

# Stochastic Modeling

## Topics for the exams 07.11.07 or 21.11.07

- **Probability space**  
probability , conditional probability,  
independence (sets  $A_1, \dots, A_n$  or random variables  $f_1, \dots, f_n$ ),  
 $\sigma$  - algebra,  
filtration,  
stopping time.
- **Maximum likelihood estimate**
- **Markov chain**  
definiton,  
Markov property and equivalent formulations,  
transition matrix and according graph,  
step-by-step-formula,  
Chapman-Kolmogorov-equations
- **Classification of states**  
absorbing states  
communicating states, irreducible Markov chain  
periodic and aperiodic states (find out the period in an example, not the definition explicitly)  
persistent and transient states
- **Branching process**  
the use of probability generating functions
- **persistent and transient states**  
definition,  
equivalent assertions,  
relation between a persistent state and its recurrence time.
- **Ergodic theorems and stationary distributions**  
ergodic Markov chain,  
Ergodic theorems (1. and 2. version),  
stationary distribution (how to compute, existence, uniqueness, examples),  
relation between the stationary distribution and the mean recurrence time (Thm 3.7.4.),  
computation of the mean recurrence time.

There will be questions like those in the exercises as well as questions to formulate important definitions and propositions.

No questions about Chapter 4 (no need to memorize the Gibbs sampler...).