Faculty of Science, Engineering and Built Environment

SIT192 Discrete Mathematics

Deakin University Unit Guide

Trimester 1, 2020

CONTENTS

WELCOME

Welcome to **SIT192 Discrete Mathematics**. SIT192 is designed to introduce and apply some of the fundamental algebraic and discrete systems of non-calculus mathematics. You will learn the mathematical concepts and skills that underpin computer science, software engineering, cybersecurity and artificial intelligence. In a broader context you will practice logical thinking skills and apply them to critical thinking and problem solving tasks.

This unit has been completely redesigned to better help you learn the mathematical content, but also to put you on a path to success in your degree by helping you develop your study and learning skills.

SIT192 builds on your existing mathematical knowledge (the more the better - if you feel unprepared, you should consider first taking SIT190), and provide a basis for further studies in mathematics.

I look forward to working with you,
Dr Julien Ugon (Unit Chair)

This Unit Guide provides you with the key information about this Unit. For the best chance of success, you should read it very carefully and refer to it frequently throughout the trimester. Your Unit site (accessed in **DeakinSync**) also provides information about your **rights and responsibilities.** We will assume you have read this before the Unit commences, and we expect you to refer to it throughout the trimester.

WHO IS THE UNIT TEAM?

Unit chair: leads the teaching team and is responsible for overall delivery of this unit

Julien Ugon

Unit chair details

Campus: Melbourne Burwood Campus
Building T, Level 2
221 Burwood Highway
BURWOOD VIC 3125

Email: julien.ugon@deakin.edu.au

Phone: +61 3 924 46311

Other members of the team and how to contact them

Geelong Waurn Ponds campus leader: contact the campus leader for assistance at your campus

Name: Guillermo Pineda-Villavicencio, Lecturer

Email: guillermo.pineda@deakin.edu.au

Phone: +61 3 522 73711

Practical instructors will be announced closer to the beginning of the trimester via the unit site.

Administrative queries

- Contact your Unit Chair or Campus Leader
- Drop in or contact Student Central to speak with a Student Adviser

For additional support information, please see the Rights and Responsibilities section under 'Resources' in your unit site.

ABOUT THIS UNIT

In this unit you will explore the foundations of discrete mathematics, the basis for mathematical reasoning in applied and computational sciences. You will learn how to rigorously build, from first principles, the tools needed to address a wide range of mathematical and scientific problems. SIT192 is designed to prepare you for further study in disciplines where discrete mathematics play a fundamental or foundational role: cryptography, networks, computer programming, and analysis of algorithms.

Unit development in response to student feedback

Every trimester, we ask students to tell us, through eVALUate, what helped and hindered their learning in each Unit. You are strongly encouraged to provide constructive feedback for this Unit when eVALUate opens (you will be emailed a link).

In previous versions of this unit, students have told us that these aspects of the Unit have helped them to achieve the learning outcomes:

- Students commented positively on the responsiveness and helpfulness of the teaching staff. (If you have questions/worries, please come and see us!)
- There were also positive comments on the quality, quantity and diversity of resources, that greatly assisted students' learning.

They have also made suggestions for improvement, and so this is what we have done:

- This unit has been completely redesigned to better help you learn the mathematical content, but also to put you on a path to success in your degree by helping you develop your study and learning skills.
- The new modular design aims at giving you the best chances to succeed by clarifying our expectations, making it easier for you to monitor your progress, and more generally giving you a better sense of control over your studies.
- The assessment tasks have been changed to fit the modular design and give you more meaningful feedback, at a time when it helps you best.
- Mathematics is learnt by doing, not by listening to some random dude (or gal) for two hours. We redesigned the activities, (both in-class and in the cloud), to put that obvious principle in practice.

If you have any concerns about the Unit during the trimester, please contact the unit teaching team - preferably early in the trimester - so we can discuss your concerns, and make adjustments, if appropriate.

Your course and Deakin's Graduate Learning Outcomes

GLO1	Discipline-specific knowledge and capabilities:	appropriate to the level of study related to a discipline or profession
GLO2	Communication:	using oral, written and interpersonal communication to inform, motivate and effect change
GLO3	Digital literacy:	using technologies to find, use and disseminate information
GLO4	Critical thinking:	evaluating information using critical and analytical thinking and judgment
GLO5	Problem solving:	creating solutions to authentic (real world and ill-defined) problems

GLO6	Self-management:	working and learning independently, and taking responsibility for personal actions
GLO7	Teamwork:	working and learning with others from different disciplines and backgrounds
GLO8	Global citizenship:	engaging ethically and productively in the professional context and with diverse communities and cultures in a global context

Each Deakin course has **course learning outcomes** which explain what the Deakin Learning Outcomes mean in your discipline. Learning in each unit builds towards the course learning outcomes.

