Mathematics of Redistricting: workshop for educators

August 10–11, 2017

Organizers

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Additional Presenters

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Nina White (University of Michigan, Mathematics Education)

Overview and Learning Objectives

The workshop is part of the Tufts Geometry of Redistricting Summer School (August 7–11, 2017). The goal of the workshop is to introduce high-school and college mathematics teachers to the mathematical discipline of *voting theory* and to offer concrete tools for incorporating mathematical topics related to voting, gerrymandering, and civil rights into their teaching.

Format

The workshop will consist of six 90-minute teaching sessions (three per day), plus one 60-minute lecture. The total instructional time during the workshop will be 10 hours.

Each session will have a lead instructor and one or two teaching assistants. In addition to introducing participants to new mathematical content, each session will include a discussion of how best to present the material to students and suggestions for how to incorporate the topic into the high-school and introductory college mathematics curricula.

The workshop will be preceded by a three-day public conference, featuring talks by leading experts on the legal, historical, and mathematical aspects of legislative redistricting and gerrymandering. (The conference schedule is online at http://sites.tufts.edu/gerrymandr.) We expect that most workshop participants will want to attend many of the conference talks, but this is optional.

Curriculum

Voting theory (1 session, 1.5 hours): an introduction to the mathematics of voting, with an emphasis on ensuring fair representation. Topics include voting systems and voting fairness criteria. (Participants who already know some voting theory will be able to attend more advanced sessions on Arrow's Theorem or apportionment.)

Geometry of redistricting (2 sessions, 3 hours): Geometric measures of district compactness. Topics include: isoperimetric ratios and the isoperimetric theorem, convexity, and dispersion/moments of inertia.

Partisan gerrymandering, representation, and fairness (2 sessions, 3 hours): Mathematical measures of partisan "fairness" in redistricting and alternative models of representation. Topics include: efficiency gap, the seats-votes curve, uniform partisan swing, proportional versus geographic representation, and mixed systems.

Additional topics (1 session, 1.5 hours): Participants will be able to select one additional sessions on either voting theory, statistical approaches to detecting racial gerrymandering, or the use of GIS (geographic information systems) in the classroom.

Redistricting software and redistricting competitions (1 lecture, 1 hour): a plenary talk on the role of educators in getting students interested and involved in issues related to redistricting.

Assessment

Each teaching session will include hands-on problem-solving activities to ensure that participants master the mathematical content. There will also be a brief online assessment at the end of each session. For the GIS session, each participant will complete a mini-project.