UNSW Course Outline

MATH3411 Information, Codes and Ciphers - 2024

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General Course Information

Course Code : MATH3411
Year : 2024
Term : Term 3
Teaching Period : T3
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Mathematics & Statistics
Delivery Mode : Multimodal
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course provides an introduction to information theory, including error-correcting codes, data compression and cryptography. Each of these subtopics are enhanced by the application of entropy functions, and more sophisticated error-correcting codes are provided by way of brief

introduction to number theory and finite fields. The lectures are held face-to-face with simultaneous interactive online streaming. There is a weekly tutorial with multiple time slots to choose from, including online tutorials and face-to-face tutorials. The course emphases understanding, not just skill learning, and on helping each other to learn, understand and enjoy the content and the course.

Course Aims

The aim of MATH3411 is to provide students with an overview and understanding of representative areas of information theory, coding theory, data compression and cryptography. The course aims to provide in-depth mathematical understanding of these areas. This can complement and support implementation-focused understanding of these areas.

Relationship to Other Courses

To understand and master MATH3411 contents, it is very useful to have a good grasp of basic linear algebra, for instance from MATH1231/41. It is also useful to know some modular arithmetic, for instance from MATH1081. A small part of the MATH3411 course content overlaps slightly with that of other courses, including MATH2400 (BCH codes) and ZEIT3102 (parts of cryptography), providing illuminatingly complementary views of the overlapping content.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Demonstrate an understanding of information theory and be able to apply various methods to solve simple and complex problems in information theory.
CLO2 : Demonstrate an understanding of various coding theories and be able to apply various methods to solve simple and complex problems in coding theory.
CLO3 : Demonstrate an understanding of cryptographic concepts and be able to apply various methods to solve simple and complex problems in cryptography.

Course Learning Outcomes	Assessment Item
CLO1 : Demonstrate an understanding of information theory and be able to apply various methods to solve simple and complex problems in information theory.	• Test 1 • Final exam
CLO2 : Demonstrate an understanding of various coding theories and be able to apply various methods to solve simple and complex problems in coding theory.	• Test 2 • Test 1 • Final exam
CLO3 : Demonstrate an understanding of cryptographic concepts and be able to apply various methods to solve simple and complex problems in cryptography.	• Test 3 • Final exam

Learning and Teaching Technologies

Moodle - Learning Management System | Blackboard Collaborate | piazza

Learning and Teaching in this course

Maths can be hard, and the concepts in MATH3411 are not always easy. However, the aims of the course are present the content in a relatable and engaging way, and to motivate and support students of the course to support each other to understand the mathematical concepts and arguments, to master the mathematical techniques, and to think and develop ideas and content of their own. The course content and material, the lectures and tutorials, and the assessments are all designed with these aims in mind. A forum is provided to support these aims, and emphasis is placed on the freedom for individual students to choose which lecture and tutorial formats suit them best.

Additional Course Information

None

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Test 1 Assessment Format: Individual	10%	Start Date: Thursday Week 4 Due Date: Thursday Week 4
Test 2 Assessment Format: Individual	15%	Start Date: Thursday Week 7 Due Date: Thursday Week 7
Test 3 Assessment Format: Individual	15%	Start Date: Thursday Week 10 Due Date: Thursday Week 10
Final exam Assessment Format: Individual	60%	Due Date: Exam Period

Assessment Details

Test 1

Assessment Overview

Test 1 is designed to assess your knowledge and understanding of the topics covered in Chapters 1 and 2. Test 1 will be held online on during Week 4, with a time limit of 30 minutes. The questions include problem solving and multiple choice questions. You will be provided with feedback with comments and/or solutions.

Course Learning Outcomes

- CLO1 : Demonstrate an understanding of information theory and be able to apply various methods to solve simple and complex problems in information theory.
- CLO2 : Demonstrate an understanding of various coding theories and be able to apply various methods to solve simple and complex problems in coding theory.

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.
For more information on Generative AI and permitted use please see here.

Test 2

Assessment Overview

Test 2 is designed to assess your knowledge and understanding of the topics covered in Chapters 3. Test 2 will be held online during Week 7, with a time limit of 45 minutes. The questions include problem solving and multiple choice questions. You will be provided with feedback with comments and/or solutions.

Course Learning Outcomes

- CLO2 : Demonstrate an understanding of various coding theories and be able to apply various methods to solve simple and complex problems in coding theory.

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.
For more information on Generative AI and permitted use please see here.

Test 3

Assessment Overview

Test 3 is designed to assess your knowledge and understanding of the topics covered in Chapters 4 and 5. Test 3 will be held online during Week 10, with a time limit of 45 minutes. The questions include problem solving and multiple choice questions. You will be provided with feedback with comments and/or solutions.

Course Learning Outcomes

- CLO3 : Demonstrate an understanding of cryptographic concepts and be able to apply various methods to solve simple and complex problems in cryptography.

Generative AI Permission Level

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.
For more information on Generative AI and permitted use please see here.

