



DMTH237

Discrete Mathematics II

S1 Day 2014

Mathematics

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General Information

Unit convenor and teaching staff

Other Staff

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Unit Convenor

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Credit points

3

Prerequisites

DMTH137 or MATH133 or MATH136

Corequisites

Co-badged status

Unit description

The purpose of this unit is to give a grounding in discrete mathematics. It is important preparation for both theoretical computing and abstract algebra. In particular, the unit: explores the concept of computability, and the measures of computational complexity and finite state machines; studies recurrence relations and generating functions; provides an introduction to discrete probability; applies graph theory to a range of problems; and examines a variety of error correcting and public key cryptography codes.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

Learning Outcomes

On successful completion of this unit, you will be able to:

Demonstrate a well-developed knowledge of the principles, concepts and mathematical techniques, particularly as applied to problems requiring or applicable to computational methods and techniques. Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate

mathematical or computational techniques.

Construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning, particularly in areas concerning how computer programs work and can be used.

Expressing yourself clearly and logically in writing.

Able to appreciate what kinds of problems are capable of being solved with a computer; in particular appreciating that there are some problems that are logically intractable.

Assessment Tasks

Name	Weighting	Due
Five assignments	20%	see unit website
1 Project	20%	see unit website
Final examination	60%	University Examination Period
online quizzes	0%	see unit website

Five assignments

Due: **see unit website**

Weighting: **20%**

For specific details, see the [unit website](#).

On successful completion you will be able to:

- Demonstrate a well-developed knowledge of the principles, concepts and mathematical techniques, particularly as applied to problems requiring or applicable to computational methods and techniques. Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical or computational techniques.
- Construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning, particularly in areas concerning how computer programs work and can be used.
- Expressing yourself clearly and logically in writing.
- Able to appreciate what kinds of problems are capable of being solved with a computer; in particular appreciating that there are some problems that are logically intractable.

1 Project

Due: **see unit website**

Weighting: **20%**

RSA Project. Consult the [unit website](#).

On successful completion you will be able to:

- Demonstrate a well-developed knowledge of the principles, concepts and mathematical techniques, particularly as applied to problems requiring or applicable to computational methods and techniques. Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical or computational techniques.
- Construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning, particularly in areas concerning how computer programs work and can be used.
- Able to appreciate what kinds of problems are capable of being solved with a computer; in particular appreciating that there are some problems that are logically intractable.

Final examination

Due: **University Examination Period**

Weighting: **60%**

See the [unit website](#) concerning the "expected participation" required for an expectation of achieving a satisfactory grade overall.

On successful completion you will be able to:

- Demonstrate a well-developed knowledge of the principles, concepts and mathematical techniques, particularly as applied to problems requiring or applicable to computational methods and techniques. Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical or computational techniques.
- Construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning, particularly in areas concerning how computer programs work and can be used.
- Expressing yourself clearly and logically in writing.
- Able to appreciate what kinds of problems are capable of being solved with a computer; in particular appreciating that there are some problems that are logically intractable.

online quizzes

Due: **see unit website**

Weighting: **0%**

These quizzes are effectively home-work, but are “compulsory”.

On successful completion you will be able to:

- Demonstrate a well-developed knowledge of the principles, concepts and mathematical techniques, particularly as applied to problems requiring or applicable to computational methods and techniques. Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical or computational techniques.
- Construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning, particularly in areas concerning how computer programs work and can be used.
- Able to appreciate what kinds of problems are capable of being solved with a computer; in particular appreciating that there are some problems that are logically intractable.

Delivery and Resources

Classes

Lectures: you should attend two hours of each lecture stream each week, making a total of four hours.

Tutorials: you should attend one tutorial each week.

Practicals: you should attend one practical each week.

Workshops: available for students wanting to see more examples and ask further questions. Attendance is strongly recommended.

Online lecture notes

- [W.W.Chen: Lecture notes on Discrete Mathematics](#)
- [C.Cooper: Mathematics Notes, DMTH237 – Discrete Mathematics](#)
- [C.Cooper: **Mathematics Notes, DMTH237 – Languages and Machines**](#)

Recommended Texts and/or Materials

- Grimaldi, *Discrete and Combinatorial Mathematics* (Addison-Wesley-Longman 2003)
- RL Graham, DE Knuth, O Patashnik, *Concrete mathematics: a foundation for computer science* (Addison-Wesley 1994)

- WD Hillis, *The pattern on the stone. The simple ideas that make computers work.* (Weidenfeld, Nicolson 1998)
- A Hodges, *Alan Turing: the enigma* (Vintage 1992)
- DR Hofstadter, *Godel, Escher, Bach: an eternal braid* (1979) The Harvester Press
- DE Knuth, *The art of computer programming - Fundamental algorithms* (1973) Addison-Wesley
- M Minsky, *Computation: finite and infinite machines* (1967) Prentice-Hall
- S Singh, *The Code Book* (1999) Fourth Estate

These and similar texts are available in the Library.

