ORAL EXAM LV11.45000, RWTH, SUMMER SEMESTER 2020

Structure of oral exam: A few questions will be asked on 4-5 randomly drawn topics in the list below. The duration of the oral exam will be approximately 20 minutes.

Time and place: The exam will be held at Kackertstrasse 9, room C301, on 31/7 from 9AM to 5PM. (I will arrange time with you individually through e-mail.)

Exam topics.

1. Fundamental concepts in probability theory.
2. Conditional probability and expectation.
3. Convergence of random variables, the Monte Carlo method and importance sampling.
4. Inverse problems, well-posedness theory and Bayesian inversion.
5. Bayesian inversion in the linear-Gaussian setting.
6. Metrics on the space of probability density functions, and the Kullback–Leibler divergence.
7. Random walks on $\mathbb{Z}^d$.
8. The Markov chain Monte Carlo method and the accept-reject sampling method.
9. Discrete-time and state-space Markov chains.
10. Filtering and smoothing in discrete-time and discrete state-space settings.
11. Discrete-time and continuous state-space Markov chains.
12. Filtering and smoothing in discrete time and continuous state space: the linear-Gaussian setting.
13. The Bayes filter in the discrete-time and continuous state-space setting.
14. Extended Kalman filtering and 3DVar.
15. Ensemble Kalman filtering.
16. Particle filtering.
17. Stochastic processes.
18. The Wiener process.
19. Itô integrals and stochastic differential equations (SDE).
20. Numerical methods for Itô SDE and application in filtering.
21. The Fokker–Planck equation.
22. Continuous-time (dynamics and observations) and continuous state-space filtering methods.
23. Advanced and shortly visited topics: Model selection in filtering and filtering in discrete time and infinite-dimensional state space.