ISE 4100 – Stochastic Modeling and Simulation

Autumn 2020

(Last updated July 15, 2020) This is a preliminary version of the syllabus. Information herein is subject to change. A final version will be published a week before the start of classes.

1 Course Overview

Lectures: Tuesdays and Thursdays, 3:55PM – 5:05PM.
Hybrid delivery: in-person location TBD + online via CarmenZoom.

Labs: Mondays, 2:30PM – 5:30PM (three 1-hour sessions).
Online delivery: via CarmenZoom.

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Catalog description: (4 units) Methods for stochastic process and discrete event simulation modeling and system design and decision-making using simulation tools.

Informal description: This course is an introduction to computer modeling and analysis of real-world systems under uncertainty. The goal of this course is to apply probability and computer simulation to model and analyze systems with time varying randomness. Such stochastic systems are commonly encountered in engineering, computer science, biology, finance, and public policy. Through this course, you will gain experience in:

- Understanding the role of stochastic modeling and simulation in system (re-)design and optimization
- Planing and conducting data collection and analysis for discrete event simulation modeling
- Formulating an appropriate simulation model for a system
- Implementing the model as a computer program (in ARENA, as well as Excel, time-permitting)
- Evaluating and interpreting the output of the simulation
- Performing decision analytics by, e.g., making recommendations for system design and management based on the simulated model

Prerequisites: STAT 3470 or equivalent, and enrollment in the Industrial and Systems Engineering major; or permission of instructor. A solid probability and statistics background is important. In particular, you should feel comfortable with topics including probability, random variables, means and variances, confidence intervals, and hypothesis testing. In addition, you should know how to code at an intermediate level: MATLAB, C, C++, or Java.

2 How This Course Works

This course consists of two lectures and a lab session each week, plus office hours. Details on the mode of delivery of each component, and attendance and participation requirements, are given below.

Mode of delivery of lectures: The lecture component of this course is delivered in *hybrid mode with cohorts*. The two lecture sessions each week will be synchronous in-person lectures with a real-time video option. An asynchronous recorded video option will be available as well in case you miss the class. In terms of the option for in-person attendance, you will be divided into two cohorts A and B; details on the assignment are given below. Cohort A/B will have the option to attend lectures in-person on Tuesdays/Thursdays, while the other cohort will join remotely. Please also see section on "attendance and participation" for the related requirements.

Cohort assignment: Cohorts will be announced shortly prior to the start of the semester. The sorting into cohorts will be done randomly. In case you have a strong preference for attending in-person on a day which you did not get based on your cohort assignment (e.g., you only commute to campus on certain days, or prefer to group your in-person classes to be on the same day in the week), please send me an email explaining the reason for your request no later than the end of the first week of classes. Swapping between complementary requests will be done in this time window as long as possible, and will be done in the order I receive the requests, so please contact me as early as possible if you *need* a reassignment.

Mode of delivery of the lab: The lab component of this course is online and *synchronous*. You must be logged onto CarmenZoom at the scheduled time of the lab you are registered for, with a video camera if available. Details on software use are given in the "technologies to access labs" section.

Mode of delivery of office hours: Office hours by the instructor and the TA will be online via CarmenZoom. Office hour times will be announced in the final syllabus.

Attendance and participation: Consistent engagement in the course is expected from all students: synchronous participation in labs is required; synchronous participation in lectures (either in-person or online) is highly encouraged. The online delivery of lectures will be interactive, and I will be conscientious of remote attendees' participation and questions (with the help of the TA). You may also be asked to answer short questions or work in small groups during class times. Therefore, synchronous attendance will be quite helpful in mastering the course. That being said, I understand that you may have to miss class (hopefully only occasionally), and therefore recorded lectures and lecture notes will be made available on CarmenCanvas as well. In case you miss a lecture, you are expected to view the missed material before the next lecture.

Overall, you are expected to log into CarmenCanvas at least once a week to complete a lecture-related activity; the participation grade will be assessed accordingly. This may be to access links to the online class, to watch material you have missed, or to answer questions asked during lectures (you will likely need to log in more times to access or submit assignments, complete quizzes, etc). If you expect to not be able to show any participation in lectures (by either attending in person or viewing missed material online) for a full week, please discuss this with me as soon as possible.

