**Course Syllabus, Fall 2021**
ISE 230:
Introduction to Stochastic Models in Operations Research

## Course Information:

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| *Lectures:* | Mondays & Wednesdays, 9:20am-10:35am, Maginnes 260 |
| *Office Hours:* | Thursdays, 1:10pm-2:30pm (in person) or online by appointment |
| *Slack:* | ise230-010-fl21.slack.com |

## Instructor Information:

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## TA Information:

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**Description:** Stochastic models and algorithmic methods are fundamental in operations research for the operation, analysis, design, and improvement of systems involving uncertainty. The purpose of this course is to provide a broad introduction to the rich field of stochastic modeling and algorithms, particularly as they relate to problems in operations research applications.

**Course Objectives:** The objectives of this course are for students to do the following:

- Appreciate the importance of modeling uncertainty in real-world problems.

- Learn basic stochastic modeling techniques for representing uncertainty.

- Explore various traditional and modern stochastic modeling paradigms.

- Understand popular algorithms for solving stochastic problems.

- Be able to apply course concepts in other areas of engineering and applied science.

**Prerequisite:** An undergraduate probability course, namely, ISE–111 or MATH–231.

**Course Model:** *Lectures will be held in person unless otherwise announced.* A Slack workspace has been created to facilitate communication about the course. If circumstances make it necessary that a lecture or lectures cannot be held in person, then they will be held virtually by Zoom in a synchronous manner; all such lectures would be held using https://lehigh.zoom.us/my/frank.e.curtis.

**Zoom:** Zoom sessions, either for lectures (as needed) or office hours, work best when all students who join are ready to participate and follow the same guidelines regarding use of video. I will be asking all students to turn on their cameras during Zoom sessions. If you have a strong preference not to do so, then please let them know in advance. Students should respect everyone's privacy by not taking screenshots or recording the live sessions. I do *not* plan to record any lectures, although if requested a Zoom session can be recorded if all participants agree. If recordings are ever made, then they would only be shared with students in the class and will be deleted at the end of the semester.

**Office Hours:** Please come to office hours if you have any questions about the course. I am also available through e-mail (always) and on Google Chat (often). If I do not respond to an e-mail within 24 hours, then please assume that I have not received it and send a follow-up e-mail. If I do not respond on Google Chat, then I am either busy or you are contacting me too late in the day, in which case you can try again the next day (during work hours) or send an e-mail instead. I am also willing to meet at other times, but in such cases please e-mail me in advance to set up a mutually convenient time.

**Course Site:** Lecture notes will be posted on Course Site. Homework assignments, solutions, announcements, and other important material will also be posted on Course Site and Slack. Important information, corrections, and updates about the course may also be sent by Course Site and Slack.

**Textbook:** The textbook for the course is [1] (below). Reading the textbook is highly recommended.

**References:**

[1] Frederick S. Hillier and Gerald J. Lieberman. *Introduction to Operations Research.* McGraw Hill Education, New York, New York, USA, Tenth edition, 2015.

**Expected Schedule:**

| Weeks | Lecture Topic | Notes |
|-------|---------------|-------|
| 1 | Course Overview | |
| 2–3 | Optimization Under Uncertainty | No lecture on 9/6 |
| 4–5 | Decision Analysis | |
| 6 | [Review] | Midterm #1 |
| 7–8 | Game Theory | No lecture on 10/11 |
| 9–10 | Markov Chains | |
| 11 | [Review] | Midterm #2 |
| 12 | Queueing Theory | |
| 13 | Dynamic Programming | |
| 14 | Markov Decision Processes | No lecture on 11/24 |
| 15 | Project Presentations | |
| 16–17 | | Final |