Final exam

Assessment Overview

The final exam is designed to assess your knowledge and mastery of the methods presented in the lectures and tutorials during the course, and to assess your understanding of the concepts presented in the lectures and tutorials during the course. The exam consists of numerical and short answer responses and multiple choice questions. The exam is 3hrs and is conducted on-campus. The exam will occur during the official university examination period. Feedback is available through inquiry with the course convener. Hurdle requirement: you must achieve a total of 50% in your final mark to receive a passing grade in the course.

Course Learning Outcomes

- CLO1 : Demonstrate an understanding of information theory and be able to apply various methods to solve simple and complex problems in information theory.
- CLO2 : Demonstrate an understanding of various coding theories and be able to apply various methods to solve simple and complex problems in coding theory.
- CLO3 : Demonstrate an understanding of cryptographic concepts and be able to apply various methods to solve simple and complex problems in cryptography.

Detailed Assessment Description

Note that your final mark is the sum of your three test marks and your final exam mark. To pass the course, you must achieve at least 50% in this final mark, which is 50 marks out of 100. This is the only hurdle requirement; there is no hurdle requirement on your final exam mark.

Generative AI Permission Level

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.
For more information on Generative AI and permitted use please see here.

General Assessment Information

Tests 1-3 will be held online and are primarily meant to serve as learning tools. They are highly randomised and can be practised for 4 weeks in advance of each tests. The test questions are, as far as possible, meant to be quick and easy (and hopefully fun) given understanding of the content but difficult to answer without that understanding. Students are encouraged to help each other understand the content and together master these tests. A forum is provided to help students do so.

Grading Basis

Standard

Requirements to pass course

At least 50 marks out of 100.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 9 September - 15 September	Seminar	Chapters 1 and 2
	Tutorial	Tutorial Questions 1 - 9
Week 2 : 16 September - 22 September	Seminar	Chapter 2
	Tutorial	Tutorial Questions 10 - 14
Week 3 : 23 September - 29 September	Seminar	Chapters 2 and 3
	Tutorial	Tutorial Questions 15 - 24
Week 4 : 30 September - 6 October	Seminar	Chapter 3
	Tutorial	Tutorial Questions 25 - 32
	Assessment	Test 1 [held on Thursday 3 October]
Week 5 : 7 October - 13 October	Seminar	Chapters 3 and 4
	Tutorial	Tutorial Questions 33 - 40
Week 6 : 14 October - 20 October	Other	Flexibility week
Week 7 : 21 October - 27 October	Seminar	Chapters 4 and 5
	Tutorial	Tutorial Questions 41 - 48
	Assessment	Test 2 [held on Thursday 24 October]
Week 8 : 28 October - 3 November	Seminar	Chapter 5
	Tutorial	Tutorial Questions 49 - 55
Week 9 : 4 November - 10 November	Seminar	Chapters 5 - 7
	Tutorial	Tutorial Questions 56 - 68 Additional recorded online tutorial: Questions 69 - 78
Week 10 : 11 November - 17 November	Seminar	Chapter 7
	Tutorial	Tutorial Questions 78 - 85 Additional recorded online tutorial: Questions 86 - 100
	Assessment	Test 3 [held on Thursday 14 November]

Attendance Requirements

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

General Schedule Information

Please see Moodle.

Course Resources

Prescribed Resources

All course material will be provided via Moodle. No additional resources are required. Some

online resources on YouTube and elsewhere are excellent for learning but pease be aware that notation and terminology might differ from that found in MATH3411 and might cause confusion. AI help can be very helpful for asking and getting good explanations for concepts. However, beware that AI answers are unrealiable, especially for mathematical calculations.

Recommended Resources

All resources for the course will be provided on Moodle.

Additional Costs

None.

Course Evaluation and Development

MATH3411 is one of the most popular courses at UNSW Sydney, and this is largely due to excellent student engagement and feedback through more than a decade. Since 2013, MATH3411 has undergone many changes in response to student feedback and wellbeing. A first major change was to swap the order of Chapters 6 and 7, by excellent suggestion of a student. The shift from semesters to trimester caused misalignment between lectures, tutorials and tests. Students were very helpful to pointed out where these misalignments occured, and which content was possibly not worth keeping. These suggestions were followed and the lectures, tutorials and tests are very well aligned now. Some students did not have previous knowledge of modular arithmetic so materials on this topic are now provided, along with additional instruction help for anyone in need of quickly learning the required aspects of this topic. Over the past decade, the course enrollment numbers have grown from 75 to up to 350 students, and this has changed the logistical and social requirements of the course to change. Students reported that it was difficult to take tests in packed auditoriums, so online tests were developed and are now used. With greater student numbers, the risk of social cohesion fragmenting increases, so the tests were made to be highly randomised and practiceable, so that they could become more like fun game-like learning tools rather than just assessments. To create a course community, a forum has been included that allows completely annonymity as well as better functionality than Moodle's forum. Since 2020, many other changes have been implemented at students' suggestions, improving the course every year.
Please help improve the course even further, by contributing your own feedback too, in class, in person, on the forum, via email and in any other way!

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Administrator	Thomas Britz		RC-5111, School of Mathematics and Statistics, Anita B. Lawrence Centre, UNSW Sydney NSW 2052	0451658790	By appointment; also feel free to send me emails and ask questions in class and via the piazza forum!	Yes	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 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.**