Fall Semester 2011: M384C / SSC384 Topic 2 / CSE 384R

Graduate Course Description

Course Title: Mathematical Statistics I
Instructor: Prof. Mary Parker

RLM 13.160
Email: parker@math.utexas.edu
Homepage: http://www.ma.utexas.edu/users/parker

Brief description:

The two semesters of this course (SSC384 Topic 2 and SSC384 Topic 3) are designed to provide a solid theoretical foundation in mathematical statistics.

During the TWO-SEMESTER course, the statistical topics include the properties of a random sample, principles of data reduction (sufficiency principle, likelihood principle, and the invariance principle), and theoretical results relevant to point estimation, interval estimation and hypothesis testing.

During the first semester, SSC 384 Topic 2, students are expected to use their knowledge of an undergraduate upper-level probability course and extend those ideas in enough depth to support the theory of statistics, including some work in hierarchical models to support working with Bayesian statistics in the second semester. Students are expected to be able to apply basic statistical techniques of estimation and hypothesis testing and also to derive some of those techniques using methods typically covered in an undergraduate upper-level mathematical statistics course. A brief review of some of those topics is included. Probability methods are used to derive the usual sampling distributions (min, max, the t and F distributions, the Central Limit Theorem, etc.) Methods of data reduction are also discussed, particularly through sufficient statistics. This includes the five chapters of the text and part of the sixth chapter as well as some additional material on estimation and hypothesis testing.

Prerequisite:
M362K, Probability, and M378K, Introduction to Mathematical Statistics, or the equivalent. Course descriptions of 362K and 378K are available on the web and more information about equivalencies is available from http://www.ma.utexas.edu/users/parker/384/prereq/

Textbook: *Statistical Inference* by George Casella and Roger L. Berger, second edition

Consent of Instructor Required: Yes.

Grading:
Midterm Exam: Thursday, October 21, 2010 Final Exam: Thursday, December 9, 2010 Course grade of A or A- or B+: That average on the two tests AND at least 90% average on the assignments AND reasonable class participation. Course grade of B or B-: That average on the two tests and at least 75% average on the assignments AND reasonable class participation. Students who make below B- on the midterm will be offered an opportunity to do some makeup work so that the midterm grade does not pull down the overall average very far below the final exam grade. A student who made below a B- on the midterm exam should not expect that makeup work will enable them to make an A or A- in the course. Course grade of below B: Average of the three grades, weighted equally: Assignments, Midterm Exam, Final Exam.

Withdrawal dates: See the appropriate year's calendar at http://www.utexas.edu/student/registrar/

Assignments:
There are two types of assignments in this course. One type is homework to be submitted eight times during the semester (approximately every two weeks.) The other type is a journal of explorations of prerequisite material and computational methods, to be prepared by groups of three students, submitted through Blackboard, and for which you will receive a group grade. Your assignment grade is 90% from the homework and 10% from the group grade on the journal.

Homework:
You are expected to do all homework assignments. No homework will be accepted for grading later than the beginning of class on the day it is due. If you do a homework assignment late, you may get feedback on it by discussion of your work on it during office hours. Assuming that you have shown that you have worked on all the assignments, the two lowest grades (out of seven) will be dropped before computing the homework average.

Homework 1, which is due on the third day of class, and Homework 5, which is due one week after the midterm exam, are each about half as long as the other homework assignments, and worth 25 points each, so those two grades are added together for one grade. All the other homework assignments have approximately 9 problems and are worth 50 points each. This results in seven grades, each on a scale of 0-50.

Journal:
A space within Blackboard will be assigned for you to use to conduct electronic discussions and compile summaries of those discussions. Questions will be provided in class for you to explore. Grading will be basically on participation, that is, if there is clear evidence that all members of the group are doing some explorations, interacting with each other productively about those explorations, and are writing some summaries of what they learn from these explorations, your group will receive a good grade. The journals will be graded twice during the semester: at the end of September and again at the end of the semester. The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TTY.

Software:
I will provide scripts and explanations of how to use R to do the types of calculations I expect you to do. You will be required to learn enough about R to adapt these scripts to use different functions and investigate different statistics. You will not be tested on your skill with R. The point of using R is for us all to have a common language to simplify communication about computations.

