Parameterized complexity of control and bribery for \(d\)-approval elections.


Summary: A \(d\)-Approval election consists of a set \(C\) of candidates and a set \(V\) of votes, where each vote \(v\) can be presented as a set of \(d\) candidates. For a vote \(v \in V\), the \(d\)-Approval voting protocol assigns one point to each candidate in \(v\). The candidate getting the most points from all votes wins the election. An important aspect of studying election systems is the strategic behavior such as control and bribery problems.

The control by deleting votes problem decides whether for a given election \((C, V)\), a specific candidate \(c\), and an integer \(k\), it is possible to delete at most \(k\) votes such that \(c\) wins the resulting election. In the control by adding votes setting, one has two sets \(V\) and \(U\) of votes and asks for a subset \(U' \subseteq U\) such that \(|U'| \leq k\) and \(c\) becomes the winner in \(V \cup U'\). The bribery problem has the same input as the vote deleting control problem and asks for changing at most \(k\) votes to make \(c\) win. All three problems have been shown NP-hard. We initialize the study of the parameterized complexity of these problems and present a collection of tractability and intractability results. In particular, we derive a polynomial-size problem kernel for the standard parameterization of the control by deleting votes problem, the seemingly first non-trivial problem kernel for the control problem of elections.

Keywords: parameterized complexity; computational social choice; problem kernels; strategic behaviors of voting protocols

doi:10.1016/j.tcs.2015.06.016