MATH 125 Mathematical Perspectives

The objective is to provide you with experiences characteristic of the mathematical enterprise at a depth that allows you to appreciate the aesthetic beauty of mathematical truth and its timeless, user-independent nature.

This course will explore the power of the mathematical perspective on some questions in the social sciences:

• **Strategies for competition**: How can we better understand the motivations of actors in situations of conflict by means of game-theoretic analyses?

• **Strategies for cooperation**: How can we better understand the consequences (many of which are unintended) of voting situations in which groups of individuals make decisions that reflect the preferences of each of the participants? Can we measure the political power held by voters?
Strategies for competition: Game Theory

A unified mathematical approach to a broad array of political, social, and economic situations involving decision makers, called players, who make choices, called strategies, that lead to outcomes. These outcomes result in measurable payoffs to the players, reflecting their preferences among the outcomes. Game theory is the mathematical analysis of such situations, which attempts to determine if there are rational choices of strategy for the players.

Game theory was “invented” by John von Neumann and Oskar Morgenstern in their seminal 1944 book, The Theory of Games and Economic Behavior, and was extended by John Nash in the early 1950s in an important series of scholarly papers.

Games are models: they abstract the situations under study by highlighting only the essential features of the decision making process:
• who are the players?
• what are their strategies?
• how many possible outcomes are there?
• how do the players value the various outcomes?
We are interested primarily in social and political situations, so we are not going to focus on traditional games (Monopoly, Trivial Pursuit, football). Still, some such games can make for useful examples.