Welcome!

Welcome to CS 225! This document is a study guide meant to cover various key pieces of information about the course, such as assignment due dates, test and exam structures, your lecturers’ contact information, and the course’s material. If you have questions about the course, read through this guide; you may find answers to your questions here!

Lecturers: Compsci 225 is taught by a pair of lecturers in this coming semester.

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Lecturer</th>
<th>Office</th>
<th>Extension</th>
<th>Email</th>
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<tbody>
<tr>
<td>1-6</td>
<td>Paddy Bartlett</td>
<td>303E.232</td>
<td>82448</td>
<td><a href="mailto:padraic.bartlett@auckland.ac.nz">padraic.bartlett@auckland.ac.nz</a></td>
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<tr>
<td>7-12</td>
<td>Tobias Rossmann</td>
<td>303.229D</td>
<td>86577</td>
<td><a href="mailto:t.rossmann@auckland.ac.nz">t.rossmann@auckland.ac.nz</a></td>
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</table>

I (Paddy) am also the course coordinator for this class; so, if you have any logistical issues with the class (e.g. your tutorial conflicts with work duties, or family matters interferes with your ability to hand in an assignment), contact me and I should be able to help!

Office hours will be posted on Canvas.

Class time/location: (as of July 18th; check SSO for the most recent information): Wednesday 12-1, Thursday 12-1 and Friday 1-2pm, in HSB1/201N-346.

Tutorials: take place once a week, starting in week 2 of the semester. There are 11 tutorials in total.

Course Description

The official course description of Compsci 225 is as follows:

An introduction to logic, principles of counting, mathematical induction, recursion, relations and functions, graphs and trees, and algorithms. This course is suited to students who are interested in the foundations of computer science, mathematics and logic.

Prerequisite: 15 points from MATHS 108, 110, 150, 153, COMPSCI 101, 107, PHIL 101

Preparation: The recommended preparation for this course is confidence with mathematics. This course requires a high degree of precision in thought and writing.

While accurate, this first part of this description is misleading in that it sounds like Compsci 225 is a collection of a bunch of different topics. Instead, I claim that Compsci 225 is a
course dedicated to exploring one concept carefully through a number of examples: namely, the idea of mathematical proof.

In mathematics, a proof is an argument we use to show that something is true. In this class, we’re going to study what proofs are, and look at how we prove things in the fields of logic, discrete mathematics, graph theory, and algorithms.

To do this, our course is going to have a slightly different feel than most other classes you’ve had — we’re going to be focused as much on the way arguments are formed as on the solutions to the problems we’re studying. Unlike other math/computer science classes, where we’re working towards various major results or ideas throughout the class, this course is focused on mathematics as a language; it’s a place where we will practice writing proofs and thinking logically.

Course Evaluation

There are three components of your grade in Compsci 225:

**Homework (25%).** There are five homework assignments in the class, each worth 5% of your final grade. They are due to the Student Resource Centre on the following dates:

- Tuesday, August 8th, by 4pm
- Tuesday, August 22nd, by 4pm
- Tuesday, September 19th, by 4pm
- Tuesday, October 10th, by 4pm
- Tuesday, October 24th, by 4pm

Note that because homework solutions are posted online shortly after the due dates, late HW cannot be accepted. If you find yourself unable to complete a homework set on time due to illness or family emergency, please contact me (Paddy) as soon as possible so that we can discuss your options. As well, if you find yourself needing to travel when a set is due, come talk to me ahead of time and we can try to work something out.

Mathematics department assignment cover sheets are required. Assignments are to be submitted using the hand-in boxes. When your assignments are graded and ready to be picked up (typically one to two weeks after the due date), an announcement will be made on Canvas letting you know that you can pick them up from the Student Resource Centre. The Student Resource Centre will hold onto assignments for ten working days before archiving them, after which they cannot be picked up.

**Test (20%).** There is a mid-semester test lasting one hour plus five minutes of reading time, on Wednesday, August 30th, from 6:25-7:30pm. Rooms for the test will be announced on Canvas closer to the test date. Try to arrive early to give us time to set up and start on time.

The test will cover material from the first five weeks of the course. We will put up resources to help you study for the test (including sample questions) closer to the test date.

**Exam (55%).** There will be a two-hour exam covering material from the whole course during the examination period. The exact date of the exam is not available until about
a week after the mid-semester break, when it will be posted on Student Services Online. You must achieve at least a 35% mark on the exam to pass the course, regardless of your performance in the rest of the class.

