

Math 423: Stochastic Processes

CATALOG DESCRIPTION

Sequences and classes of random variables. Applications to physical, biological, social and management sciences. Topics include Markov chains, branching processes, the Poisson process, queuing systems and renewal processes.

Prerequisites: Math 238 and Math 318

GOALS OF THE COURSE

- (1) To develop an understanding of the logical structure and style of mathematics and probability by:
 - (a) Using reason in an orderly, cogent fashion.
 - (b) Writing clear, well organized solutions to problems.
 - (c) Evaluating critically and using mathematical definitions.
- (2) To develop the ability to use mathematical tools to solve problems and to transfer this knowledge to analogous situations by:
 - (a) Using tools of linear algebra (matrix multiplication and eigensystems) to answer questions about probabilities and expectation of stochastic processes.
 - (b) Using function operations (e.g., composition and convolution) to answer questions about probabilities and expectations of stochastic processes.
 - (c) Using calculus (differentiation and integration) to answer questions about probabilities and expectation of stochastic processes.
- (3) To develop computational and modeling skills such as:
 - (a) Writing a computer simulation of stochastic processes and collection of relevant data.
 - (b) Applying a stochastic model for a relevant physical process and interpreting probabilistic analysis in terms of that process.
 - (c) Written communication of mathematical ideas in the context of a physical application.
- (4) To develop an understanding of the theory of stochastic processes:
 - (a) The application of conditional probability and conditional expectation.
 - (b) The theory of Markov chains, Poisson processes, branching processes and queuing processes.
 - (c) The theory of limit theorems in stochastic processes.

REQUIRED MATERIALS

Textbook: An Introduction to Stochastic Modeling by Mark Pinsky and Samuel Karlin (4th edition), Academic Press (2011). The 3rd edition by Samuel Karlin and Howard Taylor (1998) is identical for the chapters we will be using (1–9).

In addition to the hard copy book, there is an Amazon Kindle version of both editions, and the 3rd edition has a rental option that is very economical. The 4th edition also has an electronic edition through CourseSmart.com using the following link:

http://www.coursesmart.com/IR/1931417/9780123814166?__hdv=6.8

Technology:

We will be using the open-source R programming language. This is available in many campus laboratory computers and is also available as a free download through the following link:

<http://www.r-project.org/>

INSTRUCTOR INFORMATION

Dr. Brian Walton

Office: Roop 110

Phone: 540-568-6387

E-mail: waltondb@jmu.edu

Website: [Walton's JMU faculty website](#) (with links to various webapps)

Blogs: [Walton's JMU Math Blog](#)

IM: Google, Skype, AIM all using dbrianwalton (but only by appointment)

Drop-In Office Hours: (no appointment necessary)

Mondays 9:00–10:00

Tuesdays 9:00–11:00 and 3:30–4:30

Wednesdays 9:00–10:00

For other times, please contact me in advance for an appointment.

MEETING INFORMATION

Classes will meet every Monday, Wednesday and Friday at Burruss 32
10:10am–11:00am.

IMPORTANT DATES

January 11: No class meeting (conference)

January 15: Last day to drop a class without withdraw

January 21: Martin Luther King, Jr. Day. No classes

March 4–8 Spring Break

Fri, March 15: Last day to withdraw from a class

Fri, May 3: **Final Exam** 8:00am–10:00am

GRADING POLICIES

Course grades will be based on a weighted average of grades in a variety of different grading categories.

- Participation = 5%
- Homework = 30%
- Midterm Take-Home Exam = 20%
- Final Project = 15%
- Final Exam = 30%

The weighted score at the end of the semester will determine the letter grade based on the percentages:

90–100% = A, 80–90% = B, 70–80% = C, 60–70% = D, 0–60% = F.

Pluses and minuses may be rewarded.

HONOR CODE POLICY

The JMU Honor Code (<http://www.jmu.edu/honor/code.shtml>) emphasizes that every action we undertake represents our own, personal contribution, honestly obtained and submitted. It is important that you do your own work and that work you submit represents only your own work.

DISABILITY ACCOMMODATIONS

Students with disabilities who require reasonable accommodations to meet course requirements must register with the Office of Disability Services (<http://www.jmu.edu/ods/>) and contact me to discuss access issues. You will be respected and your confidentiality will be maintained.

ADDITIONAL JMU POLICIES

See <http://www.jmu.edu/syllabus/> (including Attendance, Academic Honesty, Adding and Dropping Classes, Inclement Weather, Religious Accommodations).