Technology Used and Required

Students are expected to have access to an internet enabled computer with a web browser and Adobe Reader software. Several areas of the university provide wireless access for portable computers. There are computers for student use in the Library and in the [Numeracy Centre](#) (C5A 255).

Difficulties with your home computer or internet connection do not constitute a reasonable excuse for lateness of, or failure to submit, assessment tasks.

Unit Schedule

WEEK	ALGEBRA & GRAPH THEORY	LANGUAGES & MACHINES
1	Complex numbers	Languages
2	Complex numbers	Introduction to finite-state machines (FSMs)
3	Introduction to matrix theory	Reduction of FSMs
4	Introduction to matrix theory	Non-deterministic finite-state acceptors (FSAs)
5	Revision of counting techniques	FSAs and regular languages
6	Generating functions	Turing machines
	— mid-semester break —	— mid-semester break —
7	Generating functions	Turing machines
8	Recurrence relations	Extended Turing machines

9	Recurrence relations	The Busy Beaver and Halting problems
10	Recurrence relations	Integers mod m and cryptography
11	Directed graphs	
12	Directed graphs	Polynomial codes
13	Revision	

Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](#). Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- [Workshops](#)

- [StudyWise](#)
- [Academic Integrity Module for Students](#)
- [Ask a Learning Adviser](#)

Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit <http://informatics.mq.edu.au/help/>.

When using the University's IT, you must adhere to the [Acceptable Use Policy](#). The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcome

- Demonstrate a well-developed knowledge of the principles, concepts and mathematical techniques, particularly as applied to problems requiring or applicable to computational methods and techniques. Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical or computational techniques.

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary

solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Demonstrate a well-developed knowledge of the principles, concepts and mathematical techniques, particularly as applied to problems requiring or applicable to computational methods and techniques. Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical or computational techniques.
- Construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning, particularly in areas concerning how computer programs work and can be used.
- Expressing yourself clearly and logically in writing.

Assessment tasks

- Five assignments
- 1 Project
- Final examination

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Demonstrate a well-developed knowledge of the principles, concepts and mathematical techniques, particularly as applied to problems requiring or applicable to computational methods and techniques. Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical or computational techniques.
- Construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning, particularly in areas concerning how computer programs work and can be used.
- Expressing yourself clearly and logically in writing.

Assessment tasks

- Five assignments
- 1 Project
- Final examination

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Demonstrate a well-developed knowledge of the principles, concepts and mathematical techniques, particularly as applied to problems requiring or applicable to computational methods and techniques. Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical or computational techniques.
- Construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning, particularly in areas concerning how computer programs work and can be used.
- Expressing yourself clearly and logically in writing.

Assessment tasks

- Five assignments
- 1 Project
- Final examination

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- Demonstrate a well-developed knowledge of the principles, concepts and mathematical techniques, particularly as applied to problems requiring or applicable to computational

methods and techniques. Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical or computational techniques.

- Construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning, particularly in areas concerning how computer programs work and can be used.
- Expressing yourself clearly and logically in writing.

Assessment task

- 1 Project

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Demonstrate a well-developed knowledge of the principles, concepts and mathematical techniques, particularly as applied to problems requiring or applicable to computational methods and techniques. Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical or computational techniques.
- Construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning, particularly in areas concerning how computer programs work and can be used.
- Expressing yourself clearly and logically in writing.

Assessment tasks

- Five assignments
- Final examination

extra requirements

In order to obtain a passing grade in this unit, students are required to demonstrate their mastery of the required basic skills and techniques by passing all six on-line quizzes. Students who do not meet this requirement will have their grade capped at F 49.

Satisfactory performance on supervised assessment tasks, such as tests and the final exam, is

necessary to pass this unit. If there is a significant difference between a student's marks on supervised assessment tasks and on unsupervised assessment tasks, the scaling of these tasks may be adjusted when determining the final grade, to reflect more appropriately that student's performance on supervised tasks.