

Math 541A, Graduate Mathematical Statistics, Spring 2019

Exterior Course Website: <http://www.stevenheilman.org/~heilman/541as19.html>

Prerequisite: 1 from (Math 505A or Math 407 or Math 408). Note: once you complete 541A, you cannot take 505A for credit.

Course Content: Parametric families of distributions, sufficiency. Estimation: methods of moments, maximum likelihood, unbiased estimation. Comparison of estimators, optimality, information inequality, asymptotic efficiency. EM algorithm, jackknife and bootstrap.

Lecture Meeting Time/Location: Mondays, Wednesdays, and Fridays, 11AM-1150AM, THH 114

Instructor: Steven Heilman, stevenmheilman@gmail.com

Office Hours: Mondays, 9AM-11AM, Wednesdays 10AM-11AM, or by appointment, KAP 406G

TA: Man Luo, manl@usc.edu

TA Office Hours: Mondays 5PM-6PM, Thursdays 10AM - 12PM, Kap 263 (the [Math Center](#)).

Discussion Session Meeting Time/Location: Recommended Textbook: Cassella and Berger, [Statistical Inference](#), 2nd Edition. (A link is available [here](#).)

Other Textbook: (not required): Keener, [Theoretical Statistics](#). (A link is available [here](#).)

First Midterm: Friday, February 22, 11AM-1150AM, THH 114

Second Midterm: Wednesday, Apr 3, 11AM-1150AM, THH 114

Final Exam: Wednesday, May 1, 11AM-1PM, Location TBD

Email Policy:

- My email address for this course is stevenmheilman@gmail.com.
- It is your responsibility to make sure you are receiving emails from stevenmheilman@gmail.com, and they are not being sent to your spam folder.
- Do NOT email me with questions that can be answered from this document.
- Homework questions sent to me by email will be answered altogether in the form of a “digest.” I will get to every question, but I cannot reply to every email. This digest will be sent out typically two days before the homework is due. So, one digest will answer online homework questions on Sunday, and another digest will answer quiz questions around Tuesday.

Exam Procedures: Students must bring their USCID cards to the midterms and to the final exam. Phones must be turned off. Cheating on an exam results in a score of zero on that exam. Exams can be regraded at most 15 days after the date of the exam. This policy extends to homeworks as well. All students are expected to be familiar with the [USC Student Conduct Code](#). (See also [here](#).)

Disability Services: If you are registered with disability services, I would be happy to discuss this at the beginning of the course. Any student requesting accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. DSP is located in 301 STU and is open

8:30am-5:00pm, Monday through Friday.

<https://dsp.usc.edu>

213-740-0776 (phone)

213-740-6948 (TDD only)

213-740-8216 (fax)

ability@usc.edu

Exam Resources: [Here](#) is a page containing USC Stats A Qual Exams with solutions. [Here](#) and [here](#) are former 541A course pages with several helpful links and references.

Other Resources: [An introduction to mathematical arguments](#)

Homework Policy:

- Late homework is not accepted.
- If you still want to turn in late homework, then the number of minutes late, divided by ten, will be deducted from the score. (The time estimate is not guaranteed to be accurate.)
- The lowest homework score will be dropped. This policy is meant to account for illnesses, emergencies, etc.
- Do not submit homework via email.
- There will be 7 homework assignments, assigned weekly on Friday and turned in at the **beginning** of class on the following Friday.
- A random subset of the homework problems will be graded each week. However, it is strongly recommended that you try to complete the entire homework assignment.
- You may use whatever resources you want to do the homework, including computers, textbooks, friends, the TA, etc. However, I would discourage any over-reliance on search technology such as Google, since its overuse could degrade your learning experience. By the end of the quarter, you should be able to do the entire homework on your own, without any external help.
- All homework assignments must be **written by you**, i.e. you cannot copy someone else's solution verbatim. However, I would very much encourage you to form study groups and do the homework together in small groups. Homework is the most important part of a graduate mathematics course, and I encourage you to take it very seriously.
- Homework solutions will be posted on Friday after the homework is turned in.