Little of the class time will be devoted to traditional lectures. You are expected to read the textbook and supplemental materials and to pay appropriate attention to the definitions, theorems, and proofs. Class time will be devoted to lecture/discussion of an overview of the material and the details of the theory that are hard to understand from reading alone, and problem solving.

I strongly suggest that you arrange to work with a study partner(s) on the homework. You should meet at least once a week to discuss the course. Typically, you will each review your class notes, do the reading, and attempt the homework independently before meeting with your study partner(s). You are encouraged to discuss homework; however, **all written homework must be written by you. Copying solutions from other students in the class, former students, tutors, or any other source is strictly forbidden**. Your solutions must be those that you fully understand and can produce again (and solve similar problems) without help. The ideal model to follow is first to work independently, then to discuss issues with your fellow students, and then to prepare the final write-up.

Exams must be done individually
Exams will be written in a new composition book. Copies of some definitions and theorems from the textbook will be provided to use during exams.

Homework Guidelines
There are three stages in preparing the solution to a problem in this class. 1. Outline the steps to indicate your understanding of the statistical topics and concepts. 2. Identify the mathematical techniques needed to carry out those steps. 3. Carry out the mathematical techniques correctly.

Stages 1 and 2: It is not particularly surprising that, in a math course, students spend the most time on Stage 3. However, in this course, the main content of the course concerns Stage 1 and both Stage 1 and Stage 2 need careful attention. In the beginning of the course in the first semester, some of the problems are short enough that it may seem artificial to split each homework solution into three stages. By the end of the first semester and certainly in the second semester, the problems are long and involved enough that this will not seem at all artificial and, indeed, will be helpful. Starting no later than the second homework assignment, for each homework problem, I expect you to write something for each of the first two stages. It is particularly important that you do this on all test problems. The grading for each test takes into account your understanding of the concepts and of how to perform the mathematical analyses.

Stage 3: As a professional in a quantitative field, you will be expected to be mathematically sophisticated enough to know whether or not you are carrying out a mathematical technique correctly. I expect you to practice that sophistication in all material submitted in this course. For example, don't ever turn in a problem requiring an integral where you just worked on it as far as you could and then wrote the answer you knew it should have, hoping the instructor or grader wouldn't notice that the solution wasn't complete. Instead, find the help you need to fully carry out the solution correctly before you submit the paper, as you will do in your professional activities.

Also, you must show all of your steps in carrying out the mathematical techniques. Explain what you are doing as if you are teaching it to someone. People who write journal articles often leave out most of the easy steps and just show the hardest steps. That is fine for journal articles, but it is not appropriate for a classroom situation where you need to be convincing the instructor that you understand the reasons for all the steps you are doing.

Prepare for exams: While the problems we work in class and the homework problems are important in themselves, keep in mind that you are preparing to do similar work under exam-like conditions. That means limited time for exams, not having examples available, and not being able to discuss the problems with others. All of those feel different from the situation in which students normally do homework. Start early on each homework assignment and organize your time and efforts so that you organize your thoughts about the statistical concepts and what techniques are needed very early in the process. This is, by far, the hardest part of working these problems. We will spend a considerable amount of class time discussing this. If you wait until we talk about the homework problems during class, you will have missed about half of the learning experiences. This gives you time to obtain the help you need to do all the problems thoroughly and correctly BEFORE the homework is due. Write notes about what you needed to understand to do these problems as well as the problems we work in class. (You cannot use those notes during the test, but they will be useful when you are studying for the test.) When you get help, be sure that you are thinking through the logic of what the other person is telling you, that you fully understand it, and that you could modify that logic to solve similar problems. If you don't understand it, or don't agree with it, you should not use it in a solution.

Exam Guidelines

Exam problems will cover the material from the course – from lectures, discussions, problems worked / discussed in class, specific assigned reading, journal questions, homework, and similar problems. You must use a new composition book (100 pages) for each exam. This is clearly longer than needed, but I want to be sure each of you has plenty of room for your work. You will be required to leave about six pages blank at the beginning of the book so that, before you turn it in, you can use those six pages to write a "table of contents" of which pages of your work should be graded. Purchase a book like this to bring to each exam. Throughout the course, including on tests, you'll be expected to use standard statistical tables (available on the course website) and a scientific calculator. During tests you'll also have available the basic formulas about the various distributions on pages 621-626 in the back of the text and a set of some definitions and theorems from our text. The list of what is provided for that chapter will be available early in the time when the chapter is being covered. No other notes will be allowed during the tests.

