DMTH237

Discrete Mathematics II

S1 Day 2016

Dept of Mathematics

Contents

General Information

Unit convenor and teaching staff
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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 matrices with applications to systems of linear equations and vectors; 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%	Wednesday weeks 4, 6, 8,10, 12
1 Project	20%	27 April
Final examination	60%	University Examination Period
online quizzes	0%	weeks 2, 3, 5, 9, 11, 13

Five assignments

Due: **Wednesday weeks 4, 6, 8,10, 12**
Weighting: **20%**

For specific details, see the unit iLearn site.

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: **27 April**
Weighting: **20%**

FSA Project. Consult the unit iLearn website. This project is submitted online and immediate feedback is given. Update your submitted solutions as frequently as necessary to correctly perform the required programming task.

On successful completion you will be able to:

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- 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 iLearn site 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: **weeks 2, 3, 5, 9, 11, 13**
Weighting: **0%**

These 7 quizzes are “hurdle” assessment tasks. They are effectively home-work, but are **compulsory**. Attempt each quiz as many times as necessary to be able to answer all the questions.

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.
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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. Most areas of the university provide wireless access for portable computers. There are computers for student use in the Library, in E6A and at 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	BEGINNING	ALGEBRA & GRAPH THEORY	LANGUAGES & MACHINES	TASK DUE
1	29/02/2016	Trigonometry: Cooper, Chen	Languages	
2	07/03/2016		Introduction to finite-state machines (FSMs)	Q1 Q2
3	14/03/2016	Introduction to matrix theory: Cooper, Chen	Reduction of FSMs	Q3
4	21/03/2016		Non-deterministic finite-state acceptors (FSAs)	A1
5	28/03/2016	Revision of counting techniques: Cooper, Chen	FSAs and regular languages	Q4

6	04/04/2016	Generating functions	Turing machines	A2
MID-SESSION BREAK				
7	25/04/2016	Generating functions	Turing machines	FSA
8	02/05/2016	Recurrence relations	Extended Turing machines	A3
9	09/05/2016		The Busy Beaver and Halting problems	Q5
10	16/05/2016		Integers mod *m* and cryptography	A4
11	23/05/2016	Graph algorithms: Cooper, Chen	Polynomial codes	Q6
12	30/05/2016		Matrix codes	A5
13	06/06/2016	**Revision**		Q7

This table is a rough guide to the timing of the material in DMTH237. Please note that the order and weeks of topics is likely to change. The assignment, test and quiz dates are fixed. Once complete, this table may not be updated during semester.

Attendance at lectures and tutorials is the only sure way to find out the where the schedule of topics is up to.

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

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.html

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

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.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/

Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

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://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

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.
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- Expressing yourself clearly and logically in writing.

Assessment task

- 1 Project

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 outcomes

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- 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

- Five assignments
- 1 Project

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

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.
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Assessment task

- Five assignments

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

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Assessment tasks

- Five assignments
- 1 Project
- Final examination
- online quizzes

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

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Assessment tasks

- Five assignments
- 1 Project
- Final examination
- online quizzes

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

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Assessment tasks

- Five assignments
- 1 Project
- Final examination
- online quizzes

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.
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- Expressing yourself clearly and logically in writing.

Assessment tasks

- Five assignments
- Final examination

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

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.

Changes from Previous Offering

Tutorials and Practical Sessions commence in Week 2. However there are two revision quizzes due by the end of Week 2, so students should spend time in Week 1 revising topics from the pre-requisite unit of DMTH137. Given that DMTH237 has an alternate entrance pathway (via MATH135, MATH136, etc.) avoiding DMTH137, there may be some topics which those students

have not studied yet; e.g., Logic, Set Theory, Counting methods. Lecture notes for these are available along with the Cooper notes for DMTH237. These should be studied during the first 1–2 weeks.

The 1st topic in the Algebra & Graph Theory stream “Complex numbers” is now replaced by “Trigonometry”.

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 seven (7) 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.