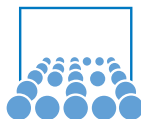


Seminar “Numerical Methods for Computational Finance”

Kick-off Meeting

Alexander Heinecke and Stefanie Schraufstetter

February 6th, 2012



Topics – an Overview

1. Basics

- stochastic basics & random numbers (Junjie Bai)
- options, futures, and other derivatives (Chris Scheingraber)

2. Monte-Carlo & Binomial Tree Methods

- Monte-Carlo method (Korbinian Graser)
- least-square Monte-Carlo (Zhan Wang)
- tree methods (Marco Seravalli)

3. Tackeling Financial PDEs

- Black-Scholes PDE (deduction) (Felix Rampe)
- discretization in time and space (with sparse grids) (Tingting Sun)

4. High-Performance Computing

- Monte-Carlo on GPUs (Jorgo Mazo)
- parallelization of PDE solvers (Shulin Gao)

Topics in Detail: Basics

- **stochastic basics & random numbers**
probability theory, probability distributions (e.g. Gaussian),
(geometric) Brownian motion,
algorithms for generation of random numbers
- **options, futures, and other derivatives**
option pricing, types of financial derivatives (European,
American, Asian, Barrier options, risc-factor models)

Topics in Detail: Monte-Carlo & Binomial Tree Methods

- **Monte-Carlo method**
simple Monte-Carlo method, quasi Monte-Carlo method, speeding up convergence, correlations in multi dimensions
- **Least-Square Monte-Carlo**
MC used to price Bermuda and American options, different kinds of regressions
- **binomial tree method**
binomial tree method (including dividends, barriers, etc.), trinomial tree method, adaptive lattice methods

Topics in Detail: Black-Scholes PDE

- **Black-Scholes PDE (deduction)**
deduction of the equation, Ito formula, non-arbitrage principle, transformation to backward time, boundary conditions
- **discretization in time and space (with sparse grids)**
forward and backward Euler, Crank-Nicolson, stability; hierarchical basis, combination technique, direct sparse grid ansatz

Topics in Detail: High-Performance Computing

- **MC-Simulations on GPUs**
random number generation, opportunities and drawbacks, implementation details, correlations in multi dimensions
- **parallelization of (sparse) grid based approaches**
parallelization of operators for: combination technique, direct sparse grid ansatz

Workload & Grading

Tasks for a successful participation:

- write a paper
- write and give a talk
- participate in all talks (mandatory attendance!)

Weighting of the final grade:

≈ 2 (paper) : 1 (talk)

Workload & Grading (cont'd)

Requirements:

- **paper:**
pdf, \approx 8 pages, font size 12, line spacing 1, A4
- **talk**
25-30 min (\sim 10-15 slides, test it before!)
+ \approx 5 min activation
(e.g. questions, interactive demonstration, short quiz, . . .
i.e. something, where your colleagues have to be active – just be creative!)
- **meetings with the advisor**
2 meetings (1 during preparation, 1 to check the slides)

Time Schedule

- kick-off meeting: Feb, 6th
- paper deadline (90% draft!!): Jun 17th
- talks: presumably Jun, 25th – Jul, 20th
(until Jul, 13th in the ideal case)
- paper deadline (final version): shortly after last talk

Important Notes

- deadlines are severely strict
- attend the meetings with your advisor to check content, paper, and slides
- send your paper to your advisor in time:
 - Alexander Heinecke: heinecke@in.tum.de
 - Stefanie Schraufstetter: schraufs@in.tum.de

Plagiarism

- avoid any act of plagiarism for your paper/talk, in particular:
 - all material that you used has to be cited (including websites)
 - even if you cite, it is not proper to copy text directly (also not, if you change the order of sentences, etc.)
- plagiarism will directly lead to a grade of 5.0
- we will check your handed in papers and reviews for plagiarism
- to avoid any problems, just keep to a simple guideline:

Write everything in your own words and cite material you create your text from.

How to Write a Good Paper

Important points for the quality of a paper:

- language and spelling
- structure (correct/intuitive order, useful abstract and conclusions, references, etc.)
- consistency of the presentation (notation, figures, graphs, etc.)
- quality of the explanations
- use of references

More important points can be found in the review sample!

