Math 1007-20: Mathematics and Politics

Summer 2025

Lectures:	MTWR 4:00 – 5:30 PM	1957 E St 314	
Textbook:	The Mathematics of Politics, Second Edition by E. Arthur Robinson and Daniel H. Ullman		
ISBN:	9781498798907		
Course Webpage:	`https://jaydaigle.net/politics/`	**Discord:**	`https://discord.gg/yVhNZp356S`
Instructor:	Jay Daigle	**Office:**	Phillips 720E
Email:	`jaydaigle@gwu.edu`	**Office hours:**	MTWR 2:15–3:30 PM

Textbook

The official textbook for Math 1007 is *The Mathematics of Politics, Second Edition* by E. Arthur Robinson and Daniel H. Ullman. It should be available free online through the library website, and you can buy a hard copy for under $50 if you wish. I will be expecting you to read sections of the textbook and assigning problems out of it.

Course content

You probably associate math with numbers—addition, multiplication, equations, solving for x. And all that stuff is math; but math isn't just that stuff. At its most general, math is about identifying the assumptions we are making and describing them completely and explicitly. It's about testing those assumptions, and studying what would change if they were different. And it's about choosing new and better assumptions to let us use all the information we care about, as simply as we can.

In this course we'll learn about some specific concrete mathematical ideas that explain how political systems work. How does the way we tabulate votes affect who wins elections? Is there a fair way to allocate political power? What sort of negotiation strategies are more likely to be successful? And yes, there will be some numbers here.

But we'll also take a step back and see how thinking like a mathematician can help you understand how, and why, people do politics. We'll learn to identify the hidden assumptions that underlie political arguments and beliefs. We'll practice articulating the assumptions we're making, and understanding what we really care about. And we'll see how flexibility with those assumptions can help us better understand the world and our fellow citizens.

Prerequisites

There are no prerequisites for this course, although you may have to do a bit of high school algebra at some point.

Technological requirements; recordings

I have set up a Discord server at `https://discord.gg/yVhNZp356S` to facilitate low-key discussions of class material. This is totally optional, but you can go there to talk about the class with each other or with me; I'll be keeping an eye on it most of the time and it's usually the easiest and fastest way to get in touch with me.

Lecture schedule

The list below gives a tentative outline of what is planned and when. The course is divided into three main topics, each of which will get two weeks of attention; however, the placement of specific ideas within these topics may shift around as the course progresses.

Voting			
June 30	Mathematical Reasoning	July 1	2-Candidate Elections
July 2	Multi-Candidate Voting Systems	July 3	Voting System Criteria
July 7	Evaluating Voting Systems I	July 8	Evaluating Voting Systems II
July 9	Arrow's Theorem	July 10	**Test 1**
Apportionment			
July 14	Apportionment	July 15	Divisor Methods
July 16	Divisor Methods II	July 17	Evaluating Methods
July 21	Apportionment Impossibility Theorem	July 22	Balinksi and Young Method
July 23	Comparing Divisor Methods	July 24	**Test 2**
Conflict and Game Theory			
July 28	Strategies and Outcomes	July 29	Zero-Sum Games
July 30	Chance and Expectation	July 31	Solving Zero-Sum Games
August 4	Conflict and Cooperation	August 5	Nash Equilibria
August 6	Bonus: Electoral College and Gerrymandering	August 7	**Final Exam**

Communication

I use male pronouns. You can call me "Professor Daigle", "Dr. Daigle", or just "Jay". I will, however, be sad if you call me "Mr. Daigle".

If you have never e-mailed a college professor before, this blog post provides a short, helpful guide to best practices: `http://tinyurl.com/h5w5nyo`.

Expected amount of work

This course is going to be fairly intensive. You have six hours of class time each week. That implies you should expect to do about twelve hours of work outside of class each week. There will be homework due essentially every day.

It's really important that you stay current on your work and on all the material, because later material will build on earlier material and we will have to move quickly. If you find yourself falling behind please talk to me as soon as you can, so we can try to get you caught up.

Course Structure

Attendance will not be monitored or enforced, but will be extremely helpful to progressing in your understanding of calculus. There will be online homework assignments due each day, two written quizzes each week, and two midterms and a comprehensive final exam.

Written Homework

There will be written homework due every day in class, generally two days after we discuss the relevant material in class. This work is very important to succeeding in this course. Mathematical reasoning is a skill that needs practice to develop. This homework will give you practice at thinking about the political structures we're studying so that you can follow our reasoning about them, and also at making solid mathematical arguments. If you need an extension please ask me; I will be as flexible as I reasonably can. But doing the work when assigned is important to learning the material and staying on pace with the course, so you will probably not benefit from taking unnecessary extensions.

I may supplement this with some auto-graded homework through the free online WeBWorK homework system. If I do, I will include that work in the written homework.

Quizzes

There will be three quizzes at the end of class on Thursdays without tests, on July 3, July 17, and July 31. These will be short (15-20 minute) quizzes to make sure you're caught up with the basic ideas of each unit, before we move in to the more advanced material in the second half of each unit that builds on it.

Participation

An important component of the course is a discussion of what ideas and criteria are important in the evaluation of political processes. There are no "correct" answers to these questions, but mathematical reasoning and the ideas in this course give us tools to develop our ideas more clearly and effectively. This development will take place through in-class discussions, so it's important that you attend class and participate in these discussions.

Tests and Final

There will be tests on October July 10 and July 24, and a comprehensive final exam on August 7.

