INTRODUCTION TO AGENT-BASED MODELING

Instructor: Garry Sotnik; Harder House, Rm. 2; gsotnik@pdx.edu; TR, 3:50 - 4:30 PM or by appointment.

Course Summary: At the crossroads of philosophy, psychology and artificial intelligence, this course introduces Agent-Based Modeling (ABM). ABM is a new computer-based approach that is rooted in the belief that the complex macro-level patterns we observe in nature are emergent from decentralized and self-organizing micro-level interaction among agents that follow simple and localized rules. This course introduces students to a new way of thinking by challenging the idea that the world around us follows linear cause-and-effect processes. Through examples, students learn how familiar macro-level patterns can emerge from uncoordinated interacting micro-level agents. The course then explores ways in which researchers use ABM to build artificial societies, which can offer us insight into human social phenomena. The common notion that human interaction must be seen through a competitive framework is challenged and ABM research into cooperation is introduced. Students will walk away from the course with a new perspective on how the world works and an understanding of how ABM can be used as a tool to study it.

Prerequisites: None

D2L: This course will use D2L for communication and content provision and submission. Please use the Dropbox function in D2L to submit your assignments. Note that they must be in before the start of class on the respective due date (see either syllabus or D2L).

COURSE WORK

1. Class participation (50% of grade) – students are asked to: (1) read assigned material before each class, (2) type-up notes to facilitate their contribution to the class discussion, and (3) engage fully in the class discussion and group presentations. The typed-up notes for each class are to be submitted at the beginning of that class. Notes should consist of three parts: (1) a description of key ideas and concepts in the assigned material; (2) several questions; and (3) when relevant, several lines on how the material relates to the student’s field of study. Questions during class discussion are encouraged and count fully toward the participation grade.

2. Mid-Term (25% of grade) – the mid-term, which takes place at the end of week four, covers the material related to self-organization in biological systems.

3. Final Exam (25% of grade) – the final exam, which takes place during exam week, covers the material related to agent-based modeling and asks students to reconstruct their prepared pseudo-ABM.

Bonus point(s): students are provided with an opportunity to earn bonus points toward their grade by designing and facilitating one or more group experiment(s) to be tested in class. The experiment(s) should: (1) engage all students; (2) follow ABM philosophy and structure; (3) be designed to lead to interesting/relevant insight; and (4) not take up more than 15 minutes of class time. After testing and discussing the experiment in class, participating students and Instructor will vote on whether the experiment is worthy of bonus points. If it is (the decision must be unanimous), the designer of the experiment will have 2 bonus points added to their overall grade. If two students collaborate on designing and facilitating a group experiment and it is found worthy of bonus points, they will each receive 2 points.
# SYLLABUS

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Wk</th>
<th>Class</th>
<th>In Class</th>
<th>Homework</th>
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<tbody>
<tr>
<td></td>
<td>Intro to Course</td>
<td>1</td>
<td>1</td>
<td>Course Review and Q&amp;A</td>
<td>Read and take notes on: SOBS, CH 1</td>
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<td>2</td>
<td>2</td>
<td>Discuss questions related to: “What Is Self-Organization?”</td>
<td>Read and take notes on: SOBS, CH 2 &amp; 3</td>
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|   |                                   | 3  | 3     | Discuss questions related to: “How Self-Organization Works” and “Characteristics of Self-Organizing Systems” | Read and take notes on: SOBS, CH 4  
Group 1 prepare presentation on selected case study from SOBS |
|   |                                   | 4  | 2     | Discuss questions related to: “Alternatives to Self-Organization”  
Group 1 presents selected case study from SOBS | Read and take notes on: SOBS, CH 5 & 6  
Group 2 prepare presentation on selected case study from SOBS |
|   |                                   | 5  | 3     | Discuss questions related to: “Why Self-Organization?” and “Investigation of Self-Organization”  
Group 2 presents selected case study from SOBS | Read and take notes on: SOBS, CH 7  
Group 3 prepare presentation on selected case study from SOBS  
Group 4 prepare presentation on selected case study from SOBS |
|   |                                   | 6  | 6     | Discuss questions related to: “Misconceptions about Self-Organization”  
Group 3 presents selected case study from SOBS  
Group 4 presents selected case study from SOBS | Read and take notes on: SOBS, CH 21  
Prepare for Mid-Term Q&A |
|   |                                   | 7  | 4     | Discuss questions related to: “Lessons, Speculations, and the Future of Self-Organization”  
Mid-Term Q&A | Study for Mid-Term |
|   | Mid-Term                          | 8  |       |                                               |                                               |
|   |                                   | 9  | 5     | Complete Tutorial #1: Models in NetLogo User Manual | Select a NetLogo model and prepare to describe in class |
|   |                                   | 10 | 5     | Complete Tutorial #2: Commands in NetLogo User Manual | Read and take notes on: Simulation as a Method  
Group 1 prepare to present: Introduction to Sugarscape |
|   | ABM as a New Scientific Instrument | 11 | 6     | Discuss questions related to: Simulation as a Method  
Group 1 presents: Introduction to Sugarscape | Read and take notes on: Agent-Based Computational Models and Generative Social Science |
|   |                                   | 12 | 6     | Discuss questions related to: Agent-Based Computational Models and Generative Social Science  
Lecture: How to build a pseudo-ABM | Read and take notes on: Multi-Agent Models  
Group 2 prepare to present: Life and Death on the Sugarscape  
Group 3 prepare to present: Sex, Culture, and Conflict |
| 7 | 13 | Discuss questions related to: Multi-Agent Models | Read and take notes on: Emergence in Social Simulation | Group 4 prepare to present: Sugar and Spice |
|   | 14 | Discuss questions related to: Emergence in Social Simulation | Group 1 prepare to present: Disease Processes | Group 2 prepare to present: Conclusions |
|   | 15 | Group 1 presents: Disease Processes | Group 3 prepare to present: Simulating Fishermen’s Society | Group 4 prepare to present: The EOS Project: Integrating Two Models of Paleolithic Social Change |
|   | 16 | Group 2 presents: Conclusions | Lecture: Example of an agent-based model and its code | Read and take notes on: Population Growth and Collapse in a Multiagent Model of the Kayenta Anasazi in Long House Valley | Prepare for Final Exam |
|   | 17 | Group 3 presents: Simulating Fishermen’s Society | Discuss questions related to: Population Growth and Collapse in a Multiagent Model of the Kayenta Anasazi in Long House Valley | Preparation for Final Exam |
|   | 18 | Group 4 presents: The EOS Project: Integrating Two Models of Paleolithic Social Change | Discuss questions related to: Agent-Based Computational Economics | Preparatory for Final Exam |
|   | 19 | Read and take notes on: Consumer Behavior | Prepare for Final Exam |
|   | 20 | Discuss questions related to: Consumer Behavior | Read and take notes on: Consumer Behavior | Prepare for Final Exam |
| 21 | Final Exam | Prepare for Final Exam | Prepare for Final Exam |
REQUIRED READING

Below is a list of required readings. The two readings in bold, Camazine et al. (2003) and Epstein and Axtell (1996), will be used as primary texts in the course and are made available for purchase at the PSU Book Store. The rest of the required reading material will be provided by the instructor.


