UNSW Course Outline

MATH3311 Computational Mathematics for Finance - 2024

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General Course Information

Course Code : MATH3311
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Mathematics & Statistics
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

<u>Useful Links</u>

<u>Handbook</u> <u>Class Timetable</u>

Course Details & Outcomes

Course Description

Finance is concerned with making definite numerical recommendations that frequently can only be obtained by analysing sophisticated models using high-speed computers. This course studies the design, implementation and use of computer programs to solve practical mathematical

problems of relevance to finance, insurance and risk management. It includes a review of MATLAB/Python, floating point numbers, rounding error and computational complexity, and a selection of topics from: approximation and parameter estimation, Fourier series and the FFT, finite difference approximations, partial differential equations (Black-Scholes PDE), sparse linear systems, nonlinear algebraic equations, trees, Monte Carlo methods and simulation, random numbers and variance reduction, numerical integration. The teaching activities include weekly lectures in which the theoretical background is explained and weekly practical computing laboratory classes.

Course Aims

This course aims to teach the use of computer programs to solve practical mathematical problems of relevance to finance, insurance and risk management. It provides students with essential tools needed to obtain numerical solutions for a variety of financial models.

Relationship to Other Courses

Prerequisite: (MATH2121 or MATH2221 or MATH2111) and (MATH2501 or MATH2601) and (MATH2801 or MATH2901 or MATH2871)

Jointly taught with MATH5335 Computational Mathematics for Finance.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Apply quantitative skills and mathematical reasoning to solve problems relevant to finance, insurance and risk management.
CLO2 : Apply the underlying mathematics, computational techniques and problem-solving skills relevant for problems in financial mathematics.
CLO3 : Determine confidence in a computed answer and the risks associated with a given computational problem.
CLO4 : Select appropriate computational techniques to analyse financial data and interpret the answers within a financial problem.

Course Learning Outcomes	Assessment Item
CLO1 : Apply quantitative skills and mathematical reasoning to solve problems relevant to finance, insurance and risk management.	• Assignment • Final exam
CLO2 : Apply the underlying mathematics, computational techniques and problem-solving skills relevant for problems in financial mathematics.	• Lab test • Assignment • Final exam
CLO3 : Determine confidence in a computed answer and the risks associated with a given computational problem.	• Lab test
CLO4 : Select appropriate computational techniques to analyse financial data and interpret the answers within a financial problem.	• Assignment • Final exam

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Assignment Assessment Format: Group	20%	Due Date: Weeks 3, 5, 7 and 10
Lab test Assessment Format: Individual	20%	Due Date: Week 9
Final exam Assessment Format: Individual	60%	Due Date: Exam Period

Assessment Details
Assignment

Assessment Overview

The Assignment is an ongoing assessment which is comprised of four parts, due in Weeks 3, 5, 7 and 10.

You will need to apply basic MATLAB or Python programming skills and knowledge from lectures to solve a series of computational problems.

This task will test your skills at synthesising mathematical theory and practical computation, and at interpreting and presenting numerical results.

The assignments will use MATLAB Grader for Matlab programs or an analogous method for Python programs which will provide you with instant feedback on whether your numerical answer is correct or not

Course Learning Outcomes

- CLO1 : Apply quantitative skills and mathematical reasoning to solve problems relevant to finance, insurance and risk management.
- CLO2 : Apply the underlying mathematics, computational techniques and problem-solving skills relevant for problems in financial mathematics.
- CLO4 : Select appropriate computational techniques to analyse financial data and interpret the answers within a financial problem.

Detailed Assessment Description

The Assignment is an ongoing assessment which is comprised of four parts, due in Weeks 3, 5, 7 and 10.

You will need to apply basic MATLAB or Python programming skills and knowledge from lectures to solve a series of computational problems.

This task will test your skills at synthesising mathematical theory and practical computation, and at interpreting and presenting numerical results.

The assignments will use MATLAB Grader for Matlab programs or an analogous method for Python programs which will provide you with instant feedback on whether your numerical answer is correct or not.

Note that the assignment will be individual assessments.

Lab test

Assessment Overview

The laboratory test in week 9 will run for 90 minutes and take place in the computer lab under exam conditions. You will be asked to write several short programming scripts and functions to solve simpler versions of the lab exercises. You can choose to write your answers in either MATLAB or Python.

The laboratory test will be returned to students with comments and/or solutions in line with standard policy.

Course Learning Outcomes

- CLO2 : Apply the underlying mathematics, computational techniques and problem-solving skills relevant for problems in financial mathematics.
- CLO3 : Determine confidence in a computed answer and the risks associated with a given computational problem.

Detailed Assessment Description

The laboratory test in week 9 will run for 90 minutes and take place in the computer lab under exam conditions. You will be asked to write several short programming scripts and functions to solve simpler versions of the lab exercises. You can choose to write your answers in either MATLAB or Python.

The laboratory test will be returned to students with comments and/or solutions in line with standard policy.

Assignment submission Turnitin type

This is not a Turnitin assignment

Final exam

Assessment Overview

The final 2 hour exam will mainly test your mathematical understanding of the numerical methods discussed in lectures, and of the application in a financial context. It occurs in the formal examination period and covers the content of the entire course.

Mark returned as part of final mark. The usual UNSW and School rules for inspection of exam applies.

