Numerical Methods for Finance

MMF 2021 Course Outline Fall 2019

Course Description:
This course is an introduction to numerical methods for mathematical finance. We will begin with a quick review of floating-point computation. The main focus of the course is the use of Monte Carlo Methods and Numerical Methods for PDEs applied to problems that arise in mathematical finance.

Instructor: Ken Jackson, BA 4228, 416–978–7075 or krj@cs.toronto.edu
`http://www.cs.toronto.edu/~krj/`
(I may change offices during the term. I'll update my room number above if I do.)

TAs: Yuwei Chen, `<ywchen@cs.toronto.edu>`, and Michael Chiu, `<chiu@cs.toronto.edu>`.

Course Web Page: `http://www.cs.toronto.edu/~krj/courses/2021/`

Office Hours: by appointment

Lectures: Tuesdays, 1–4 PM, in the MMF Suite starting September 10.

Tutorials: Thursdays, 4–5 PM.

Course Textbook: Paolo Brandimarte, *Numerical Methods in Finance: A MatLab-Based Introduction*, second edition, John Wiley & Sons, 2006.

You can download an e-copy of this book for free from the UofT Library:
`https://onlinelibrary-wiley-com.myaccess.library.utoronto.ca/doi/book/10.1002/0470080493`

Other References:

1. Paul Glasserman, *Monte Carlo Methods in Financial Engineering*, Springer-Verlag, 2004.
2. Peter Jackel, *Monte Carlo Methods in Finance*, John Wiley & Sons, 2002.
3. Karel in 't Hout, *Numerical Partial Differential Equations in Finance Explained: An Introduction to Computational Finance*, Palgrave Macmillan, 2017.
4. Yves Achdou and Olivier Pironneau, *Computational Methods for Option Pricing*, SIAM, 2005.
5. Y.-L. Zhu, X. Wu, I.-L. Chern, Z.-Z Sun, *Derivative Securities and Difference Methods*, 2nd Edition, Springer, 2013.
6. Daniel J. Duffy, *Finite Difference Methods in Financial Engineering*, John Wiley & Sons, 2002.
7. Domingo A. Tavella, *Quantitative Methods in Derivatives Pricing: An Introduction to Computational Finance*, John Wiley & Sons, 2002.

8. Domingo A. Tavella and Curt Randall, *Pricing Financial Instruments: the Finite Difference Method*, John Wiley & Sons, 2000.
9. Paul Wilmott, Sam Howison and Jeff Dewynne, *The Mathematics of Financial Derivatives: A Student Introduction*, Cambridge University Press, 1995.
10. Desmond J. Higham, *An Introduction to Financial Option Valuation*, Cambridge University Press, 2004.
11. Michael T. Heath, *Scientific Computing: An Introductory Survey*, Revised Second Edition, SIAM, 2018, or 2nd edition, McGraw Hill, 2002.
12. W. H. Press, S. A. Teukolsky, W. T. Vetterling and B. P. Flannery, *Numerical Recipes*, Cambridge University Press, (many different versions).
13. R. L. Burden and J. D. Faires, *Numerical Analysis*, 7th edition, Brooks/Cole, 2001.
14. S. D. Conte and Carl de Boor, *Elementary Numerical Analysis: An Algorithmic Approach*, 3rd edition, McGraw Hill, 1980.
15. G. Dahlquist and A. Bjorck, *Numerical Methods*, Prentice Hall, 1974.
16. D. Kincaid and W. Cheney, *Numerical Analysis: Mathematics of Scientific Computing*, Brooks/Cole, 1996.
17. J. Stoer and R. Bulirsch, *Introduction to Numerical Analysis*, Springer-Verlag, 1993.
18. Arieh Iserles, *A First Course in the Numerical Analysis of Differential Equations*, Cambridge University Press, second edition, 2009.

Grading:

1. Term assignments: 30%.
2. Midterm Test: 30%.
3. Final Exam: 40%.

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