ESI4313: Operations Research 2

Class Periods: Tuesdays and Thursdays, Period 7–8, 1:55 PM - 3:50 PM
Academic Term: Fall 2019
Location: FLG 0230

1 Course Description

<u>Credit number:</u> 4
<u>Catalog Description:</u> Introduction to stochastic models and methodologies for analyzing and providing solutions to decision-making problems with uncertainties.

2 Prerequisites/Co-Requisites

Pre-requisites: ESI 4327C and STA 4321 with minimum grades of C.

To succeed in this class, a working knowledge of calculus, linear algebra, matrix, and probability is needed. Some experience with basic programming techniques in Matlab or equivalent is a plus.

3 Course Objectives

At the end of the class, students are anticipated to (1) understand the concepts about randomness/uncertainty, probability models, Markov chains, and queueing systems; (2) be familiar with basic rules of probability and stochastic models; (3) be able to derive analytical solutions to small-scale problems; (4) be able to use probability and stochastic models in modeling uncertainty; and (5) be able to address problems that involve randomness/uncertainty.

4 Relationship of Course to Program Outcomes

In terms of ABET criteria, this course provides high coverage of "an ability to identify, formulate and solve engineering problems by applying principles of engineering, science, and mathematics".

5 Teaching Staff and Office Hours

Instructor

Hongcheng Liu
Email: liu.h@ufl.edu   *Phone:* 352-294-7728
`http://www.ise.ufl.edu/liu/`
Office hours and location: To be announced, or by appointment, Weil 478
Preferred means of contact: Email through E-learning/Canvas

Teaching Assistant

TBA
Email: TBA
TA office hours and location: TBA

We will strive to provide you with the best possible learning experience about Operations Research in this class. Although we would like to address any of your questions, problems, and concerns pertaining the course as soon as possible, please understand that it would not be possible for us to allow students to stop by our offices during unannounced hours, given the size of the class. Please consider the following sources of help when you have a question:

(1) The best option is probably to raise the question in class.

(2) You can stop by anytime during our office hours.

(3) You can ask questions through email. However, please understand that for certain questions that are infeasible to discuss/explain through email, we will have to schedule an appointment within or outside the office hours.

(4) If it becomes impossible for you to come to the office hours, you can schedule an appointment with the instructor or the TA. If you do not have a preference for who will help you, please send a single request E-mail to both instructor and TA.

Please do not call the instructor or the TA at home even for a short question. Finally, the instructor and the TA will not answer questions on the practice problems before their due dates, unless those questions are about the understanding of the statements of the homework or practice problems.

6 Textbooks and Software

Required textbook: "Introduction to Probability Models," Author: Sheldon Ross, Academic Press: 11th edition, ISBN: 978-0124079489

Recommended textbook 1: "Operations Research: Applications and Algorithms," Author: Wayne Winston, Cengage Learning; 4th edition, ISBN: 978-0534380588

Recommended textbook 2: "Probability and Computing: Randomization and Probabilistic techniques in Algorithms and Data Analysis," Author: MICHAEL MITZENMACHER & ELI UPFAL. CENGAGE LEARNIN; 2nd edition. ISBN: 9781107154889

7 Materials and Supply Fees

None

8 Course Outline

Below is a <u>tentative</u> list of topics for the class. Items may be added to or reduced from the list according to the pace of the class.

1. *Chapter 1. Probability model:* definitions, probability distribution functions, expectation and variance, sums of random variables, applications

2. *Chapter 2. Bernoulli process and Poisson Process:* definitions and properties, merging and splitting Poisson processes, applications.

3. *Chapter 3. Markov Chains:* states, transition matrices, types of chains, steady-state properties, continuous-time Markov chains

4. *Chapter 4. Queueing Theory:* definitions, Little's law, special queueing models and properties

5. *Chapter 5. Dynamic Programming (if time allows):* definitions, formulations, optimality principle, examples

6. *Chapter 6. Brownian Motion (if time allows):* definitions, variations of Brownian motion, option pricing: Black-Scholes.

