Teaching plan of the visit of Prof. Yuliya Mishura to Aalto University in October 2011

It is planned to give 8 lectures devoted to the limit theorems in application to stochastic finances.

The limit theorems immediately appear in finances when we come to the understanding of two things:

1) All the calculations including option prices are much more simple when we can measure exactly all the coefficients of underlying assets and trade them continuously in time.
2) We never know the exact values of the coefficients of underlying assets, but only with some accuracy, and we cannot trade anything in continuous time.

So, we want to know if our calculations performed in continuous time framework are the limits of calculations performed in discrete time, when the length of trading interval tends to zero.

The simplest results of the convergence to Black-Scholes formula are presented in the classical text-book of *Foellmer and Schied Stochastic Finance 2004;* also, some results concerning the rate of convergence for binomial model can be found in the papers, and also in the case of limit geometrical Brownian motion. However, more complicated cases must be considered and more flexible tools must be introduced. It will be done in this lecture course. The preliminary plan of the lectures is the following;

1. Introductory finance models
2. Introduction to functional limit theorems.
3. Simple functional limit theorems for stochastic integrals w.r.t. semimartingales.
4. Financial applications: convergence of capitals and option prices when hedging strategies and coefficients of underlying assets tend to corresponding limits. It means that we explain the robust properties of capitals and option prices.
5. Inverse problem: if we have “close ” values of capitals, can we achieve them by “close” strategies? It means some uniqueness of financial market.
6. What is the optimal rate of convergence from discrete to continuous time in different models?
7. How to investigate asymptotic behavior of the probability of the successful set in quantile hedging even if we cannot calculate the probability of the success explicitly.
8. Some simulation results and conclusions.