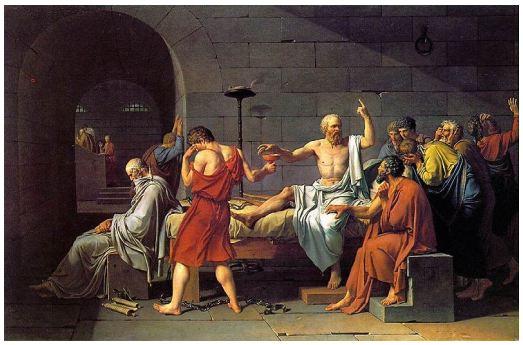
IT Services

# Case Study

**BlueBEAR** provides a substantial computing resource that properly supports the research work of research staff and students at Birmingham. It provides a cost effective facility that optimises the effectiveness of research and ensures the University continues to be a world-class academic learning and research environment.

## Optimal voting rules for two-stage committees



### Challenges

In many environments, committees are required to make both preliminary and subsequent, final decisions: bills must typically survive two parliamentary votes to be adopted; couples typically are first engaged before marrying; employees may be hired probationary before being granted a permanent position. Within such environments, committee members must decide how to vote: adopting a candidate at the preliminary stage allows the committee to glean more information about it; turning the candidate down at either stage allows the committee to search for a new candidate. What voting rules should a committee adopt at the preliminary and final stages if it wishes to efficiently trade off its impatience against a desire to make the right decision?

### Background

Each of the voting rules considered reduces to a polynomial equation. As these are typically above fifth order, they are not – by Galois' theory – solvable in radicals. We therefore use Magma to implement techniques from algebraic geometry, allowing us to solve for those points at which two voting rules yield perform equally. By testing the voting rules off of these solution, we may determine the domain over which any particular rule is optimal.

### Results

Committees that are patient, or which are highly able to glean information from probationary candidates should adopt a rising threshold rule, under which the probationary threshold is easy to leap, but the final one difficult. Committees that are either impatient or less able to glean information from probationary candidates should make both thresholds low. These results therefore provide a consistent theoretical underpinning for intuition. We also find, less intuitively, that a committee's performance can deteriorate if its ability to glean information from candidates improves: optimistic committee members may be more willing to initially vote in favour of an option, in the hope that their pessimistic colleagues will be convinced by the candidate's performance; insofar as this delays the committee's ability to consider a new candidate, this can harm it.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**Product Used**
Magma, Matlab with the Symbolic Toolbox and SOSTOOLS, Maple

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