UNSW Course Outline

# ZPEM1306 Introduction to Discrete Mathematics - 2024

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## General Course Information

**Course Code :** ZPEM1306
**Year :** 2024
**Term :** Semester 1
**Teaching Period :** Z1
**Is a multi-term course? :** No
**Faculty :** UNSW Canberra
**Academic Unit :** UC Science
**Delivery Mode :** In Person
**Delivery Format :** Standard
**Delivery Location :** UNSW Canberra at ADFA
**Campus :** UNSW Canberra
**Study Level :** Undergraduate
**Units of Credit :** 6

**Useful Links**

Handbook Class Timetable

## Course Details & Outcomes

### Course Description

Discrete Mathematics is an area of mathematics directly applicable to both practical and theoretical aspects of computer science. It is the study of mathematical structures that are inherently discrete, as opposed to continuous structures that are dealt with using differential

calculus.

The importance of Discrete Mathematics today lies in its numerous practical and relevant applications. It plays an essential role in modelling the natural world (e.g., the genome) and the technological world (e.g., the Internet), and in designing efficient solutions such as Internet routing protocols. It is commonly used in cryptography, computer security, electronic banking, algorithms, theory of computing, telecommunications, web search engines, to mention a few.

Emphasis will be placed on developing knowledge of the elements of discrete mathematics of fundamental importance in the context of computing. Topics to be covered include:  foundations of logic, propositions and predicates; the concept of mathematical proof, with a focus on proof by induction, recurrence relations and algorithm correctness; set theory and basic theory of graphs and networks, including optimisation algorithms.

## Course Aims

# This course aims to give students an understanding of introductory concepts in discrete mathematics including basic logic, proofs and algorithms, and sets, graphs and trees. This material will form a mathematical foundation for later work in computing, cryptography, cybersecurity, and other applications in information technology.

## Relationship to Other Courses

ZPEM1306 is typically taken as part of the Bachelor of Computing and Cyber Security together with ZPEM1301 Mathematics 1A. In particular, both courses serve as prerequisites to ZEIT3102 Cryptography. ZPEM1306 is distinct from ZPEM2313 Discrete Mathematics with Applications but there is some overlap of content.

## Course Learning Outcomes

| Course Learning Outcomes |
|---|
| CLO1 : Demonstrate understanding of formal logic and methods of proof |
| CLO2 : Construct a valid proof of a true and provable mathematical statement |
| CLO3 : Demonstrate understanding of concepts of algorithm construction and be able to prove correctness of basic algorithms |
| CLO4 : Demonstrate understanding of basic concepts relating to sets, graphs and trees, and ability to analyse a problem using sets, graphs and trees, with appropriate diagrams |

| Course Learning Outcomes | Assessment Item |
|---|---|
| CLO1 : Demonstrate understanding of formal logic and methods of proof | • Class test 1<br>• Class test 2<br>• Final exam |
| CLO2 : Construct a valid proof of a true and provable mathematical statement | • Class test 2<br>• Final exam |
| CLO3 : Demonstrate understanding of concepts of algorithm construction and be able to prove correctness of basic algorithms | • Class test 3<br>• Final exam |
| CLO4 : Demonstrate understanding of basic concepts relating to sets, graphs and trees, and ability to analyse a problem using sets, graphs and trees, with appropriate diagrams | • Class test 3<br>• Final exam |

## Learning and Teaching Technologies

Moodle - Learning Management System

# Assessments

## Assessment Structure

| Assessment Item | Weight | Relevant Dates |
|---|---|---|
| Class test 1 | 20% | Start Date: Not Applicable<br>Due Date: Not Applicable |
| Class test 2 | 20% | Start Date: Not Applicable<br>Due Date: Not Applicable |
| Class test 3 | 20% | Start Date: Not Applicable<br>Due Date: Not Applicable |
| Final exam | 40% | Start Date: Not Applicable<br>Due Date: Not Applicable |

# Assessment Details

## Class test 1

**Assessment Overview**

Test covering part I of the course - Logic. Test is redeemable.

**Course Learning Outcomes**

- CLO1 : Demonstrate understanding of formal logic and methods of proof

**Detailed Assessment Description**

A 50 minute paper based test conducted during a regularly scheduled lecture period. The relevant content for the test is the preceeding 3-4 weeks concerning logic.

**Assessment Length**

50 minutes

**Submission notes**

Handwritten test.

**Assignment submission Turnitin type**

Not Applicable

## Class test 2

**Assessment Overview**

Test covering part II of the course - Proof and algorithms. Test is redeemable.

**Course Learning Outcomes**

- CLO1 : Demonstrate understanding of formal logic and methods of proof
- CLO2 : Construct a valid proof of a true and provable mathematical statement

**Detailed Assessment Description**

A 50 minute paper based test conducted during a regularly scheduled lecture period. The relevant content for the test is the preceeding 3-4 weeks concerning proof and algorithms.

