Introduction to Probability and Statistics with Calculus (UN1201)
Fall 2016
https://courseworks.columbia.edu

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Course Syllabus

Description

This course provides a comprehensive introduction to statistics, the science of data. It is designed for students who desire a strong grounding in statistical concepts with a greater degree of mathematical rigor than in STAT UN1101. Calculus will be used heavily. For your benefit a calculus self evaluation has been placed on courseworks. Topics include random variables, probability distributions, pdf, cdf, mean, variance, correlation, conditional distribution, conditional mean and conditional variance, law of iterated expectations, normal, chi-square, F and t distributions, law of large numbers, central limit theorem, parameter estimation, unbiasedness, consistency, efficiency, hypothesis testing, p-value, confidence intervals, maximum likelihood estimation.

Administrative

Lecture

- Section 001: Mondays and Wednesdays, 8:40AM–9:55AM
  Location: 517 Hamilton Hall

- Section 003: Mondays and Wednesdays, 4:10PM–5:25PM
  Location: 517 Hamilton Hall

- Note: sections 002 and 004 also exist; this syllabus applies only to sections 001 and 003.

Instructor

- John Cunningham
  Office Hours: Wednesdays, 12:00PM–1:00PM, Room 1025, Department of Statistics
  Office: Department of Statistics, Room 1026, 10th Floor School of Social Work, 1255 Amsterdam
  Email: jpc2181@columbia.edu

Teaching Assistants

- Ian Kinsella
  Office Hours:

    - Mondays 5:30-6:00pm, 10th floor lobby, Department of Statistics (Ian)
    - Tuesdays 10:15-11:45am, 10th floor lobby, Department of Statistics (Ian)

  Office: Department of Statistics, 10th Floor School of Social Work, 1255 Amsterdam
  Email: iak2119@columbia.edu

Prerequisites

- A strong foundation in calculus. A calculus refresher is on courseworks, to help you self-evaluate.

Grading and Academic Integrity

I take the honor code very seriously; students caught cheating or otherwise in violation will face disciplinary action. Please note the Barnard honor code text:

> "We... resolve to uphold the honor of the College by refraining from every form of dishonesty in our academic life. We consider it dishonest to ask for, give, or receive help in examinations or quizzes, to use any papers or books not authorized by the instructor in examinations, or to present oral work or written work which is not entirely our own, unless otherwise approved by the instructor.... We pledge to do all that is in our power to create a spirit of honesty and honor for its own sake."
> http://barnard.edu/node/2875
> https://www.college.columbia.edu/academics/academicintegrity

Your grade will be determined by three different components:

- **Homework (20%).** Weekly homework is **due online each Tuesday night at 10PM** (except when otherwise noted). Your lowest two homework grades will be automatically dropped at the end of the term.

- **Midterm Exam (40%).** This will be given in class during midterm week. You will be permitted to use one page of notes (front and back).

- **Final Exam (40%).** This will be given in class during the finals period. You will be permitted to use one page of notes (front and back).

- **Course Participation.** After the course grades are calculated and curved, I will increase the letter grade of the most active participants in the lectures.

Failure to complete any of the first three components may result in a D or F.

Late Work and Regrading Policy: No late work or requests for regrades are accepted. To accommodate unexpected circumstances, we have implemented two important features:

- Your lowest two homework grades will be automatically dropped at the end of the term.

- You may submit and resubmit your homework on Courseworks as many times as you like up until the deadline (see submission particulars below). This means that you should submit any partial solutions as you complete them, to make sure you receive as much credit as possible for the work you have done. After the deadline, the system will not allow you to submit your homework. If you do not submit anything by the deadline, you will get a 0. **There will be no exceptions to this rule. Submit your homework early.**

- No exceptions will be made to this policy.

Homework: Students are encouraged to work together, but homework write-ups must be done individually and must be entirely the author's own work. Weekly homework is due at 10PM Tuesday. **Late homework will not be accepted under any circumstances.** To receive full credit, students must explain how they arrived at their solutions and include the following information on their homeworks: name, UNI, homework number (e.g., HW02), and class (STAT UN1201). All homework must be turned in online through Courseworks in PDF format, have a .pdf extension, and be less than 4MB. Homeworks not adhering to these requirements will receive no credit.

