previous method regarding **Diversity**, we considered all the candidates with respect to each other to determine the committee. Under these two goals, we are going to examine the results of 3 simulations using the following voting rules: **k-Borda**, **k-approval**, and **Approval-Based Chamberlin Courant**.

The simulations were plotted under a 2-D plane using normal distribution. The quantity of voters is 1,000, and quantity of candidates is 100. The committee size is 12 candidates, so we can notice the behavior of these voting rules in large committee size.

**k-Borda**, as we can see in figure 1, tends to take candidates at the center of the distribution. Furthermore, after running several simulations, we can notice that **k-Borda** is committee monotonic. This means that no matter the size of the committee if we increment its size by one (supposing passing from 6 to 7), all the six candidates from the first committee will be in the new committee. With those two characteristics, we can conclude that **k-Borda** is oriented to be an **Excellence-Based** voting rule because they tend to choose the “bests” candidates even if they are similar.

We must make some clarifications before analyzing **K-approval**. The method we use to compute **K-approval** is that in a committee of size  $k$ , each voter has to approve  $k$  candidates. After running several simulations under this setting, we noticed that it is not committee monotonic. When the number of approvals a voter gives increases, the winning candidates' set changes. Although it is not committee monotonic, the first 2 candidates tend to remain in the winning set as the size of the committee increases. If we analyze figure 2, we can notice that the winners are more spread around the distribution than in figure 1. This means that it is more diverse, but why? This

phenomenon happens when the size of the committee is larger than 10. When the committee size is less than 10 it resembles Borda, but once it is more than 10, those candidates that are further from the center have more chances to be selected. We can conclude that K-approval is a **middle point** between **Diversity** and **Excellence**. If we increase the size of the committee, it will be more diverse. If we keep the size of the committee small, it will be closer to selecting the “best” candidates.

Finally, **Approval-Based Chamberlin-Courant** can be summarized as follows: we have several rounds until we have all the committee members. In the first round, the winner is the one that is approved by most people. After determining the first winner, we exclude all the voters that are already satisfied with the winner(s) from the next round. In the next rounds, we check for the candidate with more supporters under the subset of non-satisfied voters. If we reach a point where all the voters are satisfied, but the committee isn't large enough, we will fill it with random candidates. We can do this because all the voters already approved at least one candidate in the committee. The quantity of candidates a voter can approve is fixed at **k** (size of the committee). If we see figure 3, we will notice that this method is oriented toward **Diversity**. It doesn't matter the size, the committee will be **Diverse**; this is because this method elects each member of the committee, after considering all the other candidates. Furthermore, this method avoids selecting similar candidates, that's why the candidates are not only further away from the center but also are more separated than the other 2 methods.

To sum up, the three voting rules achieve different goals. First being Excellence based, second in a middle point between Diversity and Excellence, and the last being completely focused on Diversity. I want to conclude by saying that these results were obtained under an ideal setting and that reality is much more complicated and complex or imperfect and deep...

I don't know with which pair of words end. Let's vote!