

COURSE: An Introduction to Financial Mathematics.

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Financial mathematics is not about predicting prices of stocks but about the theory which describes how derivative securities such as options should be priced. There are many types of derivative securities and their trade volumes are bigger than trading volumes of stock markets.

Any derivative security is based on another security such as stock whose behavior is assumed to be described by a stochastic process. The most familiar type of derivative security is the so called European options which are contracts giving the right (but not an obligation) to buy (or to sell) a stock for a prescribed price at a prescribed time. What should be a price of such contract?

In the beginning of the 1970ies Black, Scholes and Merton gave an answer to this question based on notions of hedging and replication which led later to a rigorous mathematical theory based on the notion of martingales which became an important part of the probability theory.

The course will cover the following topics:

Martingales, optimal stopping, models of financial markets, derivative securities, European, American and game (Israeli) options, Cox-Ross-Rubinstein binomial model, complete and incomplete markets, arbitrage, hedging and superhedging, fundamental theorems of asset pricing, risk evaluation, elements of stochastic analysis, Brownian motion and the Black-Scholes model of financial markets, binomial approximations.

Prerequisites: A probability course based on measure theory.

Literature:

- 1) R.J.Williams, Introduction to the Mathematics of Finance, AMS 2006.
- 2) S.Shreve, Stochastic Calculus for Finance, v.1,2, Springer 2004.
- 3) A.Shiryaev, Essentials of Stochastic Finance, World Scientific, 1999.
- 4) Several financial mathematics courses can be downloaded from the internet.