

Financial Mathematics III

ACTSC 631, Spring 2015

This is an early version of the outline as of April 2015

Instructor: Ruodu Wang, M3 3122, ext.31569, wang@uwaterloo.ca
Lectures: 2:00-3:50 Tuesdays and Thursdays, M3 2101.
Tutorials: N/A.
Office hours: Tuesdays 4:00-5:00 and Thursdays 5:00-6:00, or by appointment.
You are welcome to drop by my office at any time,
and if I am not occupied I will be happy to answer your questions.

References

The primary reference will be the lecture notes given in class.

Main reference books for mathematical materials are:

- [1] Tomas Björk. *Arbitrage Theory in Continuous Time*. 3rd edition, Oxford, 2009.
- [2] Marek Capiński and Tomasz Zastawniak. *Mathematics for Finance*. 2nd edition, Springer, 2011.

Recommended readings for the understanding of financial market:

- [1] Robert L. McDonald. *Derivatives Markets*, 3rd edition, Addison Wesley, 2013.
- [2] John C. Hull. *Options, Futures, and Other Derivatives*. 9th edition, Prentice Hall, 2014.

Test materials are based on lecture notes.

Assignments

I plan to set three individual assignments. The assignments will be equally weighted. All assignments will contribute to your coursework grade. Assignments should be handed in to the instructor by the end of the class on the due day. Late assignments are not acceptable.

Midterm

I plan to have two midterms. Tentative schedule:

- (1) lecture time on Tuesday, June 16th (7th week), 2015.
- (2) lecture time on Tuesday, July 7th (10th week), 2015.

Course Evaluation Breakdown

- (1) Assignments 10%;
- (2) Midterms 25% (12.5% each);
- (3) Final Examination 65%.

Notes

- Preliminary knowledge on stochastic calculus, including Brownian motion, σ -fields, conditional expectations and Itô's Lemma, is required.
- Preliminary knowledge on finance, including equities, dividends, bonds, continuously compounded interest rates and the present value of cash-flows, is required.
- This course has a focus on mathematical and computational aspects; however, purely theoretical proofs are not mandatory to prepare for the exams.

Tentative Schedule

	Lectures	Topics
Part I	1-5	Derivative market basics of options, futures and other derivatives arbitrage, trading strategy, and complete market model independent properties for options
Part II	6-12	Discrete-time models one-period models self-financing trading strategies fundamental theorems of asset pricing multi-period models and binomial trees American and exotic options
Lecture 13: Midterm #1		
Part III	14-18	Continuous-time models some results in stochastic calculus continuous time market models Black-Scholes equation and Black-Schole formula hedging and Greeks risk neutral valuation for general European-type derivatives
Lecture 19: Midterm #2		
Part IV	20-22 23	Interest-rate models basics of fixed income risk-neutral evaluation for interest-rate derivatives short-rate models Credit risk models models for credit risk credit ratings
Lecture 24: Final review		