Computation of final grades

- Homework: 25%
- Participation: 5%
- Quizzes: 5% each
- Tests: 15% each
- Final Exam: 25%

Minimum scores for each letter grade are as follows: A, 94%; A−, 90%; B+, 87%; B, 84%; B−, 80%; C+, 77%; C, 74%; C−, 70%; D+, 67%; D, 64%; D−, 60%.

Attendance and engagement in class and recitation, while not formally part of the computation, may be used as deciding factors in borderline cases. No extra credit will be available under any circumstances.

University Policies

Academic Integrity Code

Academic integrity is an essential part of the educational process, and all members of the GW community take these matters very seriously. As the instructor of record for this course, my role is to provide clear expectations and uphold them in all assessments. Violations of academic integrity occur when students fail to cite research sources properly, engage in unauthorized collaboration, falsify data, and otherwise violate the Code of Academic Integrity. If you have any questions about whether particular academic practices or resources are permitted, you should ask me for clarification. If you are reported for an academic integrity violation, you should contact Conflict Education and Student Accountability (CESA) to learn more about your rights and options in the process. Consequences can range from failure of assignment to expulsion from the University and may include a transcript notation. For more information, refer to the CESA website at students.gwu.edu/code-academic-integrity or contact CESA by email cesa@gwu.edu or phone 202-994-6757.

University policy on observance of religious holidays

Students must notify faculty during the first week of the semester in which they are enrolled in the course, or as early as possible, but no later than three weeks prior to the absence, of their intention to be absent from class on their day(s) of religious observance. If the holiday falls within the first three weeks of class, the student must inform faculty in the first week of the semester. For details and policy, see `provost.gwu.edu/policies-procedures-and-guidelines`.

Use of Electronic Course Materials and Class Recordings

Students are encouraged to use electronic course materials, including recorded class sessions, for private personal use in connection with their academic program of study. Electronic course materials and recorded class sessions should not be shared or used for non-course related purposes unless express permission has been granted by the instructor. Students who impermissibly share any electronic course materials are subject to discipline under the Student Code of Conduct. Contact the instructor if you have questions regarding what constitutes permissible or impermissible use of electronic course materials and/or recorded class sessions. Contact Disability Support Services at disabilitysupport.gwu.edu if you have questions or need assistance in accessing electronic course materials.

Academic Support

Academic Commons

Academic Commons is the central location for academic support resources for GW students. To schedule a peer tutoring session for a variety of courses visit go.gwu.edu/tutoring. Visit academiccommons.gwu.edu for study skills tips, finding help with research, and connecting with other campus resources. For questions email academiccommons@gwu.edu.

GW Writing Center

GW Writing Center cultivates confident writers in the University community by facilitating collaborative, critical, and inclusive conversations at all stages of the writing process. Working alongside peer mentors, writers develop strategies to write independently in academic and public settings. Appointments can be booked online at gwu.mywconline.

Support for students in and outside the classroom

Disability Support Services (DSS) 202-994-8250

Any student who may need an accommodation based on the potential impact of a disability should contact Disability Support Services at disabilitysupport.gwu.edu to establish eligibility and to coordinate reasonable accommodations.

Student Health Center 202-994-5300, 24/7

The Student Health Center (SHC) offers medical, counseling/psychological, and psychiatric services to GW students. More information about the SHC is available at healthcenter.gwu.edu. Students experiencing a medical or mental health emergency on campus should contact GW Emergency Services at 202-994-6111, or off campus at 911.

GW Campus Emergency Information

GW Emergency Services: 202-994-6111

For situation-specific instructions, refer to GW's Emergency Procedures guide.

GW Alert

GW Alert is an emergency notification system that sends alerts to the GW community. GW requests students, faculty, and staff maintain current contact information by logging on to alert.gwu.edu. Alerts are sent via email, text, social media, and other means, including the Guardian app. The Guardian app is a safety app that allows you to communicate quickly with GW Emergency Services, 911, and other resources. Learn more at safety.gwu.edu.

Protective Actions

GW prescribes four protective actions that can be issued by university officials depending on the type of emergency. All GW community members are expected to follow directions according to the specified protective action. The protective actions are Shelter, Evacuate, Secure, and Lockdown (details below). Learn more at safety.gwu.edu/gw-standard-emergency-statuses.

Shelter

- Protection from a specific hazard
- The hazard could be a tornado, earthquake, hazardous material spill, or other environmental emergency.
- Specific safety guidance will be shared on a case-by-case basis.

  Action:

  - Follow safety guidance for the hazard.

Evacuate

- Need to move people from one location to another.
- Students and staff should be prepared to follow specific instructions given by first responders and University officials.

  Action:

  - Evacuate to a designated location.
  - Leave belongings behind.
  - Follow additional instructions from first responders.

Secure

- Threat or hazard outside of buildings or around campus.
- Increased security, secured building perimeter, increased situational awareness, and restricted access to entry doors.

  Action:

  - Go inside and stay inside.
  - Activities inside may continue.

Lockdown

- Threat or hazard with the potential to impact individuals inside buildings.
- Room-based protocol that requires locking interior doors, turning off lights, and staying out of sight of corridor window.

  Action:

  - Locks, lights, out of sight
  - Consider Run, Hide, Fight
- Classroom emergency lockdown buttons All classrooms have been equipped with classroom emergency lockdown buttons. If the button is pushed, GWorld Card access to the room will be disabled, and GW Dispatch will be alerted. The door must be manually closed if it is not closed when the button is pushed. Anyone in the classroom will be able to exit, but no one will be able to get in.