Many students find it is useful to write a set of notes with important examples, ideas, and methods they are learning as they go through the problems in class and in the homework. While you can't use notes like this during the tests, they are excellent to study from when you prepare for the tests.

For the mid-term exam, you will not be restricted to just the class time. We will start at the beginning of the regular class time and you will have 3 hours for the exam. The final exam period is 3 hours long and I will allow at most half an hour past that.

Calculus facts: The notes for the exam will include a list of calculus facts, which will be provided to you within the first four weeks of the semester. I don't promise that all of the things that are provided will be needed, nor do I promise that all the calculus you will need to do on any test problem will be covered on these notes. But I am not deliberately withholding some calculus facts in order to trick you with them on tests. My intention is to give assistance to those of you who are reviewing your calculus as you work through this course.

Course Information SDS 387: Linear Models Unique number: 57535 Spring 2015

Instructor. Peter Müller. My office is R.L.M 11.174. I will hold office hours from 4-5 on Mo and Wednesday. If you cannot make my office hours and would like to come by, please make an appointment with me. My office telephone is 471-7168.

Prerequisites. Graduate standing, knowledge of mathematical statistics at a graduate level and linear algebra at an advanced undergraduate level is required as well as basic coding skills (R, Matlab, or Stata). Some prior knowledge of Bayesian inference is desirable. The course will include a brief review of Bayesian inference (see the textbook below).

Text. The textbook for the course is "Plane Answers to Complex Questions: The Theory of Linear Models" by R. Christensen, Springer-Verlag. I will place one copy on reserve in the Math library. The heart of the course will be chapters 2-6, complemented by extensive additional material on Bayesian inference for linear models. As additional text and reference for Bayesian inference we will use "A First Course in Bayesian Statistical Methods" by P. Hoff. (Any other introduction to Bayesian inference is fine – no need to buy this particular book if you have others). P. Hoff's book is available as e-book at UT libraries. You can get a paperback copy for $25 from Springer-Verlag.

Course Grading and Exams. There will be two midterm exams, each counting 25% of the course grade.

- Exam 1 will be on We, Mar 4 (tentative)
- Exam 2 will be in We, Apr 1 (tentative).
- Exam 3 will be in We, Apr 22 (tentative).

Homework problems will count for the remaining 25% of the course grade.

Homework. Homework problems will be assigned throughout the semester. Some problems will involve computational work. I recommend the use of R.

Group work. Students are encouraged (but not required) to work on homeworks in groups. Please hand in one assignment with all group member names. No need to register groups besides simply putting the names on the assignment. You can change groups at any time.

Website. Please visit the canvas site for this course

https://utexas.instructure.com/courses/1136021

Homework assignments will be posted there.

Students with disabilities. Please notify me of any modification/adaptation you may require to accommodate a disability-related need. You will be requested to provide documentation to the Dean of Students Office, in order that the most appropriate accommodations can be determined. Specialized services are available on campus through Services for Students with Disabilities.

Week-by-week schedule

In this class we will discuss the practical application of the projection approach to linear models. The course will begin with a review of essential linear algebra concepts including vector spaces, basis, linear transformations, norms, orthogonal projections, and simple matrix algebra. It continues by presenting the theory of linear models from a projection-based perspective. Still on the projection framework, Bayesian ideas will be introduced. Additional topics include: (i) Analysis of Variance; (ii) Generalized Linear Models; and (iii) Variable Selection

Therefore, the important prerequisites for the class are

- Mathematical statistics at a graduate level and linear algebra at an undergraduate level
- You should know some Bayesian inference. Well, you need not be experts. But you should be able to describe how a posterior distribution summarizes an inference problem, and why posterior simulation is important. The class will include a brief review of Bayesian inference.
- You should know some basic probability. At least you should know how to define a Markov chain. No worries I don't expect that you remember all details about classifying states etc :-)
- You should be familiar with some basic computation, ideally with R (a statistical programming language). Matlab is fine too. The class is not about programming, but you will need to know enough to implement simple algorithms for homework problems etc.