**Assessment Length**

50 minutes

**Submission notes**

Handwritten test

Assignment submission Turnitin type

Not Applicable

## Class test 3

Assessment Overview

Test covering part III of the course - Sets, graphs and trees. Test is redeemable.

Course Learning Outcomes

- CLO3 : Demonstrate understanding of concepts of algorithm construction and be able to prove correctness of basic algorithms
- CLO4 : Demonstrate understanding of basic concepts relating to sets, graphs and trees, and ability to analyse a problem using sets, graphs and trees, with appropriate diagrams

Detailed Assessment Description

A 50 minute paper based test conducted during a regularly scheduled lecture period. The relevant content for the test is the preceeding 3-4 weeks concerning set, graphs, and trees.

Assessment Length

50 minutes

Submission notes

Handwritten test

Assignment submission Turnitin type

Not Applicable

## Final exam

Assessment Overview

Covers the entire course.

The results will inform the lecturer of the difficulties, or otherwise, the current students faced during the course. This in turn, will aid the development of the course to better educate subsequent students.

Course Learning Outcomes

- CLO1 : Demonstrate understanding of formal logic and methods of proof
- CLO2 : Construct a valid proof of a true and provable mathematical statement
- CLO3 : Demonstrate understanding of concepts of algorithm construction and be able to prove correctness of basic algorithms
- CLO4 : Demonstrate understanding of basic concepts relating to sets, graphs and trees, and

ability to analyse a problem using sets, graphs and trees, with appropriate diagrams

**Detailed Assessment Description**

An in-person, paper-based exam arranged and conducted by the UNSW Canberra examinations team.

The final exam will cover all three parts of the course and will have option sections which need only be completed by students wishing to reedeem earlier class tests.

**Assessment Length**

3 hours

**Submission notes**

Handwritten exam

**Assignment submission Turnitin type**

Not Applicable

# General Assessment Information

**Use of AI in Assessments**

NO ASSISTANCE
It is prohibited to use any software or service to search for or generate information or answers. If its use is detected, it will be regarded as serious academic misconduct and subject to the standard penalties, which may include 00FL, suspension and exclusion.

**Grading Basis**

Standard

**Requirements to pass course**

Achieve a composite mark of at least 50 out of 100.

# Course Schedule

| Teaching Week/Module | Activity Type | Content |
|---|---|---|
| Week 1 : 26 February - 1 March | Lecture | Logic<br>• Lecture 1 - Introduction<br>• Lecture 2 - Variables and Statements<br>• Lecture 3 - Introductory Set Theory<br>• Lecture 4 - Relations and Functions |
| Week 2 : 4 March - 8 March | Lecture | • Lecture 5 - Logical form and equivalence<br>• Lecture 6 - Conditional statements<br>• Lecture 7 - Valid and invalid arguments<br>• Lecture 8 - Predicates and quantified statements I |
| Week 3 : 11 March - 15 March | Lecture | • Lecture 9 - Predicates and quantified statements II<br>• Lecture 10 - Statements with multiple quantifiers<br>• Lecture 11 - Arguments with quantified statements<br>• Lecture 12 - Applications of Logic |
| Week 4 : 18 March - 22 March | Lecture | • Lecture 13 - Logic Olympics<br>• Lecture 14 - Practice Class Test |
| | Assessment | Class Test 1 - Friday, March 22. |
| Week 5 : 25 March - 29 March | Lecture | • Lecture 15 - Class Test 1 Discussion<br>• Lecture 16 - Methods of Proof I<br>• Lecture 17 - Methods of Proof II<br>• Good Friday |
| Week 6 : 1 April - 5 April | Lecture | • Lecture 18 - Methods of Proof III<br>• Lecture 19 - Methods of Proof IV<br>• Lecture 20 - Methods of Proof V<br>• Lecture 21 - Sequences |
| Week 7 : 22 April - 26 April | Lecture | • Lecture 22 - Mathematical Induction I<br>• Military Training Day - Wednesday April 24<br>• ANZAC Day - Thursday April 25<br>• Lecture 23 - Mathematical Induction II |
| Week 8 : 29 April - 3 May | Lecture | • Lecture 24 - Recursion<br>• Lecture 25 - Recursion overflow and Proof extras<br>• Lecture 26 - Constructing Proofs<br>• Lecture 27 - Practice Test |
| Week 9 : 6 May - 10 May | Lecture | • Lecture 28 - Class Test 2 Discussion<br>• Lecture 29 - Algorithms I<br>• Military Training Day - Friday May 10 |
| | Assessment | Class Test 2 - Tuesday, May 7 |
| Week 10 : 13 May - 17 May | Lecture | • Lecture 30 - Algorithms II<br>• Lecture 31 - Algorithms III<br>• Lecture 32 - Algorithms IV<br>• Lecture 33 - Set Theory I |
| Week 11 : 20 May - 24 May | Lecture | • Lecture 34 - Set Theory II<br>• Lecture 35 - Graphs I<br>• Lecture 36 - Graphs II<br>• Lecture 37 - Graphs III |
| Week 12 : 27 May - 31 May | Lecture | • Reconcillation Day compensation day (Monday timetable)<br>• Lecture 38 - Graphs IV<br>• Lecture 39 - Matrix representation of graphs<br>• Lecture 40 - Graph isomorphism & trees |
| Week 13 : 3 June - 7 June | Lecture | • Lecture 41 - Minimal spanning trees<br>• Lecture 42 - Shortest path algorithm I<br>• Lecture 43 - Shortest path algorithm II |
| | Assessment | Class Test 3 - June 7 |

## Attendance Requirements

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

## General Schedule Information

The schedule of lectures is approximate and should be considered as subject to change. Note that some scheduled lecture times will be dedicated to post-test discussion and feedback, and some will be run as practice sessions (i.e., essentially as open tutorials in the lead up to Class Tests).

