



# DMTH137

## Discrete Mathematics I

S2 Day 2019

*Dept of Mathematics and Statistics*

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## General Information

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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.

## General Assessment Information

**HURDLES:** Participation in a weekly Small Group Teaching Activity (SGTA) is **compulsory** from week 2. Participation will be assessed by observation of students' work during classes or through submission of work completed during the SGTA. Participation and reasonable engagement in the class activities in at least 10 out of 12 of the SGTA's are requirements to pass the unit. This is a hurdle requirement.

The online quizzes may be attempted as many times as necessary to achieve a pass. These are **hurdle** requirements.

**ATTENDANCE and PARTICIPATION:** Please contact the unit convenor as soon as possible if you have difficulty attending and participating in any classes. There may be alternatives available to make up the work. If there are circumstances that mean you miss a class, you can apply for a [Special Consideration](#).

**ASSIGNMENT SUBMISSION:** Assignment submission will be online through the iLearn page. The following information is also available on the iLearn page:

Submit assignments online via the appropriate assignment link below. A personalised cover sheet is not required with online submissions. Read the submission statement carefully before accepting it as there are substantial penalties for making a false declaration.

Submit and access feedback from an iLearn assignment (this is a hyperlink to the attached file)

- Assignment submission is via iLearn. You should upload this as a single scanned PDF file.
- Please note the quick guide on how to upload your assignments in the link above.
- Please make sure that each page in your uploaded assignment corresponds to only one A4 page (do not upload an A3 page worth of content as an A4 page in landscape). If you are using an app like Clear Scanner, please make sure that the photos you are using are clear and shadow-free.
- It is your responsibility to make sure your assignment submission is legible.
- If there are technical obstructions to your submitting online, please email us to let us know.

You may submit as often as required prior to the due date/time. Please note that each submission will completely replace any previous submissions. It is in your interests to make frequent submissions of your partially completed work as insurance against technical or other problems near the submission deadline.

**LATE SUBMISSION OF WORK:** All assignments or assessments must be submitted by the official due date and time. No marks will be given to late work unless an extension has been granted following a successful application for [Special Consideration](#). Please contact the unit convenor for advice as soon as you become aware that you may have difficulty meeting any of the assignment deadlines. It is in your interests to make frequent submissions of your partially completed work. Note that later submissions completely replace any earlier submission, and so only the final submission made before the due date will be marked.

**FINAL EXAM POLICY:** examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is, the final day of the official examination period. The only excuse for not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these special circumstances, you may apply for special consideration via [ask.mq.edu.au](http://ask.mq.edu.au).

#### **SUPPLEMENTARY EXAMINATIONS:**

**IMPORTANT:** If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. If you apply for special consideration, you must give the supplementary examination priority over any other pre-existing commitments, as such commitments will not usually be considered an acceptable basis for a second application for special consideration. Please ensure you are familiar with the policy prior to submitting an application. You can check the supplementary exam information page on FSE101 in iLearn (<https://bit.ly/FSESup>) for dates, and approved applicants will receive an individual notification sometime in the week prior to the exam with the exact date and time of their supplementary examination.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">SGTA</a>	0%	Yes	Weekly
<a href="#">Online quizzes</a>	0%	Yes	Weeks 2, 3, 5, 9, 12
<a href="#">Assignment 1</a>	15%	No	Week 7
<a href="#">Assignment 2</a>	15%	No	Week 12
<a href="#">Class test</a>	20%	No	Week 6
<a href="#">Final examination</a>	50%	No	Formal Examination period

### SGTA

Due: **Weekly**

Weighting: **0%**

**This is a hurdle assessment task (see [assessment policy](#) for more information on hurdle assessment tasks)**

Small Group Teaching Activities allows students to explore the concepts introduced in lectures through working on specific problems.

Participation in Small Group Teaching Activity (SGTA) is compulsory from week 2. Participation will be assessed by observation of students' work during classes and through the presentation of work completed prior to the SGTA in at least 10 out of 12 of the SGTA's. This is a hurdle requirement.

On successful completion 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.
- 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.
- Appropriate interpretation of information communicated in mathematical and/or statistical form.
- Ethical application of mathematical and statistical approaches to solving problems.
- Ability to work effectively, responsibly and safely in an individual or team context.

## Online quizzes

Due: **Weeks 2, 3, 5, 9, 12**

Weighting: **0%**

**This is a hurdle assessment task (see [assessment policy](#) for more information on hurdle assessment tasks)**

Online quizzes, see iLearn for access.

The online quizzes may be attempted as many times as necessary to achieve a pass. These are **hurdle** requirements.