9 Important Dates

Two midterm exams:

1. Sept. 19, in class (Location TBA);

2. Oct. 22, in class (Location TBA).

Final exam

- Final Exam: 12/11/2019 @ 10:00 AM - 12:00 PM (location TBA)

Extra-credit project dates:

- Project deliverables submission deadline: 11:59 pm on November 26, 2018.

10 Attendance Policy

Attendance is strongly recommended. It will be to your benefit to attend all lectures. Students will be responsible for all material covered in class. If you cannot follow the lecture any more, you can leave the class quietly; I will not be offended. Please, remember to turn off your cell phone as soon as you enter the classroom. Those who behave inappropriately will be asked to leave.

11 Student Teams

Student teams are to be formed in the first week of the class. The team size is maximally 7. Please first form the team based on your own preference. Then the instruction will make adjustments if necessary. The same student teams are expected to participate in both in-class team-based activities and extra-credit projects. Team size will *not* be factored into grading.

12 Practice Problems

Multiple sets of practice problems will be announced during the course. Those problems will not be collected, but they are very helpful to prepare for the exams. Selective problems out of these practice problems will be graded upon during in-class student presentations explained in Section 13.1.

13 Evaluation of Grades

Class grades will be based on:

a. two mid terms (the one with the higher score will count 30%, and the other, 25%, towards the final grade),

b. final exam (30%),

c. class participation (15%).

13.1 In-Class Participation

In-class participation is graded upon the following components:

9% of the total grade. There will be two opportunities for the each student team to make short in-class presentations on their solutions to practice problems. While the problems will be assigned to each team before the day of the presentation, the presenter will be randomly chosen from the student team "on the fly". These presentations will be followed by questions from the student audience, TA, and the instructor. Grading rubrics of each problem will be announced before each presentation in accordance with the level of difficulty of the problems. The higher score out of the two opportunities will be the final score for this component.

6% of the total grade. Additional in-class activities requiring student participation will be announced during the course. Students will be evaluated based on their performance in those activities.

13.2 All Exams Are In-Class

- Students are required to take an in-class midterm exam. The exam will be closed-book but each student is allowed to bring in one sheet of 8.5×11.0 inches paper of handwritten notes and a calculator. The exact date of the midterm will be communicated later.

- Students are required to take a final exam. The exam will be closed-book but each student is allowed to bring in one sheet of 8.5×11.0 inches paper of handwritten notes and a calculator. The final exam is cumulative and will cover materials in both the lectures and the practice problems.

No collaboration is allowed in any form during the exam. E.g., lending/borrowing a calculator, sharing notes, etc., are not allowed.

13.3 Extra-Credit Projects

Maximally 5 extra credit: Extra-credit take-home projects will be announced. The topics of the projects include building simulators, solving problems in stochastic models, and review advanced results in operations research. Each problem can be chosen by only one team of students. The first team who formally indicates interest (via an email through elearning/Canvas) will be given the problem. This extra-credit project is for the students who are interested in gaining further insights into the stochastic models. Intense self-learning will be expected from the participants. The instructor and the TA(s) will only provide general guidance in the project. Neither the instructor nor the TA(s) will help with actual proofs, data structure, simulator/algorithm design, coding, platform environment setup, and debugging. Each participating team is required to present their solutions in class and submit their powerpoint slides. When applicable, the team should also submit their programming codes. Grading rubrics will be announced together with those extra-credit problems during the first two weeks of the class. Student teams who have agreed to participate but fail in completing the project will be penalized 0.5 point from their total score. However, if the project team makes sufficient efforts, completes the project, but the solution is wrong, extra credit will be awarded in accordance with the rubrics to be announced, but at least 0.5 point is guaranteed.

