

Course Syllabus

ISYE 6739-III

A Gentle Introduction to Statistics

Professor: Dr. David Goldsman

Course Description

This course provides an introduction to basic statistical concepts. We begin by walking through a library of probability distributions – including the normal distribution, which in turn leads to the Central Limit Theorem. We then discuss elementary descriptive statistics and estimation methods.

Prerequisites

You will be expected to come in knowing a bit of set theory and basic calculus, as well as the material from the first two mini-courses in this series (our [Introduction to Probability](#) and [Random Variables](#) courses). The prerequisite material is all available for you to access; and in any event, we will try to make the current course as self-contained as possible. In addition, this course will involve a bit of computer programming, so it would be nice to have at least a little experience in something like Excel.

Course Goals

A Gentle Introduction to Statistics

- Walk through a library of discrete and continuous probability distributions.
- Learn, in particular, about the normal distribution...
- ...and the Central Limit Theorem.
- Study elementary methods of descriptive statistics.
- And then get an introduction to methods that can be used to estimate the unknown parameters of a distribution.

Grading Policy

- There will be one exam for this course. Test questions are multiple choice or T/F.
- There will be four homework assignments for this course. The HWs often have bonus questions, which you can do to earn a few extra points. Let r = the number of required questions, R = the # of required questions you answer correctly, and B = the number of bonus questions you answer correctly. Then your HW grade will be $100 \cdot (R+B)/r$.
- You must achieve an overall weighted average of 60% to pass the course.
- Work hard and you will be rewarded – Grading is usually pretty generous.
- But let's be winners, not whiners. We are happy to discuss grades, but please make reasonable requests. 😊

- Grading Breakdown: For this course, the HW counts as 20% and the exam as 80%.

Exam Policy

- The exam covers all the material in the course.

Plagiarism Policy

Plagiarism is considered a serious offense. You are not allowed to copy and paste or submit materials created or published by others, as if you created the materials. All materials submitted and posted must be your own.

Course Materials

- All content and course materials can be accessed online.
- Suggested textbook: D. Goldsman and P. Goldsman, *A First Course in Probability and Statistics* – available for **free** PDF download. \$ave \$ave \$ave!

For an **inexpensive** hard copy, click the book icon →



Technology/Software Recommendations

- Internet connection (DSL, LAN, or cable connection desirable)
- Adobe Acrobat PDF reader (free download; see <https://get.adobe.com/reader/>)
- Excel (or equivalent)
- R statistical software (free download; see cran.r-project.org) (or similar statistics packages such as Minitab, JMP, SAS, etc.)
- Bonus software: Any “real”, high-level language such as Matlab, Python, etc.

Course Topics and Sample Pacing Schedule

- The table below contains a course topic outline and a SUGGESTED course progression timetable.
- The **SUGGESTED** (but not mandatory) time units are in weeks, so there’s one HW per week.
- Note that some topics below are marked as **OPTIONAL**. We have included this material in case you need additional review or would like to delve into a topic further. You will be given extra credit homework on those topics, but you will not be tested on those topics.

	Course Topics
Week 1	<p>Mini-Course III: A Gentle Introduction to Statistics</p> <p>Module 4: Distributions</p> <ul style="list-style-type: none"> • Lesson 1: Bernoulli and Binomial Distributions (§4.1.1 of text) • Lesson 2: Hypergeometric Distribution (§4.1.2) • Lesson 3: Geometric and Negative Binomial Distributions (§4.1.3) • Lesson 4: Poisson Distribution (§4.1.4) • Lesson 5: Uniform, Exponential, and Friends (§4.2.1–4.2.2) • Lesson 6: Other Continuous Distributions (§4.2.3) • Lesson 7: Normal Distribution: Basics (§4.3.1) <p>Homework</p> <ul style="list-style-type: none"> • Homework 1
Week 2	<p>Module 4 (cont'd): Distributions</p> <ul style="list-style-type: none"> • Lesson 8: Standard Normal Distribution (§4.3.2) • Lesson 9: Sample Mean of Normals (§4.3.3) • Lesson 10: The Central Limit Theorem + OPTIONAL Proof (§4.3.4) • Lesson 11: Central Limit Theorem Examples (§4.3.5) • Lesson 12 [OPTIONAL]: Extensions – Multivariate Normal Distribution (§4.4.1) • Lesson 13 [OPTIONAL]: Extensions – Lognormal Distribution (§4.4.2) • Lesson 14: Computer Stuff, including OPTIONAL Box-Muller Proof (§4.5) <p>Homework</p> <ul style="list-style-type: none"> • Homework 2
Week 3	<p>Module 5: Getting Started with Statistics</p> <ul style="list-style-type: none"> • Lesson 1: Introduction to Descriptive Statistics (§5.1.1) • Lesson 2: Summarizing Data (§5.1.2) • Lesson 3: Candidate Distributions (§5.1.3) • Lesson 4: Introduction to Estimation (§5.2.1) • Lesson 5: Unbiased Estimation (§5.2.2) • Lesson 6: Mean Squared Error (§5.2.3) <p>Homework</p> <ul style="list-style-type: none"> • Homework 3

Week 4	<p>Module 5: Getting Started with Statistics</p> <ul style="list-style-type: none"> • Lesson 7: Maximum Likelihood Estimation (§5.2.4) • Lesson 8: Trickier MLE Examples (§5.2.4) • Lesson 9: Invariance Property of MLEs (§5.2.4) • Lesson 10: Method of Moments Estimation (§5.2.5) • Lesson 11: Sampling Distributions (§5.3) <p>Homework</p> <ul style="list-style-type: none"> • Homework 4 <p>Homework</p> <ul style="list-style-type: none"> • Course III Exam – Study Like Crazy!
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