ESI 4313: Operations Research 2
Section 2614
Class periods: MW 8-9
Location: FAB 105
Academic term: Spring 2018

- **Instructor:** Petar Momčilović
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  - Office hours: M 6-7

  The best way to contact me is via email. However, discussing some mathematical topics over email cannot always be done efficiently. I reserve the right to request that you attend office hours if answering your question via email will be overly complicated. I am not always at my desk so phone calls might not be answered. Do not use voicemail or Canvas as a means of communication as I do not check them regularly. I reserve the right to request students attend office hours when stopping by my office during non-office hour time periods.

- **Teaching Assistants:** Jianqiu Huang / Blake Wilson / Michael Lucic
  Please contact through the Canvas website
  - Office location: 406 Weil
  - Telephone: –
  - E-mail address: jianqiuhuang@ufl.edu / blakew321@ufl.edu / mlucic2014@ufl.edu
  - Office hours: R 6-7, F 7 (Jianqiu); T 4-5 (Blake); R 8-9 (Michael)

- **Course Description:** *Credits: 4.* Introduction to stochastic models and methodologies for analyzing and providing solutions to decision-making problems with uncertainties.

- **Course Pre-requisites:** ESI 4327C (Matrix and Numerical Methods in Systems Engineering) and STA 4321 (Introduction to Probability) with minimum grades of C.

- **Course Objectives:** This course contributes to the following PEOs:
  - Can become successful professionals in industrial and systems engineering or other disciplines
  - Can acquire advanced knowledge through continuing education or advanced degree programs

  The goals of the course are:
  - Understanding the concepts behind the techniques for analyzing systems with randomness/uncertainty
  - Developing facility with the techniques themselves, and being able to solve small size problems analytically

- **Material and Supply Fees:** None

- **Professional component (ABET):** This course introduces the basic concepts of stochastic modeling in operations research. Students will develop and enhance their ability to address various problems that involve randomness/uncertainty.

- **Relation to Program Outcomes (ABET):**

Outcome	Coverage
a. Apply knowledge of mathematics, science, and engineering	High
b. Design and conduct experiments, as well as to analyze and interpret data	
c. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	
d. Function on multi-disciplinary teams	
e. Identify, formulate and solve engineering problems	Medium
f. Understand professional and ethical responsibility	
g. Communicate effectively	
h. Understand the impact of engineering solutions in a global, economic, environmental, and societal context	
i. Recognize the need for, and an ability to engage in life-long learning	Medium
j. Know contemporary issues	
k. Use the techniques, skills, and modern engineering tools necessary for engineering practice	Medium

- **Required Textbook:**
    - Title: Introduction to Probability Models
    - Author: Sheldon Ross
    - Academic Press; 11th edition
    - ISBN: 978-0124079489

- **Recommended Materials:**
    - Title: Introduction to Probability
    - Authors: Dimitri Bertsekas and John Tsitsiklis
    - Athena Scientific; 2nd edition
    - ISBN: 978-1886529236

    - Title: A First Course in Probability
    - Author: Sheldon Ross
    - Pearson; 9th edition
    - ISBN: 978-0321794772

    - Title: Operations Research: Applications and Algorithms
    - Author: Wayne Winston
    - Cengage Learning; 4th edition
    - ISBN: 978-0534380588

- **Course Schedule:**

Week	Topic	Book chapters
1:	Review of Probability Theory, Random variables	1, 2 (IPM)
2:	Random variables	2 (IPM)
3:	Conditional Probability/Expectation, Poisson process	3, 5 (IPM)
4:	Poisson process	5 (IPM)
5:	Poisson process, Markov Chains	5, 4 (IPM)
6:	Markov Chains	4 (IPM),
7:	Review, Exam 1	1-3, 5 (IPM)
8:	Markov Chains	4 (IPM)
9:	Spring break	
10:	Continuous-time Markov Chains	6 (IPM)
11:	Continuous-time Markov Chains	6 (IPM)
12:	Queueing Theory	8 (IPM)
13:	Review, Exam 2	4, 6 (IPM)
14:	Queueing Theory	8 (IPM)
15:	Dynamic programming	18-19 (ORAA)
16:	Dynamic programming	18-19 (ORAA)

- **Course Outline:**

  - Review of Probability: Axioms – Conditioning – Distribution functions – Exponential and normal random variables – Independence – Expectation – Collections of random variables – Conditional expectation – Total Expectation Theorem – Derived distributions – Moment generating functions.

  - Poisson Processes: Bernoulli processes – Multiple definitions of Poisson processes – Arrival times – A limit of a Bernoulli process – Merging/Splitting – Random incidence.

  - Markov Chains: Definition and description – Modeling: states and transition probabilities – Classification of states – Chains with finite and infinite state spaces – Steady-state probabilities – Hitting times and absorption probabilities – Birth-death processes – Continuous-time Markov Chains – Generator Matrices – Transitions – Stationarity.

  - Queuing Theory: Notation – Little's law – M/M/1 – PASTA property – Multi-server models – Models with heterogeneous servers – Finite-source models – Exponential queues in tandem – Jackson networks.

