World in Your Hand
POLSCI 427S
Spring 2025

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Office Hours: W 10-11:30 am or by appt, by Zoom (link in Canvas)	Course Website: Canvas

Course Overview

Political science addresses a wealth of questions, involving everything from the determinants of the onset or resolution of conflict to the dynamics of parties and elections to the functioning of legislatures and courts and bureaucracies. Many of those questions deal with complex systems, in which it is difficult to know how a change in any one factor might affect another. Computer simulation, an increasingly popular tool in the social sciences, can help manage that complexity and so help us derive insight into such questions. This class is your chance to explore the use of this tool yourself, and hold the (simulated) world in your hand. Specifically, in this course we will explore computer simulations of political phenomena, first theoretically, then via group projects tackling discrete practical questions in the field, and finally via individual research projects.

The course will be split into three parts. The first part of the course will be devoted to providing the background and tools needed to create simple computational models of human and organizational behavior. There will be two components to this. One, we will discuss examples of computational modeling in the literature. Two, the course will provide a brief introduction to programming in Python, accompanied by discussion of best practices in computational modeling. Both components will be hands-on, in the sense that we will, as a class, work through examples, modifying them in order to get a sense of the consequences of making certain assumptions on actors' behavior and certain coding decisions. No prior experience in coding is necessary or expected; we will start at the beginning and focus on techniques most useful for modeling political behavior, rather than attempting a more encompassing introduction to computer programming. Two brief problem sets will serve as both practice and assessment.

The second and third parts of the class will focus on taking the background and tools from the first part and using them to answer real research questions in political science. In the second part we will do this in a group setting. The class will be presented with a list of concrete research questions that are amenable to a computational approach. Students will rank their preferences over questions and then be placed in groups of 2-4 people, each tasked with addressing a single question. Each group will then formulate a simple computational model intended to answer its specific research question. Class time will be broken up into individual meetings with

each group to go over progress and work through issues. Students should come to these meetings prepared to discuss their progress, proposed next steps, and any roadblocks to progress. There will also be office hours for further feedback and group work. This part of the class will culminate in each group's writing of a scientific paper.

The intent of the group projects is to experience how a research project moves from idea through to fruition, and how computational approaches can provide insight into real-world questions of interest. Students will come to understand how one formulates answerable research questions, situates them in the literature, constructs formal assumptions on behavior, codes models instantiating these assumptions, analyzes models, interprets results, and writes a scientific paper. Assessment during this part of the class will be based both on contributions to the group project, which can take many forms, and the quality of the group paper.

The third part of the class will ask students to do individually, with instructor aid, what we just did in groups. To be more specific, each student will formulate a research question, situate it in the literature, construct a series of formal assumptions on behavior, code a model instantiating these assumptions, analyze the model, interpret its results, and write a scientific paper. Class time will be devoted to individual meetings with each student to go over progress and help resolve issues that may arise. As before, there will also be office hours available. Assessment will be based on both efforts toward the individual project and the quality of the final work.

Beyond being necessary for academic work, the skills the course will impart will be useful for a wide variety of post-graduation endeavors. Python is widely used in data science applications, for instance. The course also provides students the opportunity to explore what it's like to search for their own answers to questions that interest them.

Course Communication

Communication for this course will occur via e-mail (usually via Canvas), though I may make use of Canvas announcements as well. Please ensure that you check your e-mail and Canvas announcements regularly. Canvas has built in 24/7 support if you have technical difficulties. For immediate assistance with other learning technologies, system errors/outages, or your NetID account and password, contact the OIT Service Desk.

Course Requirements

1. **Assignments (20%):** There will be two assignments covering computational modeling and computer programming during the first part of the course, each worth 10% of the final grade. Students will have one week to complete each. Students are welcome to work together on these, but each person's work must be written up (on a computer, not by hand) independently, and all work must represent an understanding of all parts of the assignment. Students will submit each assignment to the course's Canvas website on its due date; no late assignments will be accepted. Solutions will be made available on Canvas at this time. After this point

students will have a week to figure out, with the help of the solutions, where they might have gone wrong, and why. Each student will then provide detailed comments (also by computer, in the form of comments on a text document or pdf) that identify any incorrect points and explain and justify how each question should have been done. Students will not assign themselves any grades, however. Students will turn in these commented, revised assignments to the appropriate assignment on Canvas. Students' grades on the assignments will be based on both their original performance and their self-assessment. Do not put assignments off to the last minute! The earlier you start, the more help you can expect.

