

Complex Systems

SYSC 410/510, Winter 2025.

Professor: J. J. P. Veerman

Class meets: MW 16.40-18.30, Ondine 220.

Office: FMH 464B (503-725-8187) and SMSU M310L (503-725-4961)

Office Hours: MW 18.30-19.00 or by appointment.

Email: veerman@pdx.edu

Course Announcements on Web Page: <http://web.pdx.edu/~veerman/>

Main Text: P. Smaldino, *Modeling Social Behavior, Mathematical and Agent-Based Models of Social Dynamics and Cultural Evolution*, Princeton University Press, 2023.

Recommended Text: H. Sayama, *Introduction to the Modeling and Analysis of Complex Systems*, Open SUNY Textbooks, 2015.

Free resource: <https://www.complexityexplorer.org/news>

Course Description: This is a joint undergraduate/graduate class. We will use numerical and mathematical models to study social behavior and if time permits other complex systems. We use netlogo, freely downloadable through the web. This is an agent-based language for the novice with a very short learning curve. Using that language, we will look at simulations of (simplified) models of segregation, contagion, opinion dynamics, evolution of cooperation, evolution of species, and others. We will also look at analytical aspects: how to use mathematical equations to model these phenomena, and what the mathematical equations can tell us. We start with Smaldino's text, and if time permits we will use parts of Sayama's text for more mathematical background. The concepts and techniques introduced in this class can equally be applied in other domains such environmental sciences, geosciences, biology, and so forth.

Course Objectives: Student will learn to model complex phenomena with simplified models. They will familiarize themselves with simulations, and drawing conclusions from simulations. They will learn how to write and manipulate simple mathematical equations for models. Students will be able to apply the modeling techniques they learn to other complex systems domains

Prerequisites: Good standing. Interest in computational modeling and systems thinking is recommended.

Grading: Your course grade will be based on in-class exams and/or quizzes.

Homeworks will be assigned, and the exams/midterms will in large part be drawn from those assigned homeworks. In homeworks and projects, collaboration is allowed and encouraged. Plagiarism, however, is not tolerated. You must turn in original work.

Homework and Exams: Grades will be based on homework, in-class performance, and exams or take-home exams. The percentages of these aspects will be determined in the first week of class through consent between instructor and students.

Attendance: You are expected to attend classes. Home works, changes to this syllabus or to the scheduling of exams will be announced in class. If you have to miss class, it is your responsibility to find out what happened in class.

Homework: As material is covered in class, a list of accompanying homework will be assigned. Reading the text and completing the homework is essential to your success in this course, and it will likely require a substantial amount of time and effort on your part to complete it successfully. You may find it helpful to form a study group with 2-5 other students and work together outside of class on the assignments. However, each student must write up and submit his or her own work. Plagiarism from either the web, your colleagues, or any other source is unacceptable at Portland State, and cases may be referred to the Dean Students for action. Homework (if due) must be turned in on the due date *at the beginning* of the class. ***HW 10 minutes late or more will not be accepted, except in cases governed by university guidelines (illness, etc).***

Access and Inclusion for Students with Disabilities: PSU values diversity and inclusion; we are committed to fostering mutual respect and full participation for all students. My goal is to create a learning environment that is equitable, useable, inclusive, and welcoming. If any aspects of instruction or course design result in barriers to your inclusion or learning, please notify me. The Disability Resource Center (DRC) provides reasonable accommodations for students who encounter barriers in the learning environment.

If you have, or think you may have, a disability that may affect your work in this class and feel you need accommodations, contact the Disability Resource Center to schedule an appointment and initiate a conversation about reasonable accommodations. The DRC is located in 116 Smith Memorial Student Union, 503-725-4150, drc@pdx.edu, <http://www.pdx.edu/drc>.

If you already have accommodations, please contact me to make sure that I have received a faculty notification letter and discuss your accommodations.

Students who need accommodations for tests and quizzes are expected to schedule their tests to overlap with the time the class is taking the test.

Please be aware that the accessible tables or chairs in the room should remain available for students who find that standard classroom seating is not useable.

For information about emergency preparedness, please go to the Fire and Life Safety webpage (<http://www.pdx.edu/environmental-health-safety/fire-and-life-safety>) for information.

Title IX Reporting Obligations:

As an instructor, one of my responsibilities is to help create a safe learning environment for my students and for the campus as a whole. Please be aware that as a faculty member, I have the responsibility to report any instances of sexual harassment, sexual violence and/or other forms of prohibited discrimination. If you would rather share information about sexual harassment, sexual violence or discrimination to a confidential employee who does not have this reporting responsibility, you can find a list of those individuals at <https://www.pdx.edu/sexual-assault/get-help> or you can contact a confidential advocate at 503-725-5672.