

STAT 461: Applied Probability Models (Spring 2022)

Lectures: Monday-Wednesday-Friday 11:00 - 11:50 am in BSB 337

CRN number: 37890/37891

FIRST TWO WEEKS online at:

<https://uic.zoom.us/j/88007821575?pwd=ZStrVS9XbX1HQ3p1ZjVmSUu0Y1B0Zz09>

We will meet in-person as soon as it is allowed by the university.

Instructor: Will Perkins

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Office hours: 626 SEO building, TBA

Course webpage: <http://willperkins.org/STAT461-2022/>

Course description Probability theory is used to model many real-world phenomena, in areas from physics, to economics, to biology, to social networks. This course is about the fundamentals of important probability models and stochastic processes. We will begin with a review of important concepts from probability theory (paying special attention to sigma fields, independence and conditioning, expectation and conditional expectation), then move on to studying random walks, Markov chains, branching processes, point processes, and continuous-time processes. Along the way we learn new mathematical techniques and learn about applications of these models.

Course prerequisites: C or better in STAT 401 or permission of the instructor.

Required textbooks

- *Probability and Random Processes*, Grimmett and Stirzaker.
- *Markov Chains and Mixing Time*, Levin and Peres.

Topics

- (1) Probability spaces, independence, conditioning
- (2) Expectation and variance
- (3) Concentration inequalities
- (4) Urn models
- (5) Random walks
- (6) Martingales
- (7) Markov chains
- (8) Branching processes
- (9) Point processes
- (10) Continuous time processes

Grading

The grading scheme for this course is unique, so please read this section carefully. It is designed to align the goals of the students and instructor and encourage learning while minimizing stress about grades.

The material will be divided in 10 topics, listed above in the syllabus. Your grade will be determined by how many of the 10 topics you have **mastered** by the end of the course:

- 9-10: A
- 7-8: B
- 4-6: C
- 2-3: D
- 0-1: F

Mastery goes beyond doing all the problems I've assigned on homeworks. It means understanding why terms are defined as they are; why all the conditions of a theorem are necessary; how to apply a theorem or method to a type of problem you haven't seen before.

There will be several ways in which you can demonstrate to me that you have mastered each topic:

- (1) A short **oral quiz** (10 min.) on a single topic, at the time of your choosing. You have 2 tries for each topic. You can schedule an oral quiz for multiple topics at one time.
- (2) We will have 3 **tests** scheduled; each test will give you a chance to demonstrate mastery of 3-4 of the topics above. To show mastery of a topic on a test you simply need to answer the questions on that topic correctly.
- (3) **Final Exam**. The final will have questions on each of the topics and will be a final chance to show mastery of any of the topics you have yet to complete.

Once you've mastered a topic, you don't have to worry about it for the rest of the semester. If you've mastered a topic you don't need to answer the corresponding questions on the tests or final exam. If you've mastered all the topics you don't need to take the final exam. On the other hand, if you don't master any topics until the final and then master them all, you get an A for the class.

Assignments

I will post homework problems regularly (some problems of my own creation, some from the book). You do not have to hand the homework in, but in the oral quizzes for each topic, I am likely to ask you to explain the answer to previous homework problems or answer a related question.

Course Policies

Class discussion, working in groups, and communicating with the instructor are all essential elements of the course. I expect all of us to treat each other with respect and courtesy in all of our interactions.

Disability policy

Students with disabilities who require accommodations for access and participation in this course must be registered with the Office of Disability Services (ODS). Please contact ODS at 312-413-2183 (voice) or 312-413-0123 (TTY).

Academic deadlines Please see <https://catalog.uic.edu/ucat/academic-calendar/>

Religious holidays

Students who wish to observe their religious holidays shall notify the faculty member by the tenth day of the semester of the date when they will be absent unless the religious holiday is observed on or before the tenth day of the semester. In such cases, the student shall notify the faculty member at least five days in advance of the date when he/she will be absent. The faculty member will make every reasonable effort to honor the request. <https://oe.uic.edu/religious-calendar/>