The nonlinear dynamics exhibited by complex social systems often pose difficult problems for modelers of those systems. The problems are especially challenging when modelers want to capture the way actors in these systems adapt to their environment, which usually includes other adaptive agents. Humans can be assumed to adapt their behavior in light of feedback from other individuals or from collective actions of individuals, but until recently it has been difficult to model this kind of adaptive behavior in formal models. The growing availability of computers has led to a recent proliferation of bottom-up, agent-based models of complex adaptive systems. These models consist of a number of interacting agents. Each agent's behavior is governed by a small set of simple rules, though it is typically assumed that the agents do not know or cannot calculate the aggregate patterns resulting from all agents' actions. Despite the simplicity of the individual agents' cognitive and behavioral capabilities, the interaction of the agents can produce complex emergent structures and dynamical behaviors of individuals and groups. These lectures will give an introduction to recent approaches in computer modeling of complex social systems, comparing them to more traditional mathematical (analytical) approaches and to the previous generation of computer simulations in the social sciences. In addition to describing the methods and techniques of this modeling approach, a number of social science applications will be reviewed and analyzed.

In a series of optional evening sessions, students also will be able to run and carry out experiments with implementations of several of the models discussed in the lectures. Additional sessions will be available for those students who wish to receive a brief introduction to programming Agent-Based Models (ABMs), using (free) software packages like Swarm, RePast or NetLogo. The time and location for the computer lab sessions will be announced in the first class. There are opportunities for students to present their work at the end of the session.

Students may want to purchase the following book:

# Class Schedule

**July 23: Complex Systems Modeling and Philosophy of Science (Kollman and Lamberson)**

*Introduction.*


**July 24: Complexity and Self Organized Criticality (Lamberson)**


**July 25: Inductive Reasoning and Bounded Rationality (Lamberson)**


*Introduction, Chapters. 3, 7.*


**July 26: Exploration and Exploitation (Lamberson)**


*Daedalus* 121: 17-30.


*Chapter 1.*


July 30: Models of Markets (Kollman)


July 31: Models of Participation (Kollman)


August 1: Models of Domestic Political Competition (Kollman)


August 2: Annealing, Sorting, and Institutional Mechanisms (Kollman)


August 3: Models of Leadership (Kollman)


August 6: Path Dependence and Multiple Equilibria (Lamberson)


August 7: Evolution of Technology (Lamberson)


August 8: Networks (Lamberson)


August 9: Market Structures (Lamberson)


August 10: Diversity (Lamberson)


August 13: Models of International Relations (Kollman)

Selected chapters, TBA.
August 14: Multilayered Institutions (Kollman)


August 15: Student Presentations

August 16: Student Presentations