Math475: Statistical Computing
Fall 2019

Instructor: Professor Nan LIN
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Time and location: 12 -12:50pm MWF at Crow 206
Office hours: 1-2pm Monday and 11-11:50am Wednesday
Grader: TBA

General information


Class webpage: All homework assignments, handouts, and other information will be available on Canvas (http://mycanvas.wustl.edu/). Students are responsible for checking the class webpage frequently for updates.

Course Description

The aim of this course is to introduce modern computational statistics methods rather than being a programming course. Prior knowledge of basic R programming is assumed. Topics to be covered in this class include: R markdown/knitr, data visualization, numerical methods in R, Pseudo-random number generation, Monte Carlo approximation, bootstrap procedures, Markov chain Monte Carlo methods, permutation tests, etc..

Learning Objectives

Students are expected to gain theoretical understanding to the statistical methods covered in class, and are able to implement the methods in R in real applications and integrate them into future research.

Prerequisite

- **Math and statistics**: Calculus; linear algebra; probability and statistics at the level of Math493/494 is required. To benefit more from this class, students should have also taken at least one course on statistical models such as math322, math420, math434, math439, or equivalent.

- **Programming**: Programming skills are essential for this class. Familiarity with R is required. To review basic R programming, students may refer to the online book “An Introduction to R” at http://cran.r-project.org/doc/contrib/Lam-IntroductionToR_LHL.pdf. Another useful online book on R is “simpleR - Using R for Introductory Statistics” at http://cran.r-project.org/doc/contrib/Verzani-SimpleR.pdf.

Course schedule

The following course schedule is tentative and subject to changes.
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<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tr>
<td>1</td>
<td>Introduction, R markdown/knitr, Vectorization</td>
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<td>2</td>
<td>Data Visualization, Labor Day</td>
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<tr>
<td>3</td>
<td>Numerical methods in R</td>
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<td>4</td>
<td>Numerical methods in R</td>
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<td>5</td>
<td>Pseudo-random number generators</td>
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<td>6</td>
<td>Pseudo-random number generators</td>
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<td>7</td>
<td>Monte Carlo methods</td>
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<td>8</td>
<td>Monte Carlo methods, Fall Break</td>
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<td>9</td>
<td>Bootstrap and Jackknife, Midterm</td>
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<td>10</td>
<td>Bootstrap and Jackknife</td>
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<td>12</td>
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<td>13</td>
<td>MCMC</td>
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<td>14</td>
<td>MCMC, Thanksgiving</td>
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<tr>
<td>15</td>
<td>Density estimation</td>
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**Computing**

Students are **required** to use R to complete all assignments. R can be downloaded freely from http://cran.r-project.org/, and it works under major operating systems, including Windows, Linux and Mac OS. The instruction will be mainly through the Mac OS platform.

**Homework**

Homework will be assigned regularly and students will have one week to finish and turn in the homework. Homework is due in class on the due date. The grader will grade homework and assign a score for each homework set. Late homework submitted within 2 days of due date will receive 25% penalty for each day late. Any homework late by more than 2 days will not be graded and receive zero point.

**Exams**

There will be two in-class midterm exams and one take-home final exam. The midterm exam will be held in the regular class time on October 23. The exams will be closed book and closed notes. Students can bring a calculator to the exams, but sharing calculators is not allowed.

Make-up exams will **NOT** be given under any circumstances. If a student misses the midterm exam for a legitimate absence (with verifiable documentation provided), her/his final grade will be calculated as 60% HW + 40% Final Exam. However, an ‘Incomplete’ will be given if the final exam is missed no matter for what reason.

**Grading**

Grades will be based on the homework sets (50%), the midterm (20%), and the final exam (30%). Cr means D or better if you elect “Credit/No Credit.” The final letter grade is given according to the following scale.

- [95, 100] A+
- [83, 85] B+
- [65, 75] C
- [87, 95] A
- [77, 83] B
- [60, 65] D
- [85, 87] A−
- [75, 77] B−
- < 60 Fail
Learning Tips

1. Try to show up in all the lectures. Make good notes.

2. Ask questions in class. Your questions may be others’ as well. No questions are too elementary, and all deserve to be answered.

3. Discuss with your classmates about your questions. It is perfectly acceptable to work together on homework assignments.

4. Finish homework in time.

Class Policies

1. No auditing is allowed. Students must formally register for this class.

2. Late homework: Late homework submitted **within 2 days of due date will receive 25% penalty** for each day late. Any homework late by more than 2 days will not be graded and receive zero point.

3. Exam conflicts: Prior permission and arrangement only. Students need to inform the instructor at least one week in advance.

4. Collaboration: I encourage discussion of homework in broad, conceptual terms where one student is trying to educate another without giving away the answer, but **all work turned in must be your own**. For example, each student must write his/her own programs in entirety.

5. Academic Integrity: All students are expected to adhere to the university’s academic integrity policy. Any student who is found to have cheated on an assignment or exam will receive a zero score for that work, regardless of the extent of the offense.