



DMTH137

Discrete Mathematics I

S2 Day 2017

Dept of Mathematics

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General Information

Unit convenor and teaching staff

Unit Convenor

Ross Moore

ross.moore@mq.edu.au

Contact via 9850 8955

12 Wally's Walk (E7A), Level 7.34

Tuesday 14:00–15:00, or by appointment

Credit points

3

Prerequisites

Corequisites

Co-badged status

Unit description

This unit provides a background in the area of discrete mathematics to provide an adequate foundation for further study in computer science. It is also of great interest to students wishing to pursue further study in mathematics. In this unit, students study propositional and predicate logic; methods of proof; fundamental structures in discrete mathematics such as sets, functions, relations and equivalence relations; Boolean algebra and digital logic; elementary number theory; graphs and trees; and elementary counting techniques.

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:

Knowledge of the principles and concepts of a broad range of areas in mathematical sciences with depth in at least one area

Understanding of the breadth of the discipline, its role in other fields, and the way other fields contribute to the development of the mathematical sciences

Ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning

Ability to formulate and model practical and abstract problems in mathematical and/or

statistical terms using a variety of methods

Application of mathematical and/or statistical principles, concepts, techniques and technology to solve practical and abstract problems.

Appropriate interpretation of information communicated in mathematical and/or statistical form

Appropriate presentation of information, reasoning and conclusions in a variety of modes, to diverse audiences (expert and non-expert).

Ethical application of mathematical and statistical approaches to solving problems

Ability to work effectively, responsibly and safely in an individual or team context.

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignments	30%	No	See iLearn
Tutorial work	20%	No	weekly
Final Examination	50%	No	University examination period

Assignments

Due: **See iLearn**

Weighting: **30%**

Three assignments each weighted at 10%.

On successful completion you will be able to:

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- Appropriate presentation of information, reasoning and conclusions in a variety of modes, to diverse audiences (expert and non-expert).
- Ethical application of mathematical and statistical approaches to solving problems
- Ability to work effectively, responsibly and safely in an individual or team context.

Tutorial work

Due: **weekly**

Weighting: **20%**

Recorded tutorial attendance and marked in-tutorial questions. Only students who attend the whole tutorial session will have their work graded. The best 8 marks during the unit will contribute to 20% of the grade for the unit.

On successful completion you will be able to:

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- Appropriate presentation of information, reasoning and conclusions in a variety of modes, to diverse audiences (expert and non-expert).
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Final Examination

Due: **University examination period**

Weighting: **50%**

Two-hour final exam covering any aspect of the unit, but particularly the final topics not yet assessed with an assignment.

On successful completion you will be able to:

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Delivery and Resources

Classes

Lectures: you should attend both lectures on each of two days each week, making a total of four hours.

Tutorials: you should attend one 1-hour tutorial each week.

Workshops: the Numeracy Centre runs regular workshops for students in this unit.

Required and Recommended Texts and/or Materials

The designated text for DMTH137 is

- [Kenneth H Rosen, Discrete Mathematics and its Applications](#), any edition.

RECOMMENDED READING

Many of the unit's topics are covered (perhaps going to a deeper level) in other books, such as:

- 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* (The Harvester Press, 1979)
- DE Knuth, *The art of computer programming – Fundamental algorithms* (Addison-Wesley, 1973)
- M Minsky, *Computation: finite and infinite machines* (Prentice-Hall, 1967)
- S Singh, *The Code Book* (Fourth Estate, 1999)
- [CDH Cooper, *Mathematics at the Edge of the Rational Universe*](#)

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 devices. There are computers for student use in the Library.

