Professor: Rachel Bayless   **Office:** Buttrick Hall 325
Email: rbayless@agnesscott.edu   **Office Hours:** M/W 10:30-11:30 (Atrium of Bullock)
Phone: x6231   and by appointment

TEXT: *Chaotic Elections! A Mathematician Looks at Voting* by Donald G. Saari

DESCRIPTION: This course is designed for the non-science major and provides a non-technical introduction to the topics covered. It satisfies the SUMMIT in STEM requirements as a Global Learning Across the Curriculum course. As such, the course content will be entirely motivated by global themes, and this semester, we will conduct an in-depth study of voting systems.

The main problem in voting theory is that when there are more than two candidates different voting schemes can produce drastically different outcomes. Furthermore, there are four very widely accepted and rigorous definitions of "fair," but there is a famous mathematical theorem (Arrow's Theorem) that says no voting scheme will ever satisfy all the fairness criteria. In other words, there is no completely fair voting system. This paradox has several important social and political implications on a global scale, and we will study many of them through analyzing historically controversial elections.

COURSE GOALS: "[The universe] cannot be read until we have learnt the language and become familiar with the characters in which it is written. It is written in mathematical language, and the letters are triangles, circles and other geometrical figures, without which means it is humanly impossible to comprehend a single word." - Galileo Galilei

Mathematics is a language, and just like any other language it has rules and meaning. There are complete thoughts (sentences) and incomplete thoughts (sentence fragments). Communicating mathematics should be given the same care as communicating in any other language. In this course students will:

- interpret real-world social justice issues in the language of mathematics.

- identify historically controversial elections and analyze their implications.

- argue for/against various voting systems based on certain fairness criteria.

- communicate mathematics, both orally and in writing.

Note: You should expect to spend about 3 hours outside of class for every hour spent in class.

ATTENDANCE/CLASSROOM POLICY/PARTICIPATION: You are expected to be in class each day prepared to learn. You are also expected to participate in class (ask questions, join class discussions, contribute to group work, etc...), and participation will be worth 10% of your final grade. If you do not attend class, then you are still responsible for the material covered. **Make-up homework and exams will not be given.** While you are in class please **refrain from using cellphones, laptops, and other electronic devices.** These devices are distracting to me and your fellow students.

HOMEWORK: There will be two types of homework assignments in this class: Reading Questions and Problem Sets. The entire schedule of due dates for both types of assignments is outlined in the Course Calendar.

Reading Questions: You will often have a few pages of reading that will be due prior to class. Sometimes the reading assignment will be accompanied by a set of reading questions that will be posted on MOODLE. They are short questions that gauge how well you understood the reading. The reading questions will be due by the beginning of class on their due dates. Each individual question on these assignments will be graded on a 0-2 scale. You will receive a 0 if you did not complete the question or it's clear that you did not make an honest effort in your answer. You will receive a 1 if you made an effort to answer the question, but there are errors in your solution. You will receive a 2, if your solution is correct or has very minor errors.

Problem Sets: In order to really learn mathematics you must practice the techniques we cover in class. Thus, there will be regularly scheduled problem sets. They will be hand-written assignments that are due at the beginning of class on their due dates.

You are encouraged to work together on all homework, but **the work you turn in must be your own**. In particular, copying answers from an outside source (another student, solutions manual, tutor, internet, etc...) is forbidden. If you work with another student, then you are required to cite that person in your personal write-up. **No make-up homework will be accepted**.

EXAMS: There will be two in-class exams given during the semester. **No make-up exams will be given**. Each exam is worth 20% of your final grade. The **tentative dates** for the exams are

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1. Friday, February 26.   2. Friday, April 15.

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FINAL PROJECT: The final project will be a constitutional convention, where you will use everything you learned this semester to design a constitution for a fictional group. Students will be randomly assigned to act as advocates for ethnic groups that reside in the fictional country. You will be given information about their population size, their values, the country's history etc.. You will be tasked with designing a voting scheme for the country's national elections. You will also be asked to design a scheme for picking leaders within your ethnic group. The constitutional convention will take place during the last full week of class, and it will be worth 20% of your final grade.

GRADE POLICY: The scale used for this course is a the traditional 10 point scale outlined in the Agnes Scott Handbook. Your grade will be computed as follows:

Participation	10%
Reading Questions	10%
Problem Sets	20%
Exam 1	20%
Exam 2	20%
Constitutional Convention	20%

RESOURCES: Course materials, announcements, and homework assignments will be updated on MOODLE. It is your responsibility to check the MOODLE site regularly.

OFFICE HOURS/APPOINTMENTS: Please come to office hours. This is time set aside just for you, so take advantage of it. If your schedule conflicts with the preassigned times, or if you would prefer to meet with me one-on-one, then let me know, and we can find a time to meet by appointment. To schedule an appointment, simply send me an email. Sending me an email at least 24 hours ahead of time is ideal.

EMAILS: Please don't hesitate to email me with questions and/or to set up meetings. I will usually respond to an email within 24 hours. I do not always check my email in the evenings, so if you send me a message at night, then I'll usually reply the next business day.

INCLUSION: This course adheres to the principles of diversity and inclusion integral to the Agnes Scott community. We respect people from all backgrounds and affirm people's decisions about gender expression and identity. Please feel free to correct me if your preferred name or gender pronoun are different from that listed on the class roster.

ACCOMMODATIONS: Agnes Scott College seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in this class, please contact Kelly Deasy in the Office of Academic Advising (X6150) to complete the registration process. Once registered, please contact me so we can discuss the specific accommodations needed for this course.

COURSE EVALUATIONS: The completion of course evaluations is an expectation of students in this class. Near the end of the semester you will be notified by email and provided with a link to follow to complete the evaluations online outside of class. Your feedback on the course is extremely valuable. You are responsible for completing an evaluation of the course at the end of the semester.

ACADEMIC HONESTY: The Agnes Scott College honor code embodies an ideal of character, conduct, and citizenship, and is an important part of the College's mission and core identity. This applies especially to academic honesty and integrity. Passing off someone else's work as your own represents intellectual fraud and theft, and violates the core values of our academic community. To be honorable, you should understand not only what counts as academic dishonesty, but also how to avoid engaging in these practices. You should:

- review each course syllabus for the professor's expectations regarding course work and class attendance.

- attribute all ideas taken from other sources; this shows respect for other scholars. Plagiarism can include portraying another's work or ideas as your own, buying a paper online and turning it in as if it were your own work, or not citing or improperly citing references on a reference page or within the text of a paper.

- not falsify or create data and resources or alter a graded work without the prior consent of your professor. This includes making up a reference for a works cited page or making up statistics or facts for academic work.

- not allow another party to do your work/exam, or submit the same or similar work in more than one course without permission from the course instructors. Cheating also includes taking an exam for another person, looking on another person's exam for answers, using exams from previous classes without permission, or bringing and using unauthorized notes or resources (i.e., electronic, written, or otherwise) during an exam.

- not facilitate cheating, which can happen when you help another student complete a take home exam, give answers to an exam, talk about an exam with a student who has not taken it, or collaborate with others on work that is supposed to be completed independently.

- be truthful about the submission of work, which includes the time of submission and the place of submission (e.g., email, online, in a mailbox, to an office, etc.).

You should understand that penalties result from dishonest conduct, ranging from failure of the assignment to expulsion from the college. You should speak with your professors if you need clarification about any of these policies.

Note: This syllabus is subject to change at my discretion.

Course Calendar
(This document is subject to change. Any changes will be announced in class.)

WEEK 1:

Jan 13   Introduction

Jan 15   *Read:* Saari pg. 1-4
In Class: Election Activity
Due: **Reading Questions 1**

WEEK 2:

Jan 18   MLK DAY

Jan 20   *Read:* Saari pg. 4-6
In Class: Political Power
Due: **Reading Questions 2**

Jan 22   *Read:* Saari pg. 7-9
In Class: Measuring Power
Due: **Reading Questions 3**

WEEK 3:

Jan 25   *In Class:* Preference Ballots/Schedules and Unfair yet Fair Part I

Jan 27   *Read:* Saari pg. 17 - 22
In Class: Plurality - Examples from Reading
Due: **Reading Questions 4**

Jan 29   *Read:* Saari pg. 23
In Class: Antiplurality, Plurality to Cutoff

WEEK 4:

Feb 1   *Read:* Saari pg. 24-25
In Class: Approval Voting, Cumulative Voting

Feb 3   *Read: Saari pg. 26*
In Class: Borda Count - Fair yet Unfair (cont.)

Feb 5	*Read:* Saari pg. 18 (no this is not a typo)
	In Class: Instant Runoff
	Due: **Problem Set 1**

WEEK 5:

Feb 8	*Read:* Saari pg. 27
	In Class: Pairwise Comparisons

Feb 10	*In Class:* Flex Day

Feb 12	*In Class:* Majority Criterion
	Due: **Problem Set 2**

WEEK 6:

Feb 15	*In Class:* Condorcet Criterion

Feb 17	*In Class:* Monotonicity Criterion

Feb 19	*In Class:* Independence from Irrelevant Alternatives (IIA) Criterion

WEEK 7:

Feb 22	*Read:* Saari pg. 27-31
	In Class: Arrow's Result
	Due: **Problem Set 3**

Feb 24	*In Class:* Review for Exam

Feb 26	**EXAM 1**

WEEK 8:

Feb 29	*Read:* Saari pg. 33-36
	In Class: Examples - All Possible Outcomes

Mar 2	*Read:* Saari pg. 36-40
	In Class: How bad can it get?
	Due: **Reading Questions 5**

Mar 4	*In Class:* How likely is it?

WEEK 9:

Mar 7   FIRST-YEAR TRAVEL
Mar 9   FIRST-YEAR TRAVEL
Mar 11   FIRST-YEAR TRAVEL

WEEK 10:

Mar 14   PEAK WEEK
Mar 16   PEAK WEEK
Mar 18   PEAK WEEK

WEEK 11:

Mar 21   *In Class:* Weighted Voting Systems

Mar 23   *In Class:* Banzhaf Power Index

Mar 25   EASTER BREAK

WEEK 12:

Mar 28   *In Class:* The Apportionment Problem Basic Concepts
                       Due: **Problem Set 4**

Mar 30   *In Class:* Hamilton's Method and the Quota Rule

Apr 1   *In Class:* The Alabama Paradox
                       Due: **Problem Set 5**

WEEK 13:

Apr 4   *In Class:* The Population and New-Sates Paradoxes

Apr 6   *In Class:* Jefferson's Method

Apr 8   *In Class:* Adam's Method
                       Due: **Problem Set 6**

WEEK 14:

Apr 11   *In Class:* Flex Day

Apr 13   *In Class:* Review for Exam 2

Apr 15	**EXAM 2**

WEEK 15:

Apr 18	*In Class:* Review Material
Apr 20	*In Class:* Prepare for Constitutional Convention – design your rules of conduct
Apr 22	*In Class:* Prepare for Constitutional Convention – work with partner

WEEK 16:

Apr 25	*In Class:* **Constitutional Convention** *Due:* **Partner Paper**
Apr 27	*In Class:* **Constitutional Convention**
Apr 29	*In Class:* **Constitutional Convention**

WEEK 17:

May 2	*In Class:* **Presentation of Constitution**
May 4	*In Class:* Reflections *Due:* **Final Constitution**