  - Dynamic Programming: Deterministic dynamic programming models and applications – Modeling – Optimality principle – Graphical representation – Examples: shortest-path, inventory, equipment replacement – Stochastic dynamic programming models – Markov decision processes.

  - Brownian Motion (time permitting): Definitions – Variations of Brownian motion – Hitting times – Supremum of a Brownian motion with drift – Pricing stock options: Black-Scholes.

- **Attendance and Expectations:** Attendance is mandatory – you are responsible for the announcements made in class. Students are expected to know the material covered in the prerequisite courses. When necessary, they are expected to relearn material from these courses on their own.

  This is not a course where you can do well on exams solely by blindly applying formulas. In order to get the most out of the course, try to stay ahead. By the weekend, make sure you have at the least reviewed the material covered in the lectures and readings of the preceding week. In addition to reading, working out extra exercises on your own will help in improving your understanding of

the material. With diligent practice, you can prepare yourself to the point where, on exams, instinct takes over and the problems seem straightforward.

Make-up Exam Policy: You are expected to be present without exception and to plan any travel around these dates accordingly. Medical emergencies are of course excluded if accompanied by a doctor's note. A note indicating that you were seen at the health center the day of the exam is not sufficient documentation of a medically excused absence from an exam. The note must say that you were medically unable to take the exam.

If you fail to take the exam on the assigned day and do not have a valid excuse, there will be no make up exam and you will be given a zero (0) on the exam. Employment interviews, employer events, weddings, vacations, etc. are not excused absences.

- **Evaluation of Grades:** 1/3 exam I, 1/3 exam II, 1/3 exam III.

  Exam dates: February 19/21, 2018 (8:20-10:10pm, Monday/Wednesday, pending room availability), April 2/4, 2018 (8:20-10:10pm, Monday/Wednesday, pending room availability), May 2, 2018 (3-5pm, Wednesday).

- **Grading Scale:** The final letter grade will be determined primarily by the curve. The break between "B" and "B-" will be approximately set at the average of total scores of students *receiving letter grades (A-E)*. Letter grades will be monotonic in total course scores. **Your grade will be solely based on your performance in this course and not on outside factors like your wish to graduate in a given semester.** Grades are not subject to negotiation. Being close to the next higher grade is not a relevant issue for discussion of a grade adjustment.

  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. For more information on grades and grading policies, please visit: `https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx`.

  Exam Grading Appeals: Every effort will be made to ensure that grading is as objective and fair as possible. If you believe that there is an error in the grading, please submit, in writing, an appeal within one week of your exam being returned. However, please be advised that if you submit such an appeal, the entire exam will be regraded to ensure that all parts are properly graded. As such, your grade on the exam could increase or decrease based on the secondary grading.

- **University Honesty Policy:** All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

  Any form of cheating will be penalized.

- **Accommodation for Students with Disabilities:** Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

  UF Counseling Services: Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

  - UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.

- Career Resource Center, Reitz Union, 392-1601, career and job search services.

- **Course Evaluation:** Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at `https://evaluations.ufl.edu`/evals. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at `https://evaluations.ufl.edu/results/`.

- **Software Use:** All faculty, staff and student 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.

- **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: `http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html`

- **University of Florida Complaints Policy:** The University of Florida believes strongly in the ability of students to express concerns regarding their experiences at the University. The University encourages its students who wish to file a written complaint to submit that complaint directly to the department that manages that policy. A student who is unsure as to the official responsible for handling his or her particular complaint may contact the Ombuds office or the Dean of Students Office. For complaints that are not satisfactorily resolved at the department level or which seem to be broader than one department, students are encouraged to submit those complaints to one of the following locations:

  - Ombuds: `http://www.ombuds.ufl.edu/`, 31 Tigert Hall, 352-392-1308

    The purpose of the Ombuds office is to assist students in resolving problems and conflicts that arise in the course of interacting with the University of Florida. By considering problems in an unbiased way, the Ombuds works to achieve a fair resolution and works to protect the rights of all parties involved.

  - Dean of Students Office: `http://www.dso.ufl.edu/`, 202 Peabody Hall, 352-392-1261

    The Dean of Students Office works with students, faculty, and families to address a broad range of complaints either through directly assisting the student involved to resolve the issue, working with the student to contact the appropriate personnel, or referring the student to resources or offices that can directly address the issue. Follow up is provided to the student until the situation is resolved.

  Additionally, the University of Florida regulations provide a procedure for filing a formal grievance in Regulation 4.012: `http://regulations.ufl.edu/regulations/uf-4-student-affairs/`

- **Campus Resources:**
  - Health and Wellness
    * U Matter, We Care: If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.
    * Counseling and Wellness Center: `http://www.counseling.ufl.edu/cwc`, and 392-1575.

* Sexual Assault Recovery Services (SARS), Student Health Care Center, 392-1161.
* University Police Department at 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. `https://lss.at.ufl.edu/help.shtml`.
* Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. `https://www.crc.ufl.edu/`.
* 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. `https://teachingcenter.ufl.edu/`.
* Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. `https://writing.ufl.edu/writing-studio/`.
* Student Complaints Campus: `https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf`.
* On-Line Students Complaints: `http://www.distance.ufl.edu/student-complaint-process`.