Detailed instructions for the oral exam in MAT4701

The exam will consist of 3 different parts:

Part 1: A short lecture

The candidate should prepare 5 short talks on each of the topics:

a) The Itô formula and martingale representations

b) Stochastic differential equations

c) Some results related to Itô diffusions

d) Optimal stopping

e) Control theory

Each talk should have a duration of 10-15 minutes. The talks should present some *selected* results under the 5 headlines, and there is considerable freedom of choice. It is *not* the intention to present *all* the theory we have studied in class.

15 minutes before the exam, one of these talks are drawn randomly and the result is announced to the candidate. The candidate then have 15 minutes to study his/hers notes on the topic. No aids/notes are permitted once the exam have started.

Part 2: Proof of one of the central results

The candidate should be prepared to sketch a proof of one of the central results in the theory. The required task is announced during exams once part 1 is finished, and no aids are permitted.

Definition of what are the central results in the theory

The items are listed according to when in the course the material islectured, not according to page numbers in the book.

1. Construction of the Itô integral (square integrable case)

2. The Itô formula

3. The Itô representation theorem for square integrabele random variables

4. The martingale representation theorem

5. Existence and uniqueness for solutions to stochastic differential equations

6. Weak versus strong solutions

7. Time homogeneity of Itô diffusions

8. The Markov property of Itô diffusions

9. The generator and characteristic operator of Itô diffusions

10. Dynkin's formula

11. The verification theorem for optimal stopping

12. The verification theorem for optimal control

13. The Girsanov theorem I and II

14. Self-financing and admissible portfolios, arbitrage and completeness of mathematical markets

Part 3: Problem solving

The candidate will be presented with a mathematical problem and should be able to work out the solution.

The problem will be new, i.e., *not* a problem we have solved during the course. The solution will require the same techniques we have used during exercises. To prepare for this, the candidate should solve all the given exercises/assignments.

No aids are permitted during this part. If the candidate is stuck he/she can ask for hints on how to proceed.