Text book:

- Plane Answers to Complex Questions: The Theory of Linear Models -Christensen (C)
- A First Course in Bayesian Statistical Methods -Hoff (H)

C will be our main reference.
H is a good review of Bayes, but no need to buy it for the course.

List of topics to be covered

Week 1-3: Jan 21, 26/28; Feb 2/4

Review: linear algebra, distribution theory & Bayesian inference (some of this material will be reviewed only later when and as needed)

1. **Introduction to Linear Models:** Random Vectors, Matrices
   a. C: Chapter 1, Appendix A & B
2. **Multivariate Normal Distribution Theory:** C: Chapter 1, Appendix A & B
3. **Conditional Normal Distributions: C:** Chapter 1, Appendix B and C
4. **Chi-Square and non-central Chi-Square:** Quadratic Forms C: Appendix B
5. **Eigenvalues,** Distributions of Quadratic Forms, Orthogonal Projections
   a. C: Appendix B
6. **More Distributional Results:** C: Appendix C C: Chapter 2

Week 4: Feb 9/11

1. **Intro to Bayes:** H: chapters 3,5,6

Weeks 5-6: Feb 16/18, 23/25

1. **Models:** Maximum Likelihood Estimates
   C: Chapter 2
2. **Identifiability & Estimation:** C: Chapter 2
3. **Gauss-Markov:** C: Chapter 2
4. **Weighted Regression:** C: Chapter 10

Week 7: Mar 2/4

1. **Bayesian Regression:** H: Chapter 9; C: 2
2. Mar 4: Midterm 1
3. **Marginal & Predictive Distributions**: Default Priors

Week 8: Mar 9/12

1. **Shrinkage Methods:** C. Chapter 14
2. **Bayesian Shrinkage**

Week 9: Mar 23/25

1. **Lasso Shrinkage**
2. **Bayesian Lasso:** Carvalho, Polson Scott, Hans, Park & Casella

Week 10: Mar 30/Apr 1

1. **tests**: Likelihood Ratio Tests, F-tests & Analysis of Variance, Bayes Factors versus P-values C: Chapter 3 -5; C: Chapter 6-7
2. Apr 1: Midterm 2

Week 11: Apr 6/8

1. Bayesian Model Choice/Averaging: Clyde & George, (Statistical Science, 2004)" Model Uncertainty" Liang et al. (JASA, 2008)" Mixtures of g-priors"

Weeks 12-15: Additional topics

1. **Improper Priors and Model Selection:** Intrinsic Bayes Factors Casella & Moreno (JASA, March 2006)
2. **Outlier Analysis:** Christensen Ch 13
3. **Bayesian Outlier Analysis:** Chaloner & Brant (Biometrika, 1988); Hoeting et al (Comp Stat & Data Analysis, 1996) 5

SDS 384-11

Theoretical Statistics
Spring 2024
Tu/Th 2-3:30

Professor	Purnamrita Sarkar
Class	GDC 1.406
Office Hours	TBD via Zoom
Email	`purna.sarkar@austin.utexas.edu`

Syllabus

Course Description

This course provides an introduction to theoretical frequentist Statistics. The first half of the course covers concentration of measure and U statistics, etc. The second half introduces basics from empirical processes, asymptotic testing and applications including bootstrap, subsampling, kernel regression etc.

We will cover

- Consistency of parameter estimates
  - Stochastic Convergence
  - Concentration inequalities
    - Sub-gaussian, sub-exponential random variables
    - Martingale methods
    - Lipschitz continuous functions of standard normal R.V's
    - Talagrand's inequality
  - Efron-Stein inequalities
- U Statistics and its applications in Statistics and Computer Science
- Uniform law of large numbers
  - VC classes
  - Covering numbers
  - Chaining and Dudley's entropy integral
- Bootstrap and subsampling
- Covariance estimation (If time permits).

Prerequisites Students are expected to have a good familiarity with Calculus and undergraduate probability.

