**MF 796**

**Computational Methods of Mathematical Finance**

**Spring 2021**

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| **Lectures:** | Lecture: Mon, 7:30am - 10:15 am (D1)  Recitation: Mon, 10:30 -1:15 pm (D2)  HAR208  In this course we will giving a single lecture followed by a recitation where we will review the lecture content, prepare for the homework assignments, and do additional exercises. | |
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| **Instructor:** | Professors Eugene Sorets & Chris Kelliher | |
|  | Office: | Zoom |
|  | Email: | [sorets@bu.edu](mailto:sorets@bu.edu) & [cmk44@bu.edu](mailto:cmk44@bu.edu) |
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| **Office hours:** | Fri, 11am – 12pm | |
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| **Teaching assistants:** | Hannan Zheng: [zhannan@bu.edu](mailto:zhannan@bu.edu)  Boyan Cheng: [bycheng@bu.edu](mailto:bycheng@bu.edu) | |
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| **Course websites:** | <https://questromtools.bu.edu/portal/site/SPRG21MF796D1D2/> | |
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| **Objectives & Prerequisites:** | This is a graduate level course on the computational methods commonly used in finance. We will deal with ordinary, partial, and stochastic differential equations. Because of this, we expect you to be familiar with advanced topics of stochastic calculus, linear algebra, probability, and statistics. This includes: random variables, probability distributions and densities, characteristic functions, Fourier inversion, matrix decompositions, measure changes, Taylor series, and Ito’s formula.  This course is very applied and hands-on. You will be expected to write a significant amount of code both on your homework assignments and on your final project.  You may choose to do your coding in R, MATLAB or Python. If you would like to use another programming language you must receive permission from us as well as from the TAs.  If you don’t have much coding experience we recommend you dedicate some time to honing your coding skills. Coursera offers some introductory programming classes that might be helpful (See <http://www.coursera.org/course/rprog> for example.) | |
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| **Topics:** | We will cover the following topics:   * Quadrature methods * Fast Fourier transforms * Discretization of stochastic differential equations * Finite differences for partial differential equations * Monte-Carlo simulation * Optimization / Calibration * Construction of Risk Neutral Densities | |
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| **Recommended literature:** | Computational Methods in Finance  By: Ali Hirsa  ISBN: 1439829578  Monte Carlo Methods in Financial Engineering  By: Paul Glasserman  ISBN: 0387004513  It is not required that you purchase any books for this course, as the slides from the lectures should be sufficient.  However, if you decide to purchase a book for this course, we would highly recommend Hirsa’s book as it covers almost all of the topics we will cover and is very well written. | |
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| **Grading weights:** | Exam: 35%  Final project: 35%  Homework: 30% | |
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| **Exam:** | There will be one take-home exam on **April 5th**.  Students will have 24 hours to complete the take-home exam. They will be allowed to use any books or other resources that they choose, but they must cite their sources. Collaboration on the exam, however, is forbidden and considered cheating. | |
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| **Final Project:** | There will be a final project to be submitted on the last day of class. You will be required to build teams of 4 to 6 people to work with on a project of practical relevance.  The project will require to you to research a topic of your choice, and provide an implementation of the method/technique you are researching, along with some results. Your implementation should be done in R, MATLAB or Python unless approval is given by the TAs.  You are required to submit a project proposal by **February 22th**. The proposal should consist of a summary of what you are planning to research, as well as multiple references that you plan to leverage in your work.  We will give you a great deal of flexibility in choosing your topic; however, it should be directly relevant to the topics we discuss in class. We may provide feedback on your topic after your proposal is submitted.  Each team will be required to submit a written summary of at most 10 pages containing your method and results. You are also required to submit all code that you wrote.  Also, your team will be required to give a 10-minute presentation of your results in class during the last week of class.  We expect all group members to contribute to the final project and to be able to discuss all aspects of their group’s work in detail. We reserve the right to reach out to any individual or group to ask for details on a given project after its submission, and may incorporate this into grading of the final project. | |
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| **Homework:** | Homework will be assigned weekly. There will be some theoretical questions and some assignments that involve coding. You are required to submit any code that you write as part of your Homework submission.  All Homework should be admitted via the course site on Questrom Tools by the specified deadline.  Homework should be completed individually. You may discuss assignments with other students but your write-ups and any supporting code must be unique and written by you. Any shared write-ups or shared code that we identify will be considered cheating. | |
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| **Cheating policy:** | This course will have a zero-tolerance cheating policy.  Any cheating incidence will be reported to the University, and may result in course failure or suspension from the University. | |