Math 592D. Topics in Applied Mathematics

Mathematics in Biology

Interactions between mathematics and biology have are becoming increasingly frequent. Traditional topics, such as population and disease modeling, have always been illuminated by the use of mathematics. New ones, like those in genomics arising from the accumulation of DNA data, have in fact created new areas of research in mathematics. The objective of this course is to cover selected topics on those areas, as described in the list below. The course will provide a good background of ideas and techniques of applied math, as well as as a collection of interesting and challenging problems. It should also be a good addition to the resumé of those students that will be entering the job market in the near future.

Topics (neither exhaustive nor complete)

1. Difference equations Models. Population Dynamics. Oscillations, Bifurcations and Chaos.
2. Linear models. Matrix algebra.
3. Nonlinear models. Predator-Prey systems. Linearization and stability.
4. Genetics. Probability. Game theory.
5. Molecular Evolution. Markov chains.
6. Phylogenetic Trees.
7. Biological Motion. Diffusion and random walks.

References (not exhaustive)

- Allman & Rhodes (2004) Mathematical Models in Biology. Cambridge UP.
- Yeagers et al. (1996) An Introduction to the Mathematics of Biology. Birkhauser.
- Berg (1993) Random Walks in Biology. Princeton UP (1993).

Prerequisites

Calculus. Linear Algebra.
Other things like Basic Probability, Differential Equations, can be treated within the course.