# Course Resources

## Prescribed Resources

The prescribed textbook for the course will contain all of the relevant material for the course. We will not cover all material from the textbook but we will cover the basic topics and several of the intermediate topics. The textbook for the course is:

- Epp, S. (2010), *Discrete Mathematics with Applications* (4th Edition) Brooks/Cole Cengage Learning: Boston.

Material in the textbook will be supplemented with the presentations in the lectures.

## Recommended Resources

The lecturer may also provide supplementary materials on the course website if this is required to elucidate any of the topics. Lecture slides and supplementary material will be made available to students via Moodle.

## Additional Costs

Nil.

## Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by listening to our own students. Students will be asked to complete the myExperience survey towards the end of this course.

Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups. Student opinions really do make a difference. Refer to the Moodle site for this course to see how the feedback from previous students has contributed to the course development.

Important note:  Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct Policy

# Staff Details

| Position | Name | Email | Location | Phone | Availability | Equitable Learning Services Contact | Primary Contact |
|---|---|---|---|---|---|---|---|
| Lecturer | Isaac Towers | | Room 132, Building 26, Science South, UNSW Canberra | 5114 5050 | Students can make appointments, via email, to meet during normal working hours - Monday to Friday. | No | Yes |

# Other Useful Information

## Academic Information

### Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by listening to our own students. Students will be asked to complete the myExperience survey towards the end of each course.

Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups (where applicable). Student opinions really do make a difference. Refer to the Moodle site for your course to see how the feedback from previous students has contributed to the course development.

Important note:  Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct.

https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

### Equitable Learning Services (ELS)

Students living with neurodivergent, physical and/or mental health conditions or caring for someone with these conditions may be eligible for support through the Equitible Learning Services team. Equitable Learning Services is a free and confidential service that provides

practical support to ensure your mental or physical health conditions do not adversely affect your studies.

Our team of dedicated **Equitable Learning Facilitators** (ELFs) are here to assist you through this process. We offer a number of services to make your education at UNSW easier and more equitable.

Further information about ELS for currently enrolled students can be found at: https://www.student.unsw.edu.au/equitable-learning

## Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. All students are expected to adhere to UNSW's Student Code of Conduct. Find relevant information at: Student Code of Conduct (unsw.edu.au)

Plagiarism undermines academic integrity and is not tolerated at UNSW. It is defined as using the words or ideas of others and passing them off as your own, and can take many forms, from deliberate cheating to accidental copying from a source without acknowledgement.

For more information, please refer to the following:

https://student.unsw.edu.au/plagiarism

## Submission of Assessment Tasks

### Special Consideration

Special Consideration is the process for assessing and addressing the impact on students of short-term events, that are beyond the control of the student, and that affect performance in a specific assessment task or tasks.

Applications for Special Consideration will be accepted in the following circumstances only:

- Where academic work has been hampered to a substantial degree by illness or other cause;
- The circumstances are unexpected and beyond the student's control;
- The circumstances could not have reasonably been anticipated, avoided or guarded against by the student; and either:

(i) they occurred during a critical study period and was 3 consecutive days or more duration, or a total of 5 days within the critical study period; or

(ii) they prevented the ability to complete, attend or submit an assessment task for a specific date (e.g. final exam, in class test/quiz, in class presentation)

Applications for Special Consideration must be made as soon as practicable after the problem occurs and at the latest within three working days of the assessment or the period covered by the supporting documentation.

By sitting or submitting the assessment task the student is declaring that they are fit to do so and cannot later apply for Special Consideration (UNSW 'fit to sit or submit' requirement).

Sitting, accessing or submitting an assessment task on the scheduled assessment date, after applying for special consideration, renders the special consideration application void.

Find more information about special consideration at: https://www.student.unsw.edu.au/special/consideration/guide

Or apply for special consideration through your MyUNSW portal.

**Late Submission of assessment tasks (other than examinations)**

UNSW has a standard late submission penalty of:

- 5% per day,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

**Electronic submission of assessment**

Except where the nature of an assessment task precludes its electronic submission, all assessments must be submitted to an electronic repository, approved by UNSW or the Faculty, for archiving and subsequent marking and analysis.

**Release of final mark**

All marks obtained for assessment items during the session are provisional. The final mark as published by the university following the assessment review group meeting is the only official mark.