Textbook

Probability and Statistics for Engineering and the Sciences, Ninth edition
Jay L. Devore
Cengage Learning (2016)
ISBN: 978-1-305-25180-9

Course Calendar

- All numbers reference sections of or problems in Devore's text. This calendar is subject to change.

lecture	date	content
1	Sep 7	introduction, warmup, axioms
		• reading: 1.1-1.5
2	Sep 12	counting probability, probability, conditional probability
		• reading: 2.1-2.5
	Sep 13	(HW01 delayed for calculus refresher and bookstore issues)
3	Sep 14	conditional probability, Bayes rule, independence
		• reading: 2.1-2.5
4	Sep 19	discrete random variables, pmf
		• reading: 3.1-3.3
	Sep 20	HW01 due: 2.6, 2.10, 2.18, 2.24, 2.34, 2.44, 2.48, 2.68, 2.74
5	Sep 21	important discrete distributions
		• reading: 3.3-3.6
6	Sep 26	continuous probability distributions, pdf, expectation
		• reading: 4.1-4.3
	Sep 27	HW02 due: 3.10, 3.12, 3.18, 3.28, 3.30, 3.36, 3.42, 3.44
7	Sep 28	expectation and variance
		• reading: 4.3-4.6
8	Oct 3	cdf
		• reading: 4.3-4.6
	Oct 4	HW03 due: 3.52, 3.64, 3.74, 3.86, 3.116, 4.4, 4.10
9	Oct 5	joint distributions
		• reading: 5.1-5.2
10	Oct 10	important sample statistics, law of large numbers
		• reading: 5.3-5.5
	Oct 11	HW04 due: 4.20, 4.38, 4.62, 4.64, 4.70, 4.86, extra problem in lecture notes 03
11	Oct 12	central limit theorem
		• reading: 5.3-5.5
12	Oct 17	linear combinations, sample means, midterm review
		• reading: 5.3-5.5
	Oct 18	HW05 due: 5.2, 5.10, 5.14, 5.26, 5.28, 5.42a, 5.52, 5.66a,b
13	Oct 19	midterm review
14	Oct 24	midterm exam (in class)
		• reading: review chapters 1-5
	Oct 25	(no homework due this week: midterm)
15	Oct 26	point estimation, confidence intervals
		• reading: 6.1-6.2
16	Oct 31	confidence intervals
		• reading: 7.1-7.4
	Nov 1	HW06 due: 6.8, 6.10, 6.26, 7.4a,d,e, 7.14, 7.38
17	Nov 2	hypothesis testing
		• reading: 8.1-8.2
18	Nov 7	(no class; university holiday)
		• reading: 8.3-8.5
	Nov 8	(no homework due this week: election day, university holiday)
19	Nov 9	hypothesis testing and t-tests
		• reading: 8.1-8.3
20	Nov 14	t-tests, paired sample and independent sample t tests

lecture	date	content
		• reading: 9.1-9.3
	Nov 15	HW07 due: 8.2, 8.10, 8.26, 8.30
21	Nov 16	proportions and variances
		• reading: 9.1-9.3, 9.5
22	Nov 21	ANOVA
		• reading: 10.1-10.3
	Nov 22	HW08 due: 9.4, 9.24, 9.42, 9.64, 10.4, 10.8, 10.14
23	Nov 23	optional review (held 0840-0955 only, in regular classroom)
		• reading: 6,7,8,9,10
24	Nov 28	linear regression
		• reading: 12.1-12.2
25	Nov 30	more linear regression
		• reading: 12.2-12.5
	Dec 2	HW09 due: 12.8, 12.10, 12.18, 12.36a,b,c, 12.40, 12.58a,b,c
26	Dec 5	nonlinear and logistic regression
		• reading: 13.1 - 13.3
27	Dec 7	multiple regression
		• reading: 13.4-13.5
	Dec 9	HW10 due: 13.12, 13.14, 13.20, 13.28, 13.36, 13.46
28	Dec 12	final review