Main goals of the paper:

- practice formalization of mathematical contents
- practice your scientific paper writing skill
- good practice for writing the Master thesis later

How to Write a Good Paper

Structure of a paper:

1. header with title and author
2. short abstract (that whets the appetite for reading the paper)
3. introduction (including an overview over the paper)
4. main part (several sections, structure depends on the topic)
5. conclusion/summary/outlook
6. references

For more details, please check the guides of the next slide.

How to Write a Good Paper

Guides for the structure of the paper: (just a selection)

- D. E. Knuth, T. Larrabee, P. M. Roberts: Mathematical Writing, <http://tex.loria.fr/typographie/mathwriting.pdf>
- M. Ashby: How to Write a Paper, <http://www-mech.eng.cam.ac.uk/mmd/ashby-paper-V6.pdf>
- W. Strunk and E. B. White, The Elements of Style, Longman Publishers, 1979
- A. Bundy: How to Write an Informatics Paper, <http://homepages.inf.ed.ac.uk/bundy/how-tos/writingGuide.html>
- N. Dragoni: How to Write a Research Paper, www2.imm.dtu.dk/courses/02234/slides/writing-a-paper-Nicola.pdf
- and many more...

How to Give a Good Talk

Important points for good slides:

- give a short outline
- do not put too much content on a slide
- structure every slide, make it well-arranged
- use short, clear bullet points (not sentences!)
- choose the font size large enough (not smaller than this font!)
- use visualizations instead of text
- consider the previous knowledge of your colleagues (this is usually not too much since the topic is new!)
- check the spelling

How to Give a Good Talk

Important points for a good talk:

- speak loud and articulate clearly
- keep eye-contact to the audience
- apply Occam's razor, do not go too much into detail
- do not exceed time
- practice the talk before (think what you want to tell, check time, etc.)
- prepare nice slides for the talk

Main goals of the talk:

- make your colleagues familiar with the topic
- practice your presentation skills

How to Give a Good Talk

Guides for a good talk and nice slides: (just a selection)

- R.A.Day, How to present a paper in theoretical computer science: a speaker's guide for students,
<http://portal.acm.org/citation.cfm?id=346048.346055>
- J. A. Gallian: How to Give a Good Talk,
<http://www.jcu.edu/math/constum/gallian.pdf>
- P. N. Edwards: How to Give an Academic Talk,
<http://www.si.umich.edu/~pne/PDF/howtotalk.pdf>
- B. J. Reich: Academic Presentations,
<http://www4.stat.ncsu.edu/~reich/st810A/oral.pdf>
- F. R. Kischischang: Giving a Talk – Guidelines for the Preparation and Presentation of Technical Seminars,
<http://www.comm.utoronto.ca/~frank/guide/guide0.html>
- and many more ...

Some More Specials of the Seminar

Chairman:

For every talk, one of the reviewers will be the chairman and ...

- introduce the talk,
- pay attention that the lecturer will stay in time,
- moderate the discussion after the talk,
- ask an question to the lecturer, if nobody else has a question.

We plan awarding ...

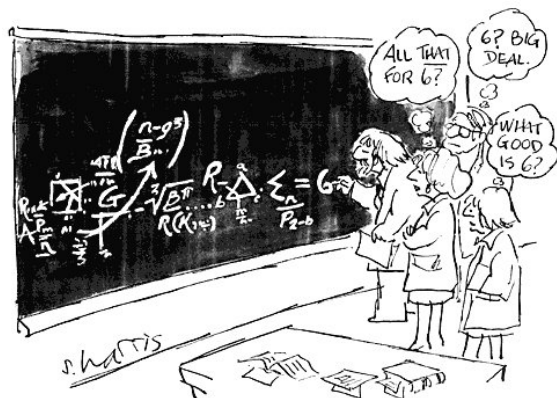
- the best talk
- the best activation

All participants of the seminar are members of the jury!

Feedback:

... is important. You will give feedback to each other in form of a questionnaire after the talk to improve your presentation skills.

Questions?



Topics

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