Grading Policy:

- The final course grade is weighted as the larger of the following two schemes. Scheme 1: homework (25% However, anyone who exceeds my expectations in the class by showing A-level performance on the exams and homeworks will receive an A for the class.

- If you cannot attend one of the exams, you must notify me within the first two weeks of the start of the quarter. Later requests for rescheduling will most likely be denied.
- You must attend the final exam to pass the course.

Tentative Schedule: (This schedule may change slightly during the course.)

Week	Monday	Tu	Wednesday	Th	Friday
1	Jan 7: 1.1-1.6, Review of Probability		Jan 9: 1.1-1.6, Review of Probability		Jan 11: 2.1-2.4, Review of Probability
2	Jan 14: 2.1-2.4, Review of Probability		Jan 16: 3.1-3.6, Review of Probability		Jan 18: Homework 1 due. 3.4, Exponential Families
3	Jan 21: No class (MLK Day)		Jan 23: 3.4, Exponential Families		Jan 25: 4.1-4.7, Review of Probability
4	Jan 28: 4.1-4.7, Review of Probability		Jan 30: 4.1-4.7, Review of Probability		Feb 1: Homework 2 due. 5.1 Random Sample
5	Feb 4: 5.2, Sums of Random Variables		Feb 6: 5.3, Sampling from the Normal		Feb 8: 5.4, Order Statistics
6	Feb 11: 5.4, Order Statistics		Feb 13: 5.5, Modes of Convergence		Feb 15: Homework 3 due. 5.5, Delta Method
7	Feb 18: No class		Feb 20: 5.6, Generating a Random Sample		Feb 22: Midterm 1
8	Feb 25: 5.6, Generating a Random Sample		Feb 27: 6.2, Sufficiency		Mar 1: 6.2, Sufficiency
9	Mar 4: 6.2.4, Completeness		Mar 6: 6.3, Likelihood		Mar 8: Homework 4 due. 6.4, Equivariance
10	Mar 11: No class (spring break)		Mar 13: No class (spring break)		Mar 15: No class (spring break)
11	Mar 18: 7.2, Point Estimation		Mar 20: 7.2.1, Method of Moments		Mar 22: Homework 5 due. 7.2.2, Maximum Likelihood Estimators
12	Mar 25: 7.2.2, Maximum Likelihood Estimators		Mar 27: 7.2.2, Maximum Likelihood Estimators		Mar 29: 7.2.3, Bayes Estimator
13	Apr 1: 7.2.4, EM Algorithm		Apr 3: Midterm 2		Apr 5: 7.3, Comparison of Estimators
14	Apr 8: 7.3.2, Unbiased Estimators		Apr 10: 7.3.2, Unbiased Estimators		Apr 12: Homework 6 due. 7.3.3, Sufficiency and Unbiasedness
15	Apr 22: 7.66, Jackknife Resampling		Apr 24: 10.1.4, Bootstrapping		Apr 26: Homework 7 due. Review of course (last day of class)

Advice on succeeding in a math class:

- Review the relevant course material **before** you come to lecture. Consider reviewing course material a week or two before the semester starts.

- When reading mathematics, use a pencil and paper to sketch the calculations that are performed by the author.
- Come to class with questions, so you can get more out of the lecture. Also, finish your homework at least **two days** before it is due, to alleviate deadline stress.
- Write a rough draft and a separate final draft for your homework. This procedure will help you catch mistakes. Also, I would very much recommend [typesetting](#) your homework. Learning LaTeX is a very important skill to have for doing mathematics. [Here](#) is a template .tex file if you want to get started typesetting.
- If you are having difficulty with the material or a particular homework problem, review Polya's [Problem Solving Strategies](#), and come to office hours.