# Preliminary program of the course "Markov Chains"

1. Markov chains with at most countable state space: two equivalent definitions. Construction of a Markov chain on a finite time interval for given transition probabilities and initial distribution.

2. Transition probability matrix. Formula for the distribution $p^{(n)}$ at the $n$-th step. Homogeneous Markov chains.

3. Markov chain in $n$ steps and its transition probabilities. Kolmogorov-Chapman equation.

4. Examples of Markov chains: random walks, Galton-Watson model, PageRank.

5. Extinction probability in the Galton-Watson model.

6. Stationary distributions of Markov chains. Their existence for the case of finite state space (two proofs).

7. Mixing transition probability matrices. Ergodic theorem for Markov chains with finite number of states.

8. Perron-Frobenius theorem.

9. Law of large numbers: classical and for Markov chains.

10. Metropolis-Hastings algorithm. Text decryption.