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Multiwinner Election Rules: Beyond Scoring Protocols

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Assume we need to select a group of people from the larger set of available candidates. Imagine we are members of a larger population of voters, and that each of us has their own view on which candidates should be selected. Our views vary substantially. How to resolve this issue: which group of candidates is the best when viewed collectively, from the perspective of the whole population of voters? How to find such a group of candidates? These and similar questions are the main focus of the voting theory. Specifically, when the goal is to select a *group* of candidates, we are dealing with *multiwinner elections*.

The abstract model of multiwinner elections describes various scenarios. Its applications range from selecting finalists in a contest (where judges/experts have opinions/preferences over contestants), through designing a targeted advertising campaign (where potential customers act as voters and drafts of advertisements—as candidates), to choosing a representative body such as a parliament. These applications are very different from each other and for each of them a different multiwinner voting system might be the most suitable. How to choose the right multiwinner rule for a particular application? In order to do that we first need to have (1) a rich set of good multiwinner rules to choose from, and (2) a good understanding of the (axiomatic and algorithmic) properties of those rules. Axiomatic properties explain at the very intuitive level how particular election rules behave; the algorithmic properties tell us whether it is feasible to use a particular voting rule, depending on the expected size of an election.

Currently, our understanding of multiwinner rules is far less advanced than that of single-winner methods, but the situation is changing rapidly. The model of multiwinner elections has attracted many researchers and a great progress in the field has been made in recent years. However, so far this research mainly focusses on a particular subclass of multwinner rules, called committee scoring rules.

Committee scoring rules are natural extensions of positional scoring rules—perhaps the simplest class of single-winner rules—to the multiwinner setting. Informally speaking, a positional scoring rule proceeds as follows: Each voters awards each candidate c with a certain score that depends on the number of candidates whom the voter prefers to c. Next, for each candidate we add the points that the candidate garnered from all the voters, and the candidate with the highest total score is claimed the winner. Committee scoring rules are defined analogously, but their definition is more involved and the class is much more diverse, in particular containing rules which are considered proportional.

In the world of single-winner elections there also exist more advanced voting methods that do not fall into the category of scoring rules. Examples of such rules include those based on the Condorcet principle. Some Condorcet-consistent rules satisfy very appealing properties—some of which cannot be provably achieved by scoring rules—and are used by various institutions and organisations to make decisions.

Yet, quite surprisingly, for multiwinner elections, research on rules based on the Condorcet principle is still scarce. Similarly, as in the single-winner setting those rules are very different from committee scoring rules. We anticipate that they satisfy very different appealing properties from those satisfied by multiwinner scoring protocols. On the other hand, they are also mathematically more involved, which makes their analysis more challenging. Our goal is to algorithmically and axiomatically explore the classes of non-scoring multiwinner rules, in general, and multiwinner rules based on the Condorcet principle, in particular. The result of this proposal will be a detailed analysis of several existing non-scoring multiwinner rules, but we will also introduce and analyze new (classes of) voting rules.