3 Textbooks and Course Technologies

Textbooks and reference books: We will have two textbooks. The first one will be used in the lectures and the second one will be used in the labs.

- Jerry Banks, John S. Carson II, Barry L. Nelson, and David M. Nicol, Discrete-Event System Simulation, 5th edition, Prentice Hall, 2010
- W. David Kelton, Randall P. Sadowski, and Nancy B. Zupick, Simulation with Arena, McGraw Hill.

Other useful textbooks and resources include:

- M.D. Rossetti, Simulation Modeling and Arena, 2nd Edition, Wiley, 2015
- A.M. Law, Simulation Modeling and Analysis, 5th edition, McGraw-Hill, 2014
- W.L. Winston, Operations Research: Volume Two. Introduction to Probability Models 4th ed., Thomson Brooks/Cole, 2004

Brief lecture notes will be posted on Carmen. These are intended to provide an overview of all topics covered in each lecture, but will not be a substitute to lectures, as they may not include all details discussed in class.

Copyright disclaimer: The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Course technologies: For remote participation in lecture and labs, you need to have access to a computer with a microphone, and preferably a webcam. For the midterm and final exams, you need to have access to a webcam as well. You need to be fairly familiar with the use of CarmenCanvas and CarmenZoom. To submit your homework, lab reports, and projects, you will have the option of uploading the assignments on CarmenCanvas. For written homeworks, you will need access to a camera (e.g. a phone camera) to take pictures and upload them on Canvas (you are not required to use a scanner).

Technologies to access labs: We will use the ARENA software in the lab. This software is available on computers in OSU labs via remote access. You should familiarize yourself with remote access to use this software. A free student version of the software is available for Windows devices on the software's website as well; the capabilities of this free version are sufficient for the course, and therefore you may choose to use this on your personal device if possible. A Mac version is not available; therefore, if you are a Mac-user, you should plan to use remote desktop to access ARENA on OSU computers, or explore dual-booting/virtual machines on your personal device to use the free version. Additional details and assistance on remoting into OSU computer labs, and software access and use, will be given during the first week of the course and first lab session by the instructor and the TA.

4 Grading

The grade will be based on homework (20%), a midterm exam (20%), a final exam (22%), quizzes (15%), a final project (15%), and class participation (3%). Homework will be given throughout the semester on roughly a biweekly basis. Late assignments will not be accepted. We will have one midterm exam and a comprehensive final exam. There will also be quizzes for both the methodology part and the application (software) part. Finally, a project will be required. Details on the project will be made available separately.

5 Other Course Policies

Collaboration policy: Students are encouraged to work together on problem sets and on general discussion of course material. Keep in mind however that all written solutions and code handed in by the students must be written solely by them and reflect their independent understanding of the course material.

Academic misconduct statement: The Ohio State University and the Committee on Academic Misconduct expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute "Academic Misconduct," as defined in the University's Code of Student Conduct (Section 3335–23–04). Any student found to have engaged in academic misconduct will be subject to disciplinary action by the university. Please contact me if you have any questions about what might constitutes academic misconduct in this course.

Resources for distressed students: A recent American College Health Survey found stress, sleep problems, anxiety, depression, interpersonal concerns, death of a significant other, and alcohol use among the top ten health impediments to academic performance. Students experiencing personal problems or situational crises during the semester are encouraged to contact the OSU Counseling and Consultation Service (614-292-5766; www.ccs.osu.edu) for assistance, support and advocacy. This service is free and confidential.

Statement regarding disabilities and accommodations: The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately (within the first two weeks of the course) so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

If you require any accommodations regarding the course material and technologies, please contact the instructor as soon as possible. Information about accessibility within CarmenCanvas and CarmenZoom is avilable in the following links:

`https://community.canvaslms.com/docs/DOC-2061Informationabout`
`https://resourcecenter.odee.osu.edu/carmenzoom/accessibility-carmenzoom`