On successful completion 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.
- Ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning.
- 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.
- Ethical application of mathematical and statistical approaches to solving problems.
- Ability to work effectively, responsibly and safely in an individual or team context.

## Assignment 1

Due: **Week 7**

Weighting: **15%**

Assignment

On successful completion 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.

## Assignment 2

Due: **Week 12**

Weighting: **15%**

Assignment

On successful completion 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.

## Class test

Due: **Week 6**

Weighting: **20%**

Test

On successful completion 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.
- Ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning.
- 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).
- Ability to work effectively, responsibly and safely in an individual or team context.

## Final examination

Due: **Formal Examination period**

Weighting: **50%**

Final exam is 2hrs (plus 10 mins reading time).

On successful completion 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.
- Ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning.
- 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).
- Ability to work effectively, responsibly and safely in an individual or team context.

## Delivery and Resources

### Classes

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

**Small Group Teaching Activities (SGTA):** you should attend one 1-hour SGTA each week,



starting in Week 2.

**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, McGraw-Hill, any edition.

## 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

WEEK	BEGINNING	GRAPHS, NUMBER THEORY	LOGIC, SETS, ALGEBRA	TASK DUE
1	29/07/2019	Introduction to Graph Theory: Undirected, directed and weighted graphs; degree of a vertex; equivalent graphs; ..	Propositional logic, truth tables	
2	05/08/2019	Complete graphs; bipartite graphs; walks, paths and cycles	Laws of logic	Q1
3	12/08/2019	Trees and Forests; Euler's formula; Planar graphs;	Predicate logic and negation, Proofs	Q2
4	19/08/2019	Properties of natural numbers; induction;	Sets: operations on sets, Cartesian products, power sets	
5	26/08/2019	Euclid's algorithm	Relations: symmetry , reflexivity, transitivity, equivalence	Q3
6	02/09/2019	Prime numbers; finding primes; congruences	Functions: injectivity, surjectivity, invertibility	T1
7	09/09/2019	Peano axioms, addition and multiplication of natural numbers	Combinatorics: counting arguments, permutations and combinations	A1
<b>MID-SESSION BREAK</b>				
8	30/09/2019	Induction Proofs, Binary numbers and arithmetic	Principle of Inclusion–Exclusion	
9	08/10/2019	arithmetic modulo $n$	The Binomial Theorem and Extended Binomial Theorem	Q4

10	14/10/2019	Inverses and powers modulo $n$	Boolean algebra	
11	21/10/2019	Minimal spanning trees; Kruskal's algorithm; Prim's algorithm	Logic gates	A2
12	28/10/2019	Graph colouring; Chromatic polynomial	Minimisation of digital circuits	Q5
13	04/11/2019	<b>Revision</b>		

## Learning and Teaching Activities

### Lectures

Four 1-hour lectures per week

### Small Group Teaching Activity (SGTA)

One 1-hour SGTA per week, starting in Week 2

### Workshop

Optional workshops provided by the Numeracy Centre

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Grade Appeal Policy](#)
- [Complaint Management Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#) (**Note:** *The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.*)

Undergraduate students seeking more policy resources can visit the [Student Policy Gateway \(https://students.mq.edu.au/support/study/student-policy-gateway\)](https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central \(http](#)

[s://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/student-conduct>

## Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) 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](https://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@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](https://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](https://ask.mq.edu.au)

If you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@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/](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.
- 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 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.
- Ability to work effectively, responsibly and safely in an individual or team context.

#### Assessment tasks

- Assignment 1
- Assignment 2

### 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

- 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.
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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.

## Assessment tasks

- Online quizzes
- Assignment 1
- Assignment 2

## 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

- 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.
- Application of mathematical and/or statistical principles, concepts, techniques and technology to solve practical and abstract problems.
- Ability to work effectively, responsibly and safely in an individual or team context.

## Assessment task

- Online quizzes

## 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

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

- Online quizzes
- Assignment 1
- Assignment 2
- Class test
- 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

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

## Assessment tasks

- Online quizzes
- Assignment 1
- Assignment 2
- Class test
- 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

- 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.
- 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

- Online quizzes
- Assignment 1
- Assignment 2
- Class test
- Final examination

## 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

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

## Assessment tasks

- Assignment 1
- Assignment 2



- Class test
- 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 outcomes

- 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.
- 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

- Assignment 1
- Assignment 2

## 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

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

### Assessment tasks

- Assignment 1

- Assignment 2

## **Changes from Previous Offering**

DMTH137 will have a mid-semester test and two assignments this session. The unit will be taught by two lecturers in two parallel streams.