

36-709: Advanced Statistical Theory I Spring 2019

Instructor:

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Lectures:

Tuesday and Thursday, 9:00am - 10:20am, PH 226A.

Class Website:

<http://www.stat.cmu.edu/~arinaldo/Teaching/36709/S19/>

Please check the website on a regular basis.

Prerequisites:

- 36-705: Intermediate Statistics

Topics:

This is a core Ph.D. course in theoretical statistics. We will cover a selection of modern topics in mathematical statistics, with a focus on high-dimensional statistical models and non-parametric statistical models. One of the main goals of this course is to provide you with some theoretical background and mathematical tools to read and understand the current statistical literature on high-dimensional models.

Class material:

Much of the course material come from a draft of the upcoming book “High-dimensional statistics: A non-asymptotic viewpoint”, by M. Wainwright. Chapters and relevant parts will be posted and **are not to be distributed**. Further reading material and notes will be posted on [the website](#).

Other recommended textbooks are:

1. *Statistics for High-Dimensional Data: Methods, Theory and Applications*, by P. Bühlman and S. van de Geer, Springer, 2011.
2. *Statistical Learning with Sparsity: The Lasso and Generalizations*, by T. Hastie, R. Tibshirani and M. Wainwright, Chapman & Hall, 2015.

3. *Introduction to High-Dimensional Statistics*, by C. Giraud, Chapman & Hall, 2015.
4. *Concentration Inequalities: A Nonasymptotic Theory of Independence*, by S. Boucheron, G. Lugosi and P. Massart, Oxford University Press, 2013.
5. *High-Dimensional Probability, An Introduction with Applications in Data Science*, by R. Vershynin, 2018+, available [here](#)
6. *Probability in High Dimension*, 2016, lecture notes by R. VCan Handel, available [here](#)

Course Grading:

Your assessment and grades will be determined as follows:

- Homework assignments (70%).
- Scribe duties (10%).
- Attendance and class participation (5%).
- Final Exam (15%).

Any failure to turn in any assignment, to fulfill the scribe duties and to miss a significant number of lectures without informing me of your absence or without a reasonable excuse will result in a lower grade.

Scribe duties:

Each student will take turn in transcribing the notes of every lecture in electronic format using the latex template available at <http://www.stat.cmu.edu/~arinaldo/Teaching/36709/S19/schedule.html>. The scribe has to attend class, take good and accurate notes, check for mistakes and inconsistencies, write them up in latex, add references and expand the material if appropriate and after consulting with me. The resulting pdf and latex files have to be submitted for my approval within one week. The pdf files containing the lecture notes will be posted on the class website.

Homework:

Homework problems will be assigned every 2 weeks. The problems will be mostly of theoretical nature and will essentially be proofs.

There is a great value in discussing problems and sharing knowledge with your classmate, so you are encouraged to engage in group work. However, you should attempt to solve homework problems by yourself and only afterwards meet and compare with others.

Attendance and Involvement:

It is important that you attend class, as the selection and organization of the topics will be on occasion different from the notes and textbooks. If you know you will be absent for few consecutive lectures, please let me know.

Come and see me any time you are confused or stuck and don't be shy in class: the more questions you ask and the more feedback I receive from you, the better I will be able to tailor the lectures to your specific needs.

Final Exam:

The final, comprehensive exam will be on TBA.

Wellness:

Course work at this level can be intense, and we encourage you to take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, socializing, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. If you are having any problems or concerns, do not hesitate to come speak with either of us. There are also many resources available on campus that can provide help and support. Asking for support sooner rather than later is almost always a good idea. If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call 412-268-2922 and visit their website at <http://www.cmu.edu/counseling/>. Consider also reaching out to a friend, faculty member, or family member you trust to help get you the support you need.

Disability Resources

If you require a special accommodation, such as needing more time to finish exams, please visit the Office of Disability Resources to obtain appropriate documentation. See <http://www.cmu.edu/hr/eos/disability/students/>