

# Syllabus For Math 640-331

Fall 2021

Rutgers University-Camden

**COURSE TITLE:** Probability and Stochastic Processes

**TEXT:** *Probability with Applications and R*, by Robert P. Dobrow, Wiley, 2014.

**COURSE DESCRIPTION:** This three-credit course provides a mathematically precise introduction to the basic concepts and results of probability, a branch of math that studies random phenomena. The basic principles of probability and stochastic modeling are described. Properties and applications of some standard stochastic models are analyzed. The concepts of conditional probabilities and independence are presented. The expectation and variance of random variables and their properties are discussed. Two fundamental limit theorems for long-time averages of independent, identically distributed random variables are stated and proven. The course concludes with an introduction to Markov chains and their long-run behavior. This course emphasizes on both theory and applications. Students will be introduced to R, a free software environment for statistical computing and graphics, and learn how to use it to simulate real-life problems. We plan to cover most chapters in the textbook (see tentative schedule below for details). Prerequisites of the course are: Calculus I (640:121) and Calculus II (640:122).

**INSTRUCTION PLAN:** This is an in-person class. However, Canvas, Zoom, emails and other digital tools will be used to aid the instruction and communication. Students are expected to have access to: (1) high speed internet; (2) a laptop, a desktop computer, an iPad, or a tablet; together with a built-in microphone and camera or a separate webcam and a mic; (3) a scanner, or a phone camera with an app for producing pdf documents from photos.

## COURSE INFORMATION:

- Instructor: Siqu Fu
- Office: BSB 426
- Office hours: TTH 10:00 am-11:00 am (in-person or through Zoom) or by appointments
- Phone: (856) 225-2349.
- E-mail: [sfu@camden.rutgers.edu](mailto:sfu@camden.rutgers.edu)
- Web page: <http://people.camden.rutgers.edu/sfu>.
- Lectures: BSB 107, TTH 11:10 am-12:30 pm

**ASSESSMENT:** There will be approximately 7 homework and 5 R-project assignments. Students are asked to submit their work through Canvas Assignments. There will be two in-class midterm tests and a comprehensive final exam.

Grades will be assigned based on students' performance in the assignments, mid-term tests, and the final exam. Your course grade will be determined according to the following weights:

- Attendance, homework and R-project assignments: 30%
- Test I (Thursday, 10/14/2021): 20%
- Test II (Thursday, 11/18/2021): 20%
- Final Exam (11:30 am-2:20 pm, Tuesday, 12/21/2021): 30%

**ATTENDANCE POLICY:** Attendance will be checked and is expected for every class period with exception for illness, court appearance, and other legitimate emergency. See the Rutgers University Attendance Policy.

**CODE OF CONDUCT AND ACADEMIC INTEGRITY:** Rutgers University-Camden seeks a community that is free from violence, threats, and intimidation; is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and does not threaten the physical or mental health or safety of members of the University community, including in classroom space, and a community in which students respect academic integrity and the integrity of your own and others work.

As a student at the University you are expected adhere to the Student Code of Conduct and Academic Integrity Policy. Please review the Academic Integrity Policy and Code of Conduct.

**STUDENTS WITH DISABILITIES:** If you are in need of academic support for this course, accommodations can be provided once you share your accommodations indicated in a Letter of Accommodation issued by the Office of Disability Services (ODS). If you have already registered with ODS and have your letter of accommodations, please share the letter with this instructor early in the course. If you have not registered with ODS and you have or think you have a disability (learning, sensory, physical, chronic health, mental health or attentional), please contact ODS by first visiting their website. The website will further direct you who to contact and how to contact them depending on the free, confidential services you are in need of. Please Note: Accommodations will be provided only for students with a Letter of Accommodation from ODS. Accommodation letters only provide information about the accommodation, not about the disability or diagnosis.

**FACE COVERINGS:** In consistent with university policy, face coverings are required in classrooms (unless there is a change of university policy). Please refer to documents Guide to Returning to Rutgers and Navigating Our Classrooms and Student spaces for details.

## Tentative Schedule.

Lecture	Sections	Topics
1	1.1-1.3	Random experiment, sample space, event, probability function
2	1.4-1.7	Properties of probabilities, counting I
3	1.8-1.10	Random variables, simulation
4	2.1-2.2	Conditional probability
5	2.3	Finding $P(A \text{ and } B)$
6	2.4-2.5	Law of total probability and Bayes formula
7	3.1	Independence and dependence
8	3.2-3.3	Independent Random variables, Bernoulli sequences
9	3.4-3.5	Counting II, binomial distributions
10	3.5-3.7	Stirling's formula, Poisson distribution
11	4.1-4.2	Expectation, functions of random variables
12	4.3-4.4	Joint distributions, independent random variables
13	Test 1	Covers Chapters 1-3
14	4.5-4.6	Linearity of expectation, variance and standard deviation
15	4.7-4.8	Covariance and correlation
16	6.1-6.3	Probability density and cumulative distribution functions, uniform distribution
17	6.4-6.5	Expectation and variance, exponential distribution
18	6.6	Functions of random variables
19	6.7-6.8	Joint distributions, independence
20	6.8-6.9	Covariance and correlation
21	7.1	Normal distribution
22	7.2	Gamma distribution
23	Test 2	Covers Chapters 4 and 6
24	7.3	Poisson process
25	9.1-9.3	Weak and strong laws of large numbers, Monte Carlo integration
26	9.4-9.5	Central limit theorem, moment-generating functions
27	10.6	Stochastic process, Markov chain
28	Review	Additional topics, review for final