MAT 486 Random Processes (Fall 2019)

Instructor Allan Sly (allansly@princeton.edu)

Class time 11:00 - 12:30 on Mondays and Wednesdays at 401 Fine Hall.

Office hours
Monday 12:30-2:00 or by arrangement. Room 405 Fine Hall.

Course Description

The course will begin with a short introduction to concentration of measure and large deviations, essential topics in the analysis of random processes. The largest topic will focus on diffusions which will include the following:

- Gaussian processes and construction of Brownian motion.
- Properties of Brownian motion.
- Stochastic Calculus and Ito's formula.
- Stochastic differential equations.
- Brownian excursions and the continuum random tree.
- Applications of Brownian motion to partial differential equations.

For the remainder of the course we will cover some of the following topics based on a poll of student interest in the first class.

- Mixing times of Markov chains.
- Random graph models.
- Random Matrices.
- Stationary processes and ergodic theory.

Grading

The grade for the course will be made up of problem sets (50%) and a final take home exam (50%) after scaling.

Probability is a subject where actively working on problems is essential to your understanding of the material, it is not enough simply to listen in class or read the text. There will be a weekly problem set which will be posted each Wednesday (starting September 18) on blackboard and will be due the following Wednesday in class. These can be done in pairs (or with permission groups of 3 if there is an odd number of students in the class). You should list who you worked with on the problem set. Each of you should write your own solutions separately - this is important to make sure you understand the solutions yourself. I also strongly encourage you to try the problems yourself first before working with your partner.

There will be a take home final exam covering all the material of the course. This must be done individually between January 15 and January 21.

Text Books

- Probability: Theory and Examples by Rick Durrett.
- Theory of Probability and Random Processes by Koralov and Sinai

The will be supplemented by other readings, depending on the topics.