Calculators are prohibited on the test and exam.

Note that there is no plussage in CS225; attempt all of the assignments and tests!

Course content and learning outcomes

Compsci 225 covers a lot of material! This is a rough outline of the topics we’re hoping to cover this semester, along with the days on which we plan to discuss them.

Topics

- Logic and proofs
- Integers
- Set theory
- Graph theory
- Relations
- Induction
- Trees
- Functions
- Principles of counting
- Satisfiability
- Finite automata
- Coding theory

Calendar

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<tr>
<th>Week</th>
<th>Monday</th>
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<td>Codes 3/3</td>
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Mid-Semester Break: Sept 4-17

We will almost certainly not cover every topic in this course on the days listed on this calendar; depending on student interest, time constraints, and performance on the assignments and test, we may expand on certain topics or cut others short to ensure that we’re running the best course we can. Accordingly, expect the days on which we cover certain topics to shift around slightly as the semester progresses.
Compsci 225’s official learning outcomes are the following. We hope that students at the end of this course can do the following:

• Use the basic notation and terminology of sets, relations, functions, trees, graphs, and strings.
• Translate problems stated in ordinary language (e.g. counting problems or graph problems) into the language of discrete structures.
• Apply proof methods (e.g. direct proof, proof by cases) to simple mathematical statements and analyse a simple format of the statements using logic (e.g. propositional logic).
• Apply propositional logic to find truth values of statements given in ordinary language.
• Apply induction and recursion principles to analysis of algorithms and proving simple mathematical statements (that involve integers).
• Know basic mathematical results about properties of graphs and trees (e.g. the number of nodes in a tree equals the number of edges plus 1).
• Know the basics of finite automata (e.g. design automata recognizing the language of strings that contain a substring aba).

Our tests and exams will be designed to measure these learning outcomes.

**Collaboration/resources policy**

Collaboration is allowed (and indeed encouraged) on the homework sets; mathematics at the research level is a collaborative activity, and there is no reason that it should not also be this way in a classroom. Work with your classmates!

The only things that we ask of you are the following:

1. You must **write up your work separately**, and only write up solutions you understand fully.

2. When writing up your own work, you can directly cite and use without proof anything proven in class or in the class notes posted online. Anything else — i.e. results from textbooks, Wikipedia, etc. — you need to both cite in your writeup, and reprove the results you’re using from those sources carefully **in your own words**. Simply copying solutions over directly is plagiarism / cheating / otherwise poor academic form; it is passing off as your own work the ideas of others.

   You are certainly welcome to read and learn what other people have attempted! All I am asking you to do here is to not pass it off as your own work, and rephrase and present it in a new way so that it is clear that you have actually learned something.

If you have any questions on the collaboration policy, please email me and I’ll be glad to clarify matters.
Course resources:

An electronic copy of the coursebook is available as a .pdf on Canvas. Printed and bound copies of the coursebook can be purchased from the Science Student Resource Centre for the cost of printing (typically 10-20.)

There is no compulsory textbook for this course. The following books are recommended for further reading, if so desired:

- Epp, “Discrete mathematics with applications;” can be found at 510-E64 in the library.

Announcements will be made in lectures and through the Canvas course webpage. All assignments will be available on Canvas, as will scanned lecture notes and links to lecture recordings when available. We cannot guarantee that all lectures will be successfully recorded; the University usually does a good job with this, but typically 1-3 recordings per semester get hit with some sort of unforeseen technical glitch.

More importantly, these lecture recordings should be considered as an additional resource to help you review lectures after you’ve attended them, not as a replacement for attending class. A massive body of mathematics education research has shown that attending lectures in person is highly correlated with improved performance in your classes. Skipping lectures with the intention of watching the recordings is a bad plan, and likely to cause your grades to suffer.

Feedback

Complaints about marking should be taken to your lecturers who are in a position to do something immediately. Other requests and feedback should be given to the lecturers either in person or by email. More general complaints can be taken up by your class representative and communicated to the lecturer or the Staff Student Consultative Committee. You may also approach the Head of Department if you need to.

The University is committed to ensuring people are treated with dignity and respect. Staff members and students have a right to work and study in an environment that is harmonious and free from unacceptable conduct. Harassment on any grounds, such as racial, sexual, religious or academic is unacceptable.

Student feedback is valued to assist in the improvement of courses and teaching. There may be a course and/or lecturer evaluation near the end of the course.