

**The George Washington University
Department of Statistics**

STAT 4157-10

Introduction to Mathematical Statistics

Fall 2021

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| Days: | Monday-Wednesday |
| Meeting Time: | 11:00 a.m.-12:15 p.m. |
| Meeting Place: | E 314, 1957 E Street |
| Instructor: | Hosam M. Mahmoud, Professor |
| Email: | hosam@gwu.edu |
| Office hours: | 4:00-5:00 Wednesday |

Plan for COVID-19:

To deal with the reality of the coronavirus and the pandemic, the class plans will be adaptive according to the recommendations of the university, the emergence of new teaching technology and the status of the pandemic. Plans may change as we go along. For example, we may start with streamed in-person meetings then move into an in-line model, if we are ordered again to stay at home. An updated syllabus may be released from time to time.

Textbooks:

Mathematical Statistics with Applications, 7th Edition. Brooks/Cole, Belmont, California.

By W. Mendenhall, D. Wackerly and R. Scheaffer.

Scope:

Probability is presented as a mathematical foundation for statistical inference. All the basics of probability theory are presented: sample spaces, axioms, random variables, discrete and continuous distributions and joint distributions.

Prerequisites:

An introductory course in Statistics and/or probability can be helpful, but is not required. Familiarity with integral and differential calculus is assumed. For example, I expect everyone in the class to know how to compute $\int x^6 dx$, $\int e^{-x} dx$, $\int \ln x dx$. Competence in basic algebra is expected, for example extraction of roots of equations of the second and third degree, and accurate manipulation of algebraic expressions are assumed to be in your background.

Topics:

Combinatory and calculus-based introduction to statistics and probability, axioms, combinatorial probability, Bayes' rule, random variables, discrete distributions (Bernoulli, uniform, binomial, geometric, Poisson) and continuous distributions (uniform, exponential, gamma, normal, beta), expectation and variance, moment generating functions, probability inequalities, joint distributions.

Basically, we shall cover the first four chapters of the textbook and a selection of topics from chapters 5 and 6.

Class plan

- Week 1: Introduction, combinatorial probability
- Week 2: More on combinatorial probability, poker, H (1)
- Week 3: poker, additive and multiplicative probability laws, Independence, Q (1)
- Week 4: Sampling, Bayes' rule, H (2)
- Week 5: Discrete random variables: Bernoulli, binomial, geometric, Q (2)
- Week 6: Hypergeometric distribution, midterm, H (3)
- Week 7: Poisson distribution, Problem session (discrete probability), H (4)
- Week 8: Continuous random variables, uniform, normal H (5)

Week 9: Exponential and gamma distributions, Q (3)
Week 10: Winding up continuous distributions, Problem session H (6)
Week 11: Multivariate (joint) Probability distributions
Week 11: More on joint distributions H (7)
Week 13: Functions of a random variables, Q (4)
Week 14: Time permitting: Order statistics, review, H (8).

Learning outcomes:

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

1. Make probabilistic arguments.
2. Formulate probabilistic models for science, engineering, economics, public policy and many other areas of application.
3. Have a global overview of the interplay between probability and statistics.

Grading Policy:

1 Midterm (20%)

1 Final (40%)

4 Quizzes (5% each)

6-8 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.

Workload:

It is expected that the student will spend about 5-6 hours a week studying and preparing for the class. This time may be evenly split between writing solutions to homework problems and reading in the textbook.

Class Policy:

Late work: Will not be accepted.

Make-up exams: Except for medical cases (with proper documentation), there will absolutely be no make-ups, 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>