Washington University in St. Louis

L32-5082 John W. Patty and Elizabeth Maggie Penn
Advanced Computational Modeling Winter 2012

Syllabus

1 Introduction

This graduate-level course explores advanced theoretical and methodological topics in computational modeling of social phenomena. Computational modeling allows us to explore topics – including complexity, emergence, and dynamics – that are difficult to study using traditional analytic methods. In addition, computational techniques offer researchers and analysts a method for systematic and efficient exploration of theoretical models. The course will meet once a week for two hours. Students will be evaluated based on presentations, class participation, and a final paper in which they design and implement their own computational model of a social, political, or economic phenomenon of their choosing.

Course Software. The required software for the course is *Mathematica*, which is available in a standard student edition as well as more inexpensive year-long and semester-long editions at the Wolfram website.

Course Readings. There is no required text for the course: we will use various assigned readings, available on the course website. However, two useful books include:

- Miller, John H., and Scott E. Page. 2007. *Complex Adaptive Systems: An Introduction to Computational Models of Social Life*, Princeton, NJ: Princeton University Press.
- Schelling, Thomas. 2006. *Micromotives and Macrobehavior*. New York: W. W. Norton.

Contact Information.

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Graded Components. Each student's grade for the course will be based on the following:

1. Midterm Presentation: 25%
2. Class Participation: 25%
3. Final paper: 50%

Final Course Grading. The final course grade is based on the following 10 point scale:

Score	Grade	Score	Grade	Score	Grade	Score	Grade
$\geq$94	A	$\geq$83	B	$\geq$73	C	$\geq$63	D
$\geq$90	A-	$\geq$80	B-	$\geq$70	C-	$\geq$60	D-
$\geq$87	B+	$\geq$77	C+	$\geq$67	D+	$<$60	F

Academic Honesty. We strongly encourage you to review Washington University's policies regarding academic honesty.[1] In general, if you have *any* questions, please feel free to ask us.

Midterm Student-Led Discussions. Each student is expected to present an overview of his or her research project and lead a discussion about the project halfway through the course. One week prior to these presentations, each student is expected to circulate 2 related papers, as well as a rough draft describing his or her own project. All students (and instructors) are expected to read these before the presentations so as to facilitate discussion.

Class Schedule

Class	Date	Topic	
1	(1/23)	Introduction & Course Logistics	
2	(1/30)	Foundations of Computational Modeling	
3	(2/6)	Justifications for the Computational Point-of-view	
4	(2/13)	Self-Organization & Criticality	
5	(2/20)	Simulation as a Tool	**Midterm Readings Due**
6	(2/27)	*Midterm Student-Led Discussions*	
7	(3/5))	*Midterm Student-Led Discussions*	
8	(3/19)	Heuristics and Approximations, I	
9	(3/26)	Heuristics and Approximations, II	
10	(4/2)	Networks, I	
11	(4/9)	Networks, II	**Final Paper Due**
12	(4/16)	*Final Student Presentations*	
13	(4/23)	*Final Student Presentations*	

[1] http://www.wustl.edu/policies/undergraduate-academic-integrity.html.

- Week 2: The Foundations of Computational Modeling
  - Page, Scott. 1999. "Computational models from A to Z." *Complexity* 5(1): 35–41.
  - Epstein, Joshua M. 1999. "Agent-Based Computational Models and Generative Social Science." *Complexity* 4(5): 41–60.
- Week 3: Justifications for the Computational Point-of-view
  - Procaccia, Ariel D. 2008. *Computational Voting Theory: Of the Agents, By the Agents, For the Agents.*, Chapter 1.
  - Chevaleyre, *et al.* 2007. "A Short Introduction to Computational Social Choice."
- Week 4: Self-Organization & Criticality
  - Brunk, G.G. 2001. "Self-organized Criticality: A New Theory of Political Behaviour and Some of its Implications." *British Journal of Political Science* 31(2): 427–445.
  - Miller, John H., and Scott E. Page. 2007. *Complex Adaptive Systems*, Chapter 9.
- Week 5: Simulation as a Tool
  - Johnson, Paul E. 1999. "Simulation Modeling in Political Science." *American Behavioral Scientist* 42(10):1509–1530.
  - Axelrod, Robert. 2003. "Advancing the Art of Simulation in the Social Sciences." *Japanese Journal for Management Information Systems* 12(3).
- Week 8: Heuristics and Approximations, I
  - Haupt, Randy L., and Sue Ellen Haupt. 2004. *Practical Genetic Algorithms*, 2nd ed., Chapters 1–3.
  - Kollman, Ken and John H. Miller and Scott E. Page. 1997. "Political Institutions and Sorting in a Tiebout Model." *The American Economic Review* 87(5): 977–992.
- Week 9: Heuristics and Approximations, II
  - Luke, Sean. 2011. *Essentials of Metaheuristics: A Set of Undergraduate Lecture Notes*, working paper, Department of Computer Science, George Mason University, Chapter 6.
  - Bednar, Jenna, and Scott E. Page. 2007. "Can Game(s) Theory Explain Culture?" *Rationality and Society* 19(1): 65–97.
- Week 10: Networks, I
  - Siegel, David A. 2009. "Social Networks and Collective Action" *American Journal of Political Science* 53(1): 122–128.
  - Scholz, John T., and Cheng-Lung Wang. 2009. "Learning to Cooperate: Learning Networks and the Problem of Altruism." *American Journal of Political Science* 53(3): 572–587.
- Week 11: Networks, II
  - Carpenter, Daniel, David Lazer, and Kevin Esterling. 2003. "The Strength of Strong Ties: A Model of Contract Making in Policy Networks with Evidence from U.S. Health Policies." *Rationality and Society* 15(4): 411–440.
  - Lustig, Ian S., Dan Miodownik, and Roy J. Eidelson. 2004. "Secessionism in Multicultural Settings." *American Political Science Review* 98(2): 209–229.