Exam Questions

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Procedure

For the oral exam I shall choose randomly three questions from the following list, of which you have the right to choose two. The exam is "open book", i.e. you can use all the scripts and papers during the exam. You will have about 12 minutes of time for each question after about 6 minutes of preparation. I expect you to speak about the question like in a seminar, i.e. explaining the structure of the answer and important details such that a good mathematician, who does not know precisely about the topic could in principle follow.

1. What is a semi-martingale and a good integrator? What does the Bichteler-Dellacherie theorem tell? What does the Girsanov-Meyer theorem tell?
2. Describe the ucp topology, the Emery topology and their completeness properties.
3. How does Stricker's proof of the Bichteler-Dellacherie theorem work?
4. Ito's formula and its proof.

1. The stochastic exponential and its construction.
2. What do the Burkholder-Davis-Gundy inequalities assert and how does one proof of them work? How can we use them to construct the stochastic integral for predictable integrands?
3. What does (NFLVR) mean? Why is the L^∞ case considerably more complicated? Explain in detail (NFLVR) $=$ (NUPBR) $+$ (NA).
4. Give a guided tour through the proof following [T14].

1. Explain meaning and proof steps of Kostas Kardaras proof for the existence of super-martingale deflators, see [K09].
2. Explain super-replication prices.
3. Explain pricing of American Options.
4. Explain the martingale optimality principle and the Merton problem as outlined in the lecture notes.
5. Explain by the change of numeraire theorem the basic idea of Stochastic portfolio theory: it may happen to have (NFLVR) with respect to one numeraire and only (NUPBR) with respect to another one.
6. Explain and prove Fernholz' master equation from stochastic portfolio theory. What is a functionally generated portfolio?