Textbook

This course is designed to be self-contained, and there is no required textbook. Two textbooks that you may find useful is:

- High dimensional Statistics: A Non-Asymptotic viewpoint, Martin Wainwright, Cambridge,
- Asymptotic Statistics, Aad van der Vaart. Cambridge. 1998.
- Convergence of Stochastic Processes, David Pollard. Springer. 1984. Available on-line at `http://www.stat.yale.edu/~pollard/1984book/`

Course website

https://psarkar.github.io/sds384.html

Evaluation Grading - 4-5 homeworks (60%), class participation (10%), Final Exam (30%)

Class participation 2% is for speaking up and asking questions. If you don't do that at all, you will lose this portion. 8% is for peer grading. You will be divided into 5 groups. Every two weeks, one group will grade the homeworks of the rest of the class. I will grade the homeworks for the grading group. Simple calculations say that, in the whole course of the class, any one of you will grade around one homework of 4 students, so 4 assignments. **Remember that this does not mean you submit homeworks in groups. This is just for grading.**

Homework will be assigned biweekly and due via canvas. You must submit a PDF and latex version of your homework. Please do **not** include your names on your homework submission. *Please note that everyone has to submit their homework* ***written in their own words****. Nearly identical assignments from two persons will result in a zero grade for that entire HW.*

Exam There will be one in-class final exam.

Attendance: The class modality will be in person. Attendance is recommended, but not mandatory. Masks and physical distancing are strongly recommended. If you are unwell, I strongly recommend staying at home. I will make the day's material available.

Requests for Regrade: Clerical requests will be corrected without hassle. Other regrading requests must be submitted in writing within 2 days of the assignment/exam return. Be aware that the entire assignment/exam will be subject to regrading, and grades may go up or down.

Students with Disabilities

Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 512-471-6259, `http://www.utexas.edu/diversity/ddce/ssd/`.

Religious Holidays

By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

Scholastic Honesty

We expect students to behave with integrity. Students found Cheating on exams or homeworks will receive a score of zero for that exam or assignment, and may be subject to additional disciplinary action. For more information on the University of Texas scholastic dishonesty policy, see the 2006-2007 General Information Catalog, Appendix C.

Campus Safety

Please note the following recommendations regarding emergency evacuation from the Office of Campus Safety and Security, 512-471-5767, `http://www.utexas.edu/safety`:

- Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting and assembling outside.
- Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.
- Students requiring assistance in evacuation should inform the instructor in writing during the first week of class.
- In the event of an evacuation, follow the instruction of faculty or class instructors.
- Do not re-enter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin Police Department, or Fire Prevention Services office.
- Behavior Concerns Advice Line (BCAL): 512-232-5050
- Further information regarding emergency evacuation routes and emergency procedures can be found at: `http://www.utexas.edu/emergency`.

Course Information SDS 386D: Monte Carlo Statistical Methods Unique number: 57530 Spring 2015

Instructor. Peter Müller. My office is R.L.M 11.174. I will hold office hours from 4-5 on Monday and Wednesday. If you cannot make my office hours and would like to come by, please make an appointment with me. My office telephone is 471-7168.

Prerequisites. Graduate standing, knowledge of mathematical statistics as well as basic coding skills (ideally R, or Matlab or something equivalent). Some prior knowledge of Bayesian inference is needed. (At the level of Peter Hoff's book – see below). The course will start with a brief review of Bayesian inference (see the textbook below).

For a quick self-test, whether this class is right for you: Do you know

- Bayesian inference? Do you know how to do posterior inference in a normal linear regression? In a hierarchical model?
- Basic probability? Do you know what a Markov chain is?
- Some basic computation, ideally in R (or matlab or anything equivalent). The class will not be about computation, but you will need it for homeworks. Can you program an iterative loop, functions (macros)?

Text. The main textbook for the course is

> Dani Gamerman and Hedibert F. Lopes, "*Markov Chain Monte Carlo: Stochastic Simulation for Bayesian Inference,*" Chapman & Hall/CRC Texts in Statistical Science.

