

OPTIONS AND MATHEMATICS (CTH[*mve095*] (5 points))

MATEMATIK OCH OPTIONER (GU[*man690*] (5 poäng))

<http://www.math.chalmers.se/Math/Grundutb/CTH/mve095/>

<http://www.math.chalmers.se/Math/Grundutb/GU/mam690/>

Period 4, spring 2007

REMARK 1: Students who wish examination according to the course Options and Mathematics (3p) (CTH[*tma155*]&GU[*mam690*]) must inform the office at the department of mathematics at the latest one week before the examination.

REMARK 2: The course Options and Mathematics (5p) (GU) will be initiated in 2008. However, the course Matematik och optioner (5p) (GU[*man690*]) is identical with Options and Mathematics (5p) (CTH[*mve095*]) during 2007.

Lectures (50 hours): Monday, Wednesday, Thursday 10-12 except Monday, week 18 and Thursday, week 20; Wednesday also 13-15, weeks 12, 13, 20.

Room: Monday MVF33; Wednesday MVF21; Thursday HA2

Teacher and examiner: Christer Borell, e-mail: borell@math.chalmers.se, phone: 772 35 53

Textbook: Christer Borell, Introduction to the Black-Scholes Theory (can be purchased at the DC, Maskingränd, Chalmers, from week 10)

CONTENTS

Week 12

Financial derivatives of European and American types. Forward contracts. The Dominance principle. Put-call parity. Convexity properties of European call and put prices.

Week 13

The Binomial model. Arbitrage portfolio. Replicating and self-financing strategies. Some basic concepts in probability: event, random variable, Markov's inequality, characteristic function.

Week 16

More on basic concepts in probability: Gaussian random variables, independence, random walk, Law of Large Numbers, Monte Carlo simulation.

Week 17

Brownian motion. The geometric Brownian motion model of a stock price. Some remarks on portfolio theory. Heat conduction, simple random walk, and Brownian motion. Probabilistic representations of solutions to the heat equation and some other parabolic differential equations. Simple random walk and the heat equation.

Week 18

The Black-Scholes model and differential equation. Call prices. European and American put prices. Simple currency derivatives.

Week 19

Options on futures contracts. The Greeks and sensitivity analysis. The Black-Scholes prices of path-dependent options. Implied volatility.

Week 20

Bivariate Brownian motion. Change of numéraire. The option to exchange one asset for another. The option on the maximum of two asset prices.

The assignments must be handed in at the latest Wednesday May 16 at 14⁴⁵.

Week 21

Calls and puts written on dividend-paying underlying assets.

EXAMINATION

Assignments handed in to the examiner

A number of exercises solved and handed in by the student at the latest Wednesday May 16 at 14⁴⁵ will result in a maximum of 1.2 points at the final examinations.

The courses CTH[*tma155*] and GU[*mam690*] have no assignments.

Written final examination (4 hours)

May 26, 2006, morning, v

August

January

Aid not permitted.

The test comprises 15 points (plus at most 1.2 points from the assignments); to pass requires at least 6 points (at GU 11 points or more is graded VG; at Chalmers a result greater than or equal to 9 points and smaller than 12 points is graded 4 and a result greater than or equal to 12 points is graded 5).

The written examination thus comprises 15 points, where at least 6 points are of theoretic nature. At least 3 points from the theoretic part are collected from the following list:

Theorem 1.1.2; Theorem 1.1.3; Theorem 1.1.4; Theorem 2.1.1; Theorem 2.2.1; Theorem 3.3.1; Theorem 4.1.1; Theorem 4.2.1; Theorem 4.3.1; Theorem 4.3.2; Theorem 5.1.1; Theorem 5.2.1; Theorem 5.3.1 (only the formula for δ); Theorem 6.1.1; Example 6.1.1

Göteborg March 14, 2007

Christer Borell