2. **Group Project Work (40%):** During the second part of the course, there will be work on the group project, as discussed previously. Because research often involves starts and stops, assessment of students' work for this part will be based both on effort and on outcome. Attempting to the best of one's ability to perform one's tasks each week, even if this is not always met with success, will garner full scores for effort. Each group will be collectively responsible for the outcome of its project, which will take the form of a journal article that would typically be classified as a research note (approx. 20 pages or 4000 words, not including appendices). More information about the format will be provided during the semester. Group research notes are due to Canvas at the date in the class schedule. Each member of the group should submit the same research note.

3. **Individual Project (40%):** During the third part of the course, students will devise, perform the work for, and formally write up a piece of original research. Aid from the instructor will be frequent and extensive; however, each student is expected to individually complete an original piece of research. The format is similar to that of the group project, though with more leeway: a journal research note of 2000-4000 words, or 10-20 double-spaced pages, not including any appendices. We will talk at length during the class about the specific requirements for this paper, and will see how to complete each piece of the paper during the group projects. These research notes are due to Canvas one week after the last class ends. No extensions will be given.

Readings

All readings for the class are listed in the tentative schedule below in the order in which they will be used, and in the order in which they should be read. Any book chapters or articles not available through Duke's library or on the Internet will be posted to Canvas. Required readings are to be done before class in all cases. Students, particularly those lacking specific methodological training, should focus on the substantive contributions of the readings; we will discuss all methods in class. Readings were chosen to be a very small sample of important research and to illustrate points I desire to make in class. Note that the reading load for this class is intended to be light: we'll be learning by doing, primarily, and most of students' time outside of class will be allocated to active research and writing.

Grading

Your final grade is a weighted average of the two assignments, group project, and individual project, with the weighting provided above. I will use the following, standard, scale to calculate

your course grade: A+ (97-100), A (93-96.99), A- (90-92.99), B+ (87-89.99), B (83-86.99), B- (80-82.99), C+ (77-79.99), C (70-76.99), D (60-69.99), F (59.99 and below).

Attendance

No separate grade is assigned to class attendance. However, barring illness (in which case you should not attend–your health, and the health of others in the class, is more important!) or other extenuating circumstances, you should plan to be in class every day. That is particularly true while working on your projects: class is a time when everyone can meet, allowing you to more easily make progress and obtain help.

Student Success

If you are having trouble completing assignments or understanding the materials, please consult with me about appropriate course preparation and readiness strategies as needed. Either send me an email or visit office hours describing the personal or academic difficulties you are facing. I may also direct you to other resources on campus.

The Academic Resource Center (ARC) offers services to support students academically during their undergraduate careers at Duke. The ARC can provide support with time management, academic skills and strategies, course-specific tutoring, ADHD/LD coaching, and more. ARC services are available free to any Duke undergraduate students, studying any discipline. Contact: (919) 684-5917 or theARC@duke.edu

Mental Health and Wellness Resources

Student mental health and wellness are of primary importance at Duke, and the university offers resources to support students in managing daily stress and self-care. Some resources are listed below:

DuWell provides Moments of Mindfulness (stress management and resilience building) and meditation programming (Koru workshop) to assist students in developing a daily emotional well-being practice. All are welcome and no experience is necessary.

If your mental health concerns and/or stressful events negatively affect your daily emotional state, academic performance, or ability to participate in your daily activities, many resources are available to help you through difficult times.

DukeReach provides comprehensive outreach services to identify and support students in managing all aspects of well-being.

Counseling & Psychological Services (CAPS) services include individual and group counseling services, psychiatric services, and workshops. To initiate services, walk-in/call-in 9:00 AM – 4:00

PM (M/W/Th/F) and 9:00 AM – 6:00 PM Tuesdays. CAPS also provides referral to off-campus resources for specialized care. Contact: (919) 660-1000

TimelyCare (formally known as Blue Devils Care) is an online platform that is convenient, confidential, and free way for Duke students to receive 24/7 mental health support through TalkNow and scheduled counseling.

Academic Accommodations

If you are a student with a disability and need accommodations for this class, it is your responsibility to register with the Student Disability Access Office (SDAO) and provide them with documentation of your disability. SDAO will work with you to determine what accommodations are appropriate for your situation. Please note that accommodations are not retroactive and disability accommodations cannot be provided until a Faculty Accommodation Letter has been given to me. Contact: sdao@duke.edu

Academic Integrity

All students must adhere to the Duke Community Standard (DCS): Duke University is a community dedicated to scholarship, leadership, and service and to the principles of honesty, fairness, respect, and accountability. Citizens of this community commit to reflect upon and uphold these principles in all academic and nonacademic endeavors, and to protect and promote a culture of integrity.