The class will cover more material and some more detail than the book. But the book is an excellent reference and overview. As additional text and reference for Bayesian inference we will use

> P. Hoff, *"A First Course in Bayesian Statistical Methods",* Springer-Verlag.

available as e-book at UT Libraries – for $25 you can ask them to print your personal copy. See http://www.springer.com/librarians/e-content/mycopy?SGWID=0-165802-0-0-0 for instructions. I also recommend reading the excellent (public domain) lecture notes for a recent short course by

> Ioana A. Cosma and Ludger Evers, "*Markov Chain Monte Carlo Lecture Notes",* http://users.aims.ac.za/~ioana/

Course Grading and Exams. There will be 3 midterm exams, each counting 25% of the course grade.

- Exam 1 will be on We, Mar 4 (tentative)
- Exam 2 will be in We, Apr 1 (tentative).
- Exam 3 will be in We, Apr 22 (tentative).

(Dates to be confirmed in the first class). All three midterms will be take-home. All three are likely to involve some computation (nothing fancy – R programming should do).

Homework problems will count for the remaining 25% of the course grade. There will be one problem set approximately every two weeks.

Homework. Homework problems will be assigned throughout the semester. Problems will involve sometimes heavy computational work. The use of R is recommended, but not required.

Group work. Students are encouraged (but not required) to work on homeworks in groups. Please hand in one assignment with all group member names. No need to register groups besides simply putting the names on the assignment. You can change groups at any time.

Website. Please visit the canvas site for this course

https://utexas.instructure.com/courses/1136020

Homework assignments will be posted there.

Students with disabilities. Please notify me of any modification/adaptation you may require to accommodate a disability-related need. You will be requested to provide documentation to the Dean of Students Office, in order that the most appropriate accommodations can be determined. Specialized services are available on campus through Services for Students with Disabilities.

Week by week outline

In this class we will discuss simulation-based methods to implement Bayesian statistical inference, with an emphasis of Markov chain Monte Carlo methods. Therefore the important prerequisites for the class are

- You should know some Bayesian inference. Well, you need not be experts. But you should be able to describe how a posterior distribution summarizes an inference problem, and why posterior simulation is important.
- You should know some basic probability. At least you should know how to define a Markov chain. No worries -I don't expect that you remember all details about classifying states etc :-)
- You should be familiar with some basic computation, ideally with R (a statistical programming language). Matlab is fine too. The class is not about programming, but you will need to know enough to implement simple algorithms for homework problems etc.

Text book:

- MCMC, by Gamerman & Lopes
- A First Course in Bayesian Statistical Methods -Hoff (H)

GL will be our main reference
H is a good review of Bayes, but no need to buy it for the course.

List of topics to be covered

As we proceed, I will put dates on the topics.

Weeks 1-2: Jan 21, 26/28:

1. **Review of Bayesian inference H:** chapters 3,5,7
2. **Bayesian Regression H:** ch 9, 11

Week 3: Feb 2/4

1. **Monte Carlo Integration GL:** Ch 3

Week 4: Feb 9/11

1. **Metropolis-Hastings GL:** Ch 6

Week 5: Feb 16/18

1. **Gibbs GL:** Ch 5

Week 6: Feb 23/25

1. **Convergence**

Week 7: Mar 2/4

1. **Transdimensional MCMC :** Pseudo priors: Carlin & Chib (1995, JRSSB) RJ MCMC: Green (1995 Biometrika)
2. Mar 4: Midterm 1

Week 8: Mar 9/12

1. Catch up…

Week 9: Mar 23/25

1. **MCMC in nonparametric Bayes models,** MAD Bayes (if time permits...)

Week 10: Mar 30/Apr 1

1. **Approximate Bayesian Computation (ABC):** Marin et al. (2011 Stat & Computing)
2. April 1: Midterm 2

Week 11: Apr 6/8

1. **Hybrid Monte Carlo**

Week 12: Apr 13/15

1. **Exact approximate methods**

Week 13: Apr 20/22

1. **Test of fit:** DIC: Spiegelhalter et al. (2002, JRSSB) Chi-square TOF: Johnson (2004, Annals of Stat) Convergence diagnostics

Week 14: Apr 27/29

1. **Particle filter:** dynamic Monte Carlo
2. Apr 29: Midterm 3

Week 15: May 4/6 catch up…

1. May 6: last class