

# Syllabus for Penn State STAT 540, Fall 2019

## Computationally Intensive Statistical Inference

**Instructor:** Murali Haran, Professor, Department of Statistics, Penn State University, University Park, Pennsylvania.

Office: 326 Thomas Building

Office Hours: Tuesdays 1-2 pm or by appointment

**Grader:** Vincent Pisztor, PhD Student

Office Hours: by appointment

**Email communication:** You can reach me and the TA through email via Canvas.

**Class Times:** TuThu 10:35-11:50 am in Boucke 306.

**Prerequisites:** STAT 513 and 514 or equivalent Casella and Berger level mathematical statistics sequence, and at least one course in computer programming (undergraduate level would suffice)

**Textbook:** None; occasional lecture notes posted on Canvas (*please do not distribute*).

References: Numerical Analysis for Statisticians by K. Lange and Computational Statistics by G.H. Givens and J.A. Hoeting.

**Coverage:** The main topics covered in the course are:

- Statistics-relevant computing basics; matrix computations
- Numerical integration, Laplace approximations
- Monte Carlo methods: foundations, importance sampling, Markov chain Monte Carlo
- Bootstrap
- Optimization: unconstrained; second and first order methods, including stochastic gradient
- Surrogate methods: EM/MM
- Advanced topics (time permitting)

**Course Website:** Main: <http://personal.psu.edu/muh10/540/540.html>

Course schedule: <http://personal.psu.edu/muh10/540/schedule540.Fall2019.html>

Please bookmark these website. I will use the course website in tandem with Canvas for course related communications.

### Course Requirements:

- Homework (50%). You may discuss them but they *must be written up independently*. The homework assignments may vary in length and difficulty, and hence may differ in the number of points they are worth.
- Course project (50%: proposal + reports + presentation). I expect this to be a substantial project. Possibilities include: original research, review of existing methods, extensive simulation studies, or some combination of all of the above. I will determine whether the scope of your project is appropriate for this course. Important: **(1) The project must be focused on algorithms used for statistics/probability; (2) You must obtain my approval for the topic; (3) You may not submit a project from a different class for this class. Also, your project cannot be thesis research that you were planning to do before you began this course.**

### Course Rules:

1. Homework will be due online **on Canvas**. Unless you contact me with a good reason ahead of time (*at least 1 day in advance*), the following late policies hold: submit your homework by midnight on the same day with a 20% reduction or 10:30 am the next day with a 50% reduction in your score. No late homework will be accepted after that time under any circumstance. *You have 1 week to appeal any grade. No grade changes will be made 1 week after a graded homework is returned.*
2. You are welcome to use any computer language you like, as long as you make it easy for the TA to grade your work, and run your code. I strongly recommend you use R since most of the class examples will be in R.
3. Homework submissions: All students are required to submit *typed* computing assignments. Statistics graduate students are required to use LaTeX to write up assignments.
4. Academic Integrity and Mutual Respect: All Penn State University, College of Science, and Department of Statistics policies regarding ethics, honorable behavior, and mutual respect apply in this course.
  - Penn State's Policies <https://studentaffairs.psu.edu/support-safety-conduct/student-conduct/code-conduct>
  - College of Science's Academic Integrity Policy <http://science.psu.edu/current-students/Integrity/Policy.html>
  - College of Science's Code of Mutual Respect and Cooperation <http://science.psu.edu/climate/code-of-mutual-respect-and-cooperation>
5. If you have a disability-related need for reasonable academic adjustments in this course, contact the Student Disability Resources (SDR) at 814-863-1807 or visit their website <http://equity.psu.edu/student-disability-resources>