First Year Seminar: The Mathematics of Voting (FYS 100-R) Syllabus, Spring 2008

Professor: **Dr. Jason Parsley**
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1. Course Time & Location: TuTh 1:30-2:45, Manchester 245

2. Primary text: Jonathan Hodge and Richard Klima, *The Mathematics of Voting and Elections*, AMS, 2005

Supplementary texts: Donald Saari, *Chaotic Elections!: A Mathematician Looks at Voting*, AMS, 2001.

Alan Taylor, *Social Choice and the Mathematics of Manipulation*, MAA, 2005.

3. Course description: Voting and its quagmires have heavily influenced politics in the 21st century. In this course, students will examine the foundations behind voting, be it for political candidates or for toppings on a pizza. One striking result quickly encountered is Arrow's Impossibility Theorem: except for a dictatorship, any voting system among three or more persons must inevitably fail one of a few natural criteria, which one would expect to hold in any election. We will examine the strengths and weaknesses of several voting systems, including (1) majority rule, (2) a Borda count method (similar to many sports polls), (3) approval voting, and (4) instant runoff voting, which several states (including North Carolina) and municipalities have recently adopted. We will also study the Electoral College and other examples of weighted voting systems. Much of our data will topically be taken from the ongoing primaries. Students will work directly with exit-polling data and predict outcomes of these races; one course project will analyze the accuracy of their projections. Some readings will address the current debate regarding electronic voting machines. Students will explore a voting topic in greater depth for a final project.

4. Goals. In this seminar, students will

- explore an important current issue, voting, during the election year of 2008; they will learn to think, speak, and write critically about elections, and hopefully come to understand the pursuit of fair elections as a vital nonpartisan concern in a democracy

- intertwine ideas from mathematics and political science to comprehend voting theory

- actively (generate and) interpret polling data through which they will gain personal ownership of this topic

5. Format. Our course breaks naturally into 4 topics; see below. The majority of the course will be discussion-based. I will lecture some at the start of the second and third

topics (voting systems & weighted voting systems) to augment the readings, but we will quickly switch into more inquiry-based learning. For certain classes in the other two topics, a pair of students will make a quick oral presentation to begin the class, followed by time for students reactions.

Four written assignments will be completed, Students will submit both a rough draft and a final version of each paper; the second and third papers will be peer reviewed. I plan 3-5 short 25-minute quizzes on these topics: exit polling, voting systems, and weighted voting systems.

6. Course content: There are four sections to the course.
note: the structure of the course and especially the timing is subject to change

1. *U.S. Elections and Primaries* (4-5 wks) – The SC primary will occur on two dates: Saturday, Jan. 19th for Republicans, and Saturday, Jan. 26th, for Democrats. Soon after comes 'Super Tuesday', Feb. 5th, with primaries in over 20 states. We explore voting theory and exit polling in this context. Students will learn how to take their own exit polls, and to analyze data from other exit polls and make predictions; they do so in **Assignment #1 (4-6 pages):** students will contribute both an oral presentation and a written paper on the data, predictions, and results from various ongoing political races.

2. *Voting Methods and Arrow's Impossibility Theorem* (4-5 wks) We discuss different voting systems for elections involving three or more candidates and important properties they should have. Kenneth Arrow proved that all such voting systems are fatally flawed; it is impossible to satisfy all the important properties simultaneously.
   Assignment #2 (3-5 pages): investigate an organization/state that uses a system other than plurality or majority rule. Discuss the history of why they do so, its advantages and disadvantages, and recommend whether they should continue using this voting system or switch to another. (Assignments 2 and 3 will be peer-reviewed.)

3. *Weighted Voting Systems & the Banzhaf Power Index* (3 wks) What happens when some voters have more power than others? We learn how to estimate each voters power, and learn what a 'dummy voter' is. As a complicated example, we discuss the Electoral College. **Assignment #3 (3-5 pages):** will include various topics; some suggestions:
   (a) The Electoral College – either defend it or argue for its abolition/adaptation.
   (b) investigate another country/state/organization which utilizes weighted voting. Discuss the history of why they do so, its advantages and disadvantages, and recommend whether they should continue using this voting system or switch to another.

4. *Current Electoral Issues* (4 wks) We discuss some of the following topics: electronic voting machines and paper trails; the primary calendar; disenfranchisement of felons; effects of social class and race upon voting; low voter turnout: should election day be a holiday? Should states use instant-runoff voting? **Assignment #4 (8-10 pages):** Students will investigate one topic in depth as a final paper.

7. Grade Calculation.

Quizzes	15%
Participation	20%
Assignment 1	15%
Assignment 2	10%
Assignment 3	10%
Assignment 4	25%
Peer Review	5%

If you have a disability which may require an accomodation for taking this course, please contact the Learning Assistance Center (758 5929), then contact me, within the first 2 weeks of the semester.