Qualifying Examination Topics and References for Financial Mathematics at Florida State University

The focus of the financial mathematics qualifying exam is the mathematical foundation rather than the financial concepts. However, to understand the problems, a basic understanding of financial concepts, which is provided in MAP5601 and MAP6621, is required. The problems are proof-based and a rigorous understanding of the theorems and their proofs is essential.

Students need to at least know the following topics from the first two references; Stochastic calculus for finance I & II. However, problems can be assigned from other references oroutside all references that can be solved based on the knowledge acquired from reading the books in the list of references.

Topics

1) Binomial model (No arbitrage condition, martingale property, Markovian property, Discrete stochastic integral, Markovian European option, Path-dependent European options, American option, Radon-Nikodým derivative, utility maximization, Interest rate derivatives)

2) Probability (Random walk: symmetric and asymmetric, conditional expectation, hitting time of random walk, reflection principle)

3) General probability (Uncountable probability spaces, σ-algebra, Random variable and their Distribution, Expectation, Change of measure, Independence, Conditional expectation, Martingales, Markov chains, Weak convergence, Brownian motion and its properties, hitting time of Brownian motion, reflection principle, quadratic variation)

4) Stochastic calculus (Stochastic integral, Itô integral, Itô formula, Multidimensional Brownian motion and Itô formula, Lévy characterization of Brownian motion, Gaussian processes, Brownian Bridge)

5) No arbitrage pricing (Black-Scholes-Merton equation and Greeks, Girsanov theorem, Fundamental theorem of asset pricing and risk-neutral probability, Martingale representation theorem and replication, Completeness of markets, Forwards and Futures, Stochastic differential equations, Feynmann-Kac formula and partial differential equations)

References

1) Shreve, Steven. *Stochastic calculus for finance I: the binomial asset pricing model.* Springer Science & Business Media, 2004.

2) Shreve, Steven. *Stochastic calculus for finance II: Continuous-time models.* Vol. 11. Springer Science & Business Media, 2004.

3) Karatzas, Ioannis, and Shreve, Steven. *Methods of mathematical finance*. Vol. 39. New York: Springer, 1998.

4) Zastawniak, Tomasz, and Marek Capinski. *Mathematics for Finance: An Introduction to Financial Engineering*. Springer, 2003.

5) Baxter, Martin, and Rennie, Andrew. *Financial calculus: an introduction to derivative pricing*. Cambridge university press, 1996.

6) Wilmott, Paul, et al. *The mathematics of financial derivatives: a student introduction*. Cambridge university press, 1995.