Stokastiska fenomen (Stochastic phenomena) (5 hp), VT 2015

Svante Janson

Schedule

Start: Tuesday 3 February, 10.15.

Contents

This course is intended for Ph.D. students in Mathematics or Mathematical statistics from Uppsala University, Stockholm University or the Royal institute of Technology (KTH).

The main topic of the course will be some random discrete structures, for example random graphs and random trees, and asymptotic properties of them as the size goes to infinity. Although the structures are discrete, there are sometimes continuous random limit structures, for example limits that can be described using Brownian motion. The interplay between discrete and continuous will be a recurrent theme. Some of the methods used will use branching processes and (generalized) Pólya urns.

Prerequisites

Integration theory (Lebesgue integrals, the dominated convergence ...).
Basic probability theory. (Probability measures, law of large numbers, central limit theorem, ...).
I intend to explain the concepts that I use from probability theory.

Where?

All lectures are in the Ångström building in Uppsala, 10.15-12.00 and 13.15-15.00. (4 hours each day.)
The rooms will vary, see the schedule. The first lecture is in room 80127.
(Code: 80127 means "House" 8 (i.e. part 8 of the building); level 0 (i.e. ground floor); room number 127.)

Literature

There is no single course book. Material will be selected from several sources, including

- Béla Bollobás, *Random Graphs*, Cambridge University Press, 2nd edition, 2001.
- Svante Janson, Tomasz Luczak and Andrzej Rucinski, *Random Graphs*>, Wiley, New York, 2000.
- Remco van der Hofstad, Random Graphs and Complex Networks , lecture notes, 2014 version.

Homework

Homework assignments will be given. These form part of the examination, and should be solved individually. Solutions can be given to me at lectures, or in my mailbox at Ångström (floor 4), at the latest on the days shown below.

1. 6 March.

Lectures

Here is a rough list of contents for the lectures so far.

1. 3/2: Random graphs. Definition of G(n,p) and G(n,m). Thresholds, coarse and sharp. Some examples: containing a given subgraph; no isolated vertices; connected.
2. 9/2: Random graph processes G(n,m), $0\le m \le \binom {n}{2}$ and G(n,p), $0\le p \le 1$. The phase transition. Galton-Watson processes. See e.g Hofstad Chapter 3.1 and (parts of) 4.1-4.4.
3. 6/3:
4. 26/3:
5. 8/4:
6. 20/4:
7. 5/5:
8. 13/5: