

## POSSIBLE PROJECTS FOR MATH 294 - WINTER 2003

1. Rigorously derive the Black-Scholes option pricing formula for a European call option by taking a limit of a sequence of binomial models.

Reference: Pages 38-43 of Elliott and Kopp.

2. Game options, Y. Kifer, Finance and Stochastics, Vol. 4 (2000), 443-463.

Considers pricing and hedging for game options – options that can be exercised early by the buyer and terminated early by the seller (a symmetric version of American options). One could just do the first part of this paper which deals with pricing under a binomial model, or one could just do the continuous part.

3. Option Games: <http://www.puc-rio.br/marco.ind/opt-game.html> Option games combine option pricing theory with game theoretic models.

4. Hedging and pricing in incomplete markets (discrete models). Chapter 4 of M. Musiela and M. Rutkowski, Martingale Methods in Financial Modelling, Springer, 1998.

5. Information and option pricing, Xin Guo, Quantitative Finance, Vol. 1 (2001), 38-44.

Considers a continuous time Black-Scholes type of model where the drift and diffusion coefficients can depend on the state of a (hidden) Markov chain. This is intended to model a change in parameters that can occur when insider information is used.

6. R. J. Battig and R. A. Jarrow, The Second Fundamental Theorem of Asset Pricing: A New Approach, Review of Financial Studies, 12 (1999), 1219–1235.

Presents a new definition of market completeness that is independent of notions of no arbitrage and equivalent martingale measures. This notion preserves the Second Fundamental Theorem of Asset Pricing, but can have arbitrage opportunities even when the market is complete. This uses continuous time models.

7. Option pricing in incomplete markets, M. H. A. Davis, in Mathematics of Derivatives Securities, edited by M. A. H. Dempster and S. R. Pliska, Cambridge University Press, 1997, pp. 216–226.

This uses continuous time models.

8. Functional convergence of Snell envelopes: application to American option approximations, S. Mulinacci and M. Pratelli, Finance and Stochastics, 2 (1998), 311–327.

Gives conditions under which the Snell envelopes for a sequence of processes approach the Snell envelope of a limit process. Has applications to approximating the Snell envelope associated with an American option based on the Black-Scholes model. There are also earlier papers referenced in this paper. One could also base a project on one of the earlier papers such as N. J. Cutland, P. E. Kopp, W. Willinger and M. C. Wyman, Convergence

of Snell Envelopes and Critical Prices in the American Put, in *Mathematics of Derivatives Securities*, edited by M. A. H. Dempster and S. R. Pliska, Cambridge University Press, 1997, pp. 126–140.