To uphold the Duke Community Standard, students agree:

- I will not lie, cheat, or steal in my academic endeavors.
- I will conduct myself honorably in all my endeavors; and
- I will act if the Standard is compromised.

Regardless of course delivery format, it is the responsibility of the student to understand and follow Duke policies regarding academic integrity, (e.g., completing one's own work, following proper citations of sources, and adhering to guidance around group work, and more). Ignoring these requirements is a violation of the Duke Community Standard. Any questions and/or concerns regarding academic integrity can be directed to the Office or Student Conduct and Community Standards at conduct@duke.edu.

A Note on Writing

As the goal of each of the group and the individual projects is the production of a piece of original research that satisfies journal standards, it is important that all students be familiar with standard requirements for source citation and use. The university offers several resources to aid students with this, which may be found at these links: https://library.duke.edu/research/citing,

https://library.duke.edu/research/plagiarism, and
https://twp.duke.edu/twp-writing-studio/resources-students/sources.

A Note on AI

It is possible to get a great deal of help from AI in this class. I cannot really stop you from extensive AI use, but I will note that you would be doing yourself a disservice if you were to rely solely on it. People using AI effectively at this stage in its development learn to tailor their prompts to what AI can handle. In the context of this class, that means you may find your simulations constrained not by your interests or your imagination, but by what AI can produce for you. I suggest as much as possible making use of AI only for programming help, and only *after* the assignments are done. Their point, after all, is to help you learn a bit of basic programming, and if AI does it for you, you won't learn that very useful skill.

Class Schedule with Readings

Th Jan 9: Introduction to Computational Modeling 1

Schelling segregation model on-line simulations (from Schelling 1971):
http://nifty.stanford.edu/2014/mccown-schelling-model-segregation/

Axelrod, R and WD Hamilton. 1981. "The evolution of cooperation." *Science* 211 (4489): 1390-1396. DOI: 10.1126/science.7466396

De Marchi, Scott and Scott E. Page. 2014. "Agent-based models." *Annual Review of Political Science* 17:1–20.

Tu Jan 14: Introduction to Computational Modeling 2

Golder M, SN Golder, and DA Siegel. 2012. "Modeling the institutional foundation of parliamentary government formation." *Journal of Politics*. 74(2): 427-445.

Kollman, Ken, John H. Miller, and Scott E. Page. 1992. "Adaptive parties in spatial elections." *American Political Science Review* 86(4): 929–937.

Weidmann N and Idean Salehyan. 2013. "Violence and ethnic segregation: a computational model applied to Baghdad." *International Studies Quarterly* 57: 52–64.

Th Jan 16: Introduction to Python

Class Notes (Canvas)

Tu Jan 21: Basic Programming in Python

Assignment #1 handed out.

Th Jan 23: Coding Computational Models 1

Class Notes (Canvas)

Tu Jan 28: Coding Computational Models 2

Assignment #1 due.

Th Jan 30: Methods for Analyzing Computational Models 1

Siegel, David A. 2018. "Analyzing Computational Models." *American Journal of Political Science* 62 (3): 745-759.

Tu Feb 4: Methods for Analyzing Computational Models 2

Assignment #1 revision due. Assignment #2 handed out.

Th Feb 6: Extended Example of a Computational Model Derivation

Siegel, David A. 2009. "Social Networks and Collective Action." *American Journal of Political Science* 53 (1): 122-138 with appendix at http://people.duke.edu/~das76/Research/Siegel_network_model_AJPS_appendix_final.pdf.

Siegel, David A. 2011. "When Does Repression Work?: Collective Action and Social Networks." *Journal of Politics* 73 (4): 993-1010 with appendix at http://people.duke.edu/~das76/Research/Siegel_Repression_JOP_2011_Appendix.pdf.

Siegel, David A. 2013. "Social Networks and the Mass Media." *American Political Science Review* 107 (4): 786-805 with appendix at http://people.duke.edu/~das76/Research/Siegel_APSR2013_appendix.pdf.

Tu Feb 11: Group Project Begins--Class Meeting to Choose Projects

Assignment #2 due.

Th Feb 13--Th Mar 6: Group Project Work
Assignment #2 revision due Tu Feb 18.

Spring Break (no meetings) Mar 11+13

Tu Mar 18--Tu Apr 22: **Individual Project Work**

Tu Apr 29: **Individual Projects Due by noon to Canvas**