Course Learning Outcomes

- CLO1 : Apply quantitative skills and mathematical reasoning to solve problems relevant to finance, insurance and risk management.
- CLO2 : Apply the underlying mathematics, computational techniques and problem-solving skills relevant for problems in financial mathematics.
- CLO4 : Select appropriate computational techniques to analyse financial data and interpret the answers within a financial problem.

Detailed Assessment Description

The final 2 hour exam will mainly test your mathematical understanding of the numerical methods discussed in lectures, and of the application in a financial context. It occurs in the formal examination period and covers the content of the entire course.

Mark returned as part of final mark. The usual UNSW and School rules for inspection of exam applies.

Assignment submission Turnitin type

This is not a Turnitin assignment

General Assessment Information

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Lecture	Computing with real numbers
Week 2 : 3 June - 9 June	Lecture	Size, equality, norms, sensitivity
Week 3 : 10 June - 16 June	Lecture	Matrix structures, factorizations Data fitting
Week 4 : 17 June - 23 June	Lecture	Splines and sparse matrices
Week 5 : 24 June - 30 June	Lecture	Fourier Analysis and FFT
Week 6 : 1 July - 7 July	Lecture	Flexibility Week
Week 7 : 8 July - 14 July	Lecture	Implied Volatility and Nonlinear Equations Numerical Integration
Week 8 : 15 July - 21 July	Lecture	Random numbers and simulation
Week 9 : 22 July - 28 July	Lecture	Stochastic Integration and SDEs
Week 10 : 29 July - 4 August	Lecture	Partial differential equations and finite difference methods

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
	Kassem Mustapha		Works off campus		Consultation Time will be provided in Moodle	No	Yes

Other Useful Information

Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the UNSW Student Code of Conduct Website.

Academic Honesty and Plagarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.
Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others'

ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity, plagiarism and the use of AI in assessments can be located at:

- The Current Students site,
- The ELISE training site, and
- The Use of AI for assessments site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct

Submission of Assessment Tasks

Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration

Important note: UNSW has a "fit to sit/submit" rule, which means that if you sit an exam or

submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

Faculty-specific Information

Additional support for students

- [The Current Students Gateway](#)
- [Student Support](#)
- [Academic Skills and Support](#)
- [Student Wellbeing, Health and Safety](#)
- [Equitable Learning Services](#)
- [UNSW IT Service Centre](#)
- Science EDI Student [Initiatives](#), [Offerings](#) and [Guidelines](#)

School-specific Information

School of Mathematics and Statistics and UNSW Policies

The School of Mathematics and Statistics has adopted a number of policies relating to enrolment, attendance, assessment, plagiarism, cheating, special consideration etc. These are in addition to the Policies of The University of New South Wales. Individual courses may also adopt other policies in addition to or replacing some of the School ones. These will be clearly notified in the Course Initial Handout and on the Course Home Pages on the Maths Stats web site. Students in courses run by the School of Mathematics and Statistics should be aware of the School and Course policies by reading the appropriate pages on the web site starting at: [The School of Mathematics and Statistics assessment policies](#)

The School of Mathematics and Statistics will assume that all its students have read and understood the School policies on the above pages and any individual course policies on the Course Initial Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedure in it.

Special Consideration - Short Extension Policy

The School of Mathematics and Statistics has carefully reviewed its range of assignments and

projects to determine their suitability for automatic short extensions as set out by the UNSW Short Extension Policy. Upon comprehensive examination of our course offerings that incorporate these types of assessments, we have concluded that our current deadline structures already accommodate the possibility of unexpected circumstances that may lead students to require additional days for submission. Consequently, the School of Mathematics and Statistics has decided to universally opt out of the Short Extension provision for all its courses, having pre-emptively integrated flexibility into our assessment deadlines. The decision is subject to revision in response to the introduction of new course offerings. Students may still apply for Special Consideration via the usual procedures.

Computing Lab

The main computing laboratory is room G012 of the Anita B.Lawrence Centre (formerly Red Centre). You can get to this lab by entering the building through the main entrance to the School of Mathematics (on the Mezzanine Level) and then going down the stairs to the Ground Level. A second smaller lab is Room M020, located on the mezzanine level through the glass door (and along the corridor) opposite the School's entrance.

For more information, including opening hours, see the computing facilities webpage. Remember that there will always be unscheduled periods when the computers are not working because of equipment problems and that this is not a valid excuse for not completing assessments on time.

School Contact Information

Please visit the School of Mathematics and Statistics website for a range of information.

For information on Courses, please go to "Student life & resources" and either Undergraduate and/or Postgraduate and respective "Undergraduate courses" and "Postgraduate courses" for information on all course offerings.

All school policies, forms and help for students can be located by going to the "Student Services" within "Student life & resources" page. We also post notices in "Student noticeboard" for your information. Please familiarise yourself with the information found in these locations. If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

Undergraduate

E: ug.mathsstats@unsw.edu.au

P: 9385 7011 or 9385 7053

Postgraduate

E: pg.mathsstats@unsw.edu.au

P: 9385 7053

Should we need to contact you, we will use your official UNSW email address of in the first instance. **It is your responsibility to regularly check your university email account. Please use your UNSW student email and state your student number in all emails to us.**