INDUSTRIAL ENGINEERING DEPARTMENT

IE 48F

Agent-based Modelling and Simulation

Spring 2017

Credits/ECTS:	4 Credits / 6 ECTS
Class/Laboratory/PS schedule:	Tuesday 11:00-12:50 (M2200) – Regular Class Thursday 16:00-16:50 (M3100) – Computer Practical
Instructor:	Gönenç Yücel (gonenc.yucel@boun.edu.tr) Engineering Building, Room: M4014 Office Hours: T 10:00 – 11:00, Th 10:00-11:00
Prerequisite(s):	None
Course Webpage	**http:**//moodle.boun.edu.tr

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 first part of the course introduces agent-based models, and what they can be used for. This involves basic introduction to simulation modeling in general, and to agent-based models in specific. Following that, we will discuss two broad classes of scientific/applied questions for which agent-based models can be used as an appropriate method. Linked to that, the first part of the lecture will conclude with a discussion on how to identify a good topic to tackle with this approach.

The second part of the course will be focused on how to build a simple agent-based model. A significant portion of these lectures will be conducted in the computer lab, and we will be doing hands-on modelling during the lectures. We will tackle advanced topics such as advanced decision making, sensing, perception implementations, evolutionary agent behavior, dynamic network structures, etc. as time allows.

The final part of the course focuses on the concluding stages of a model-based analysis process; i.e. model verification and validation, output analysis, and communication of the model and the results to peers and/or clients.

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.

Textbook:

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

- *"Agent-Based and Individual-Based Modeling: A Practical Introduction"* by Steven F. Railsback & Volker Grimm
- *"An Introduction to Agent-Based Modeling: Modeling Natural, Social, and Engineered Complex Systems with NetLogo"* by Uri Wilensky &William Rand

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 and/or IE 550 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:

The grading will be based on four assignments and a modelling project, which are designed to evaluate your competency in developing and using ABMs. The assignments will be spread throughout the semester. You will be working in groups of 2 or 3 for all these assignments and the project.

Assignment 1	15%
Assignment 2	20%
Assignment 3	10%
Assignment 4	15%
Final Presentation	10%
Final Report	30%

Prepared by, and date of preparation: Gönenç Yücel, December 2016