13.4 Exam Grading Appeals

The instructor and the TA will make every effort to ensure that grading is as objective and fair possible. Students are allowed to submit an appeal in writing within one week of your exam being returned. The written appeal should be done on a sheet of paper that is stapled to your original graded paper. The packet should before/after the class or during office hours. The written appeal should indicate the reason why you believe re-grade is appropriate. At the receipt of such an appeal, the instructor and the TA will regrade the entire exam to ensure that all parts are properly graded. It is possible that the second grade will be either higher or lower than the first grade.

No re-grade will take place on the spot nor will be considered face-to-face. The instructor and TA keep the prerogative of deciding of a complete re-grade of the paper when you request the re-grade of any of its parts. This rule is to prevent frivolous complaints. Finally, be aware that samples of quizzes and tests are photocopied and kept to verify if any alteration was made between the return of a paper and the request for a re-grade. In the case of such event, you will receive a failing grade for the totality of your paper and the case will be handed to the Dean of Students Office for prosecution.

Please be aware that if the grader misunderstood your answer during the first grading, it is probably that it was not clear. Explaining what you meant afterwards will not earn you any point as it should have been clear the first time around.

14   Grading Policy

The grading scale for the class is as below:

Grade	Range	Grade Points
A	[93, 100]	4.00
A-	[90, 93)	3.67
B+	[87, 90)	3.33
B	[83, 87)	3.00
B-	[80, 83)	2.67
C+	[77, 80)	2.33
C	[73, 77)	2.00
C-	[70, 73)	1.67
D+	[65, 70)	1.33
D	[60, 65)	1.00
D-	[55, 60)	0.67

Curving might occur in any assignment/exam if the average result is too low. More information on UF grading policy may be found at: `https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/`.

Grades are not subject to negotiation and will be solely based on your performance in this course; that is, no outside factors will be considered. Those outside factors include the plan to graduate within certain timeline and the current grade being near to the next higher or lower grade.

A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement.

15   Make-up Exam Policy

We anticipate the students be present without exception in the exams; please make all other plans in avoidance of conflicts with the exam dates. Absence in exams can be excused in medical emergencies, if accompanied by a doctor's note. A note indicating that you were seen at a health/medical care provider on the day of the exam is not sufficient documentation of a medically excused absence from an exam. The note explicitly must state that the absent student were medically unable to take the exam. If the absent student fails to take the exam on the assigned day and do not have a valid excuse, there will be no makeup exam and a zero (0) grade will be given on the exam. Reasons such as job interviews, employer events, weddings, vacations, etc., are not valid excuses for being absent in any of the exams. Maximally one make-up exam is allowed for each of the midterm and final exams.

16   Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, `https://www.dso.ufl.edu/drc`) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented

to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

17 Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at `https://gatorevals.aa.ufl.edu/students/`. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via `https://ufl.bluera.com/ufl/`. Summaries of course evaluation results are available to students at `https://gatorevals.aa.ufl.edu/public-results/`.

18 University Honesty Policy

UF students are bound by The Honor Pledge which states, ?We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (`https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/`) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

19 Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator

- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu

- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu

- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

20 Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

21 Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: `https://registrar.ufl.edu/ferpa.html`

22 Campus Resources

U Matter, We Care: Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: `http://www.counseling.ufl.edu/cwc`, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence: If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the Office of Title IX Compliance (`https://titleix.ufl.edu/`), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS): Student Health Care Center, 392-1161.

University Police Department: 392-1111 (or 9-1-1 for emergencies), or `http://www.police.ufl.edu/`.

Academic Resources

E-learning technical support: 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. `http://lss.at.ufl.edu/help.shtml`.

Career Resource Center: Reitz Union, 392-1601. Career assistance and counseling. `https://www.crc.ufl.edu/`.

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Library Support: `http://cms.uflib.ufl.edu/ask`. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center: Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. `http://teachingcenter.ufl.edu/`.

Writing Studio, 302 Tigert Hall: 846-1138. Help brainstorming, formatting, and writing papers. `http://writing.ufl.edu/writing-studio/`.

Student Complaints Campus: `http://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf`.

On-Line Students Complaints: `http://www.distance.ufl.edu/student-complaint-process`.