**Software:** Students are expected to use AMPL and Matlab to solve some homework and exam problems. A student version of AMPL is sufficient, which is freely available. Matlab is available on Lehigh computers. If you are not able to access a library or laboratory computer, then you can use Matlab on your personal computer using virtual software, which is available through Lehigh; see https://lts.lehigh.edu/services/virtual-software-luapps. **Please investigate these services and make sure that you are able to run AMPL and Matlab as soon as possible! Please do not wait until the first assignment.**

**Submitting Work:** Your solutions for each assignment and each exam must be submitted as a single PDF file. There are no exceptions to this requirement. Please do not attempt to submit multiple files for any assignment or exam, and please do not attempt to submit any other type of file besides a PDF file. **However you intend to write your homework and exam solutions, please make sure that you know how to generate a PDF file from your work!**

**Grading:** Your grade will be calculated as follows.

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| Homework: | 20% |
| Project: | 10% |
| Midterm Exam #1: | 20% |
| Midterm Exam #2: | 20% |
| Final Exam: | 20% |
| Participation: | 10% |

**Homeworks:** There will be regular homework assignments throughout the semester, generally assigned and due every other week. Each homework must be submitted electronically via Course Site. No credit will be given for any late assignment. You are free to consult with other students when working on homeworks, but the work you submit must be your own. *Please cite any references you use, including fellow students.* Your homework grade will be determined by the number of points you accumulate over the entire semester as compared to the maximum number of points that are possible to accumulate. In this manner, homeworks with more questions effectively have a higher weight in determining your homework grade.

**Project:** A project will be assigned during the semester, for which presentations will be held during the last week of the semester. It will be a group project for which you and your group members will present a topic about a real-world use of stochastic modeling.

**Exams:** All exams will be cumulative take-home exams.

**Participation:** Attendance will not be taken. However, participation will factor into your grade. If you are unable to participate in lecture, then participation entails being a presence online—via e-mail or Course Site—or in office hours. In short, if by the end of the semester we have not had any one-on-one discussions about the course and/or course material, then your participation grade will suffer.

**Collaboration Policy:** The sharing of ideas is educationally useful and you are encouraged to discuss assignments with other students. However, *plagiarism* of any kind is destructive, fraudulent, and unacceptable. You are *strictly* forbidden to copy another student's written work, whole or in part, and submit that work under your name. You are also *strictly* forbidden to make trivial or mechanical changes to another student's written work and submit that work under your name. Note that while electronic plagiarism is easier to perform (via copy-and-paste), it is also easier to detect. Plagiarized work will receive no credit and repeat offenses will result in more severe action. A sure way to avoid this issue is to discuss the assignments with fellow students, but write your solutions individually and independently.

**Emergencies:** Everyone is responsible for all material covered and announcements made in lecture. If you believe you will miss a long period of time in the course due to illness, a family emergency, etc., then please contact me as early as possible. Under no circumstances will credit be given for missed work unless you have discussed your absence with me in advance.

**Regrade Requests:** If you disagree with a grade you receive, then you may submit a regrade request. This request must be written and submitted no more than 48 hours after you receive the grade.

**Recording Devices:** Voice and/or video recording devices may be used only with the approval of everyone. Please let me know in advance if you wish to record voice and/or video.

**Accommodations for Students with Disabilities:** Lehigh University is committed to maintaining an equitable and inclusive community and welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact Disability Support Services (DSS), provide documentation, and participate in an interactive review process. If the documentation supports a request for reasonable accommodations, DSS will provide students with a Letter of Accommodations. Students who are approved for accommodations at Lehigh should share this letter and discuss their accommodations and learning needs with instructors as early in the semester as possible. For more information or to request services, please contact Disability Support Services in person in Williams Hall, Suite 301, via phone at 610-758-4152, via email at indss@lehigh.edu, or online at https://studentaffairs.lehigh.edu/disabilities.

**The Principles of Our Equitable Community:** Lehigh University endorses The Principles of Our Equitable Community [http://www.lehigh.edu/~inprv/initiatives/PrinciplesEquity_Sheet_v2_032212.pdf]. We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.