IE 48F Agent-based Modelling and Simulation
Spring 2016

Instructor
Assoc. Prof. Gönenç Yücel (gonenc.yucel@boun.edu.tr)
Office hours: TBA

Prerequisites
None

Course Description
This course is designed to provide students with the tools and knowledge necessary to conduct a simulation supported analysis of socio-technical problems using agent-based models (ABMs). Students will gain understanding and awareness of the fundamental differences of agent-based modeling from other simulation modeling approaches, and nature of problems/objectives that ABMs fit the best. Besides, students will develop competency in building ABMs, analyzing and interpreting results from these models, and communicating a complete simulation supported analysis cycle to peers/clients. Example models used during the semester will be drawn from social, economic, environmental, industrial, energy and logistic/transportation problems. For the term project, students will go through a model supported analysis process as they develop an ABM in order to analyze a problem from their own areas of interest.

Course Outline and Content
The course is divided into two modules. The first module focuses on the basic concepts related to agent-based modeling. This involves basic introduction to simulation modeling in general, and to agent-based models in specific. Besides, the developments that led to the emergence of the agent-based models as a novel type of simulation models, such as object-oriented modeling, complexity theory and complex adaptive systems field, will be discussed.

The second module addresses the modeling process in conducting a model supported problem/policy analysis. Apart from technical aspects of building and simulating an agent-based model, this module also focuses on other crucial aspects of the process such as formulation of the modeling objectives, interpreting model output and communicating the model and the results to peers and/or clients. The term project runs parallel to this module, and students are expected to complete their projects gradually as the second module progresses.

Learning Objectives

By taking this course, students will:

- Gain a general understanding about the basic principles of agent-based simulation models, and the type of problems they suit the best
- Build competency in completing a full modeling cycle (i.e. design, implement, analyze, etc.) in a simulation supported analysis with agent-based models
- Build competency in analyzing model outcomes, and in communicating the results obtained.

Student Background and Prerequisites

This course is appropriate for senior undergraduate and graduate (Master's level) who are interested in systems modeling and simulation as well as in analyzing dynamic socio-technical problems. The course requires a background in basic simulation concepts. Therefore, IE 306 (Systems Simulation) would be useful, but it is not a hard prerequisite. Since the modeling software to be used (i.e. NetLogo) requires some simple programming/coding, students are expected to have basic programming knowledge (especially in an object-oriented programming language). However, this is not a must.

Grading

Assignments	15%
Term Project (Plan, model, report, and presentation)	30%
Midterm Exam	25%
Final Exam	30%

Assignments

There will be 3 short assignments, which will require students to apply some practical issues discussed in the class, such as modeling question identification/formulation, basic coding with NetLogo and output analysis.

Term Project

For the term project, students will go through a model supported analysis process as they develop an ABM in order to analyze a problem from their own areas of interest. The project will be conducted in groups of 2 or 3, depending on the class size. Groups will give two presentations during the semester. The first presentation will be about the project plan; i.e. project topic and problem background, modeling questions, experimentation plan and preliminary conceptualization of the model. The second presentation will be about the model and the results obtained. The groups are expected to submit a brief report (i.e. 20-25 pages) about their projects.

Course Book/Reading List

There is no required textbook for this class. Although the course follows a slightly different flow, the following book is highly recommended as a supplementary course material:

- *"Agent-Based and Individual-Based Modeling: A Practical Introduction"* by Steven F. Railsback & Volker Grimm