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

31/07/2017	Laws of logic	Propositional logic, truth tables	
07/08/2017	Sets: operations on sets, Cartesian products, power sets	Predicate logic and negation; Proofs	
14/08/2017	complete graphs; bipartite graphs; walks, paths and cycles; trees and forests	Relations: symmetry, reflexivity, transitivity, equivalence; Undirected, directed and weighted graphs; degree of a vertex; equivalent graphs	X3
21/08/2017	Minimal spanning trees; Kruskal's algorithm; Prim's algorithm with Induction Proofs	Euler's formula; Planar graphs Euler and Hamiltonian cycles	X4
28/08/2017	Combinatorics: counting arguments; Permutations and Combinations	Functions: injectivity, surjectivity, invertibility	A1 X5
04/09/2017	The Binomial Theorem	Principle of Inclusion-Exclusion	X6
11/09/2017	more on Graph colouring	Graph colouring; Chromatic polynomial	X7
02/10/2017	Vectors, Case study: polygonal shapes	Matrices and Linear Transformations	X8
09/10/2017	Euclid's algorithm	Prime numbers; finding primes, Euclid's algorithm	A2 X9
16/10/2017	Binary numbers and arithmetic, arithmetic modulo n	Extended Euclid's algorithm	X10
23/10/2017	Inverses and powers modulo n	congruences, arithmetic modulo n	X11
30/10/2017	Minimisation of digital circuits — only if there's time	Boolean algebra, Logic gates — only if there's time	A3 X12
06/11/2017	Revision		X13

Learning and Teaching Activities

Lectures

Four 1-hour lectures per week

Tutorial

One 1-hour tutorial per week

Workshop

Optional workshops provided by Numeracy Centre

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_2016.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 (in effect until Dec 4th, 2017): http://www.mq.edu.au/policy/docs/disruption_studies/policy.html

Special Consideration Policy (in effect from Dec 4th, 2017): <https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration>

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

- Knowledge of the principles and concepts of a broad range of areas in mathematical sciences with depth in at least one area
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- Appropriate interpretation of information communicated in mathematical and/or statistical form
- Appropriate presentation of information, reasoning and conclusions in a variety of

modes, to diverse audiences (expert and non-expert).

Assessment tasks

- Assignments
- Final Examination

Learning and teaching activities

- Four 1-hour lectures per week
- One 1-hour tutorial per week

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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- Appropriate presentation of information, reasoning and conclusions in a variety of modes, to diverse audiences (expert and non-expert).
- Ethical application of mathematical and statistical approaches to solving problems
- Ability to work effectively, responsibly and safely in an individual or team context.

Learning and teaching activities

- Four 1-hour lectures per week
- One 1-hour tutorial per week

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.

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Learning outcomes

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- Application of mathematical and/or statistical principles, concepts, techniques and technology to solve practical and abstract problems.

Learning and teaching activities

- One 1-hour tutorial per week
- Optional workshops provided by Numeracy Centre

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.

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Learning outcomes

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- Ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning
- Ability to formulate and model practical and abstract problems in mathematical and/or statistical terms using a variety of methods
- Application of mathematical and/or statistical principles, concepts, techniques and technology to solve practical and abstract problems.

Assessment tasks

- Assignments
- Tutorial work
- Final Examination

Learning and teaching activities

- Four 1-hour lectures per week
- One 1-hour tutorial per week
- Optional workshops provided by Numeracy Centre

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.

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Learning outcomes

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Learning and teaching activities

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- One 1-hour tutorial per week
- Optional workshops provided by Numeracy Centre

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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- Appropriate presentation of information, reasoning and conclusions in a variety of modes, to diverse audiences (expert and non-expert).

Assessment tasks

- Assignments
- Tutorial work
- Final Examination

Learning and teaching activities

- Four 1-hour lectures per week

- One 1-hour tutorial per week

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

- Appropriate interpretation of information communicated in mathematical and/or statistical form
- Appropriate presentation of information, reasoning and conclusions in a variety of modes, to diverse audiences (expert and non-expert).

Assessment tasks

- Assignments
- Tutorial work
- Final Examination

Learning and teaching activities

- Four 1-hour lectures per week
- One 1-hour tutorial per week

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

- Ethical application of mathematical and statistical approaches to solving problems

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active

participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes

- Ethical application of mathematical and statistical approaches to solving problems
- Ability to work effectively, responsibly and safely in an individual or team context.