

**The George Washington University
Department of Statistics**

**STAT 8273-10
Stochastic Processes**

Spring 2023

Days: Wednesday
Time: 6:10 a.m.-8:40 p.m.
Venue: Fungler Hall 208.

Instructor: Hosam M. Mahmoud, Professor

Office address: 801 22nd Street, Room 770
Telephone: (202) 994-6667
Email: hosam@gwu.edu
Office hours: 4:00-5:15 Tuesday, also available by appointment

Grader: Yi Zhang, Ph.D. Candidate

Email:

Textbooks:

Stochastic Processes. Wiley, New York.

By Sheldon Ross

Prerequisites:

An introductory course in probability at the level of GWU Stat 6201 (or equivalent) is required. Familiarity with all the basic discrete distributions (Bernoulli, binomial, geometric, Poisson, etc.) and all basic continuous distributions (uniform, exponential, normal, gamma, beta, etc.) is assumed. Also, familiarity with convergence concepts (almost surely, in probability, in distribution) should be in your background. We shall start with a review of these concepts and a variety of fun problems.

Topics:

- WEEK 1: Some fun problems on basic probability (poker, urns, etc.). A review of Kolmogorov's axiomatic probability foundation. Weak and strong laws, the central limit theorem: Interpretation as stochastic processes.
- WEEK 2: Conditional expectation.
- WEEK 3: The Bernoulli process, independent increments and stationarity.
- WEEK 4: The Poisson Process.
- WEEK 5: Quiz 1, more on the Poisson Process.
- WEEK 6: Renewal theory, Wald's equation.
- WEEK 7: Midterm, branching processes.
- WEEK 8: Markov chains, Chapman-Kolmogorov equations, classification of states.
- WEEK 9: Stationary distributions and limit distribution.
- WEEK 10: Continuous-time Markov chains.
- WEEK 11: Martingales.
- WEEK 12: Quiz 2, up-crossing and down-crossing theorems. Martingale convergence theorems.
- WEEK 13: Brownian motion.
- WEEK 14: Brownian Bridge.

Learning outcomes

As a result of completing this course, students will be able to:

1. Construct stochastic models in engineering, social sciences and physical phenomena.
2. Have a panoramic overlook of the interplay between probability and other disciplines.

Grading Policy

1 Midterm (25%)

1 Final (35%)

2 Quizzes (10% each)

about 12 homeworks (25%)

Note that these add up to a total of 105 percentage points!.

Here is an example of what constitutes an A grade in this class. You score 95% or above: all homeworks and tests are solid and well done. You can miss a couple of problems here and there and still get an A.

Class Policy

Late work: Will not be accepted.

Makeup exams: Except for medical cases (with proper documentation), there will absolutely be no makeups, you missed an exam, you failed it.

Blackboard

Please check Blackboard frequently, as there may be assignments, announcements, and material passed to the class via this electronic medium during the week. You can find it at

<http://blackboard.gwu.edu/webapps/portal/frameset.jsp>

You need to login, using your GW user ID and password.

For university policies on teaching, see

<http://www.gwu.edu/~academic/Teaching/main.htm>

Academic Integrity

I support the GW Code of Academic Integrity. It states: “Academic dishonesty is defined as cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information.” For the remainder of the code, see:

<http://www.gwu.edu/~ntegrity/code.html>

Any case of the slightest hint of cheating will be prosecuted to the fullest extent of the university Academic Integrity Policy. You will receive an automatic F, and the case will be taken to the proper administrative channels.

Support for students outside the classroom

DISABILITY SUPPORT SERVICES (DSS)

Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in the Marvin Center, Suite 242, to establish eligibility and to coordinate reasonable accommodations. For additional information please refer to:

<http://gwired.gwu.edu/dss/>

UNIVERSITY COUNSELING CENTER (UCC) 202-994-5300

The University Counseling Center (UCC) offers 24/7 assistance and referral to address students' personal, social, career, and study skills problems. Services for students include:

- crisis and emergency mental health consultations
- confidential assessment, counseling services (individual and small group), and referrals

See

<http://gwired.gwu.edu/counsel/CounselingServices/AcademicSupportServices>

Security

In the case of an emergency, if at all possible, the class should shelter in place. If the building that the class is in is affected, follow the evacuation procedures for the building. After evacuation, seek shelter at a predetermined rendezvous location.