Your Unit Learning Outcomes

Each Unit in your course is a building block towards these Graduate Learning Outcomes - not all Units develop and assess every Graduate Learning Outcome (GLO).

	These are the Learning Outcomes (ULO) for this Unit **At the completion of this unit successful** students can:	Deakin Graduate Learning Outcomes
ULO1	Understand and apply tools from discrete mathematics to solve complex mathematical problems.	GLO1: Discipline-specific knowledge and capabilities GLO4: Critical thinking
ULO2	Design and implement rigorous problem-solving strategies from first principles.	GLO4: Critical thinking
ULO3	Plan and reflect on task management strategies to successfully fulfil responsibilities	GLO6: Self-management
ULO4	Identify knowledge gaps and effectively seek and use appropriate learning resources to acquire necessary knowledge	GLO3: Digital literacy GLO6: Self-management

These Unit Learning Outcomes are applicable for all teaching periods throughout the year

ASSESSING YOUR ACHIEVEMENT OF THE UNIT LEARNING OUTCOMES

Hurdle requirements

To be eligible to pass in this unit you must achieve a mark of at least 50% overall, and a mark of at least 50% at the examination.

Brief summary of the hurdle requirement	Rationale
1. **Pass tasks** • By the end of week 4, students are required to have completed at least the week 1 and 2 Pass Tasks. • By the end of week 7 students are required to have completed at least the weeks 1 to 4 Pass Tasks. • By the end of the unit, students are required to have submitted all pass tasks, and have sufficient Pass Tasks marked as completed to demonstrate achievement of the unit learning outcomes. Credit, Distinction, and High Distinction tasks are required for higher grades.	The pass tasks in this unit provides students the opportunity to develop and demonstrate the achievement of Unit Learning Outcomes at the minimum expected standards. These tasks are included as hurdle requirements so that students are able to provide evidence of achievement of these ULOs through their portfolio. The portfolio artefact that they submit is used to measure their performance against the minimum standards as well as their ability to justify the outcomes that they have achieved through self-assessment and reflection. The hurdle requirement also provides a mechanism for student-staff interaction to check progress and address educational and motivational issues before it is too late in the trimester.
3. **Examination** To be eligible to pass this unit you must achieve a mark of at least 50% in the examination. You will be required to demonstrate mastery of core components of this unit within examination conditions.	This hurdle requirement aims to ensure students demonstrate achievement of critical components of the unit learning outcomes to at least the minimum expected standard in an invigilated setting.

Summative assessments

(tasks that will be graded or marked)
NOTE: It is <u>your responsibility</u> to keep a backup copy of every assignment where it is possible (eg written/digital reports, essays, videos, images). In the unusual event that one of your assignments is misplaced, you will need to submit the backup copy. Any work you submit may be checked by electronic or other means for the purposes of detecting collusion and/or plagiarism.

When you are required to submit an assignment through your unit site (accessed in DeakinSync), you should receive an email to your Deakin email address confirming that it has been submitted. You should check that you can see your assignment in the Submissions view of the Assignment folder after upload, and check for, and keep, the email receipt for the submission.

- Summative assessment task 1

	Learning Portfolio
Brief description of assessment task	In this unit, assessment is designed to encourage and reward you for demonstrating achievement of the unit learning outcomes; with higher grades representing better achievement of these outcomes. We will be using OnTrack (previously Doubtfire), which is a web application designed specifically to support your completion of learning and assessment activities. Working regularly and completing the tasks on time will help you collect evidence for your portfolio. Your portfolio will consist of work that you complete in response to the unit's **tasks**. These tasks are designed to help you learn, and demonstrate achievement of the unit learning outcomes. Tasks will consist of the following kinds of activities: • Review problem descriptions and design appropriate solving strategies. • Explain and categorize the relevant methodology to apply these strategies. • Communicate your understanding. • Research learning material. • Reflect on your progress.

Detail of student output	This is an individual assessment task. You will work through a number of tasks throughout this unit and produce a range of artefacts including online quizzes, written and oral reports. This work will be combined together with your own critique and reflections on your learning performance into your learning portfolio for assessment.
Grading and weighting (% total mark for unit)	80%, marked and graded Each task in the unit is associated with a grade: either Pass, Credit, Distinction, or High Distinction. Complete all the **Pass Tasks** for a result between 40 and 49. Complete all the **Pass and Credit** tasks for a result between 50 and 59, complete all the **Pass, Credit, and Distinction** tasks for a result between 60 and 69, and complete **all Pass, Credit, Distinction and High Distinction** tasks for a result between 70 and 80. Doubtfire lets you select a target grade, and will show you only the tasks you need to complete in order to achieve that grade.
This task assesses your achievement of these Unit Learning Outcome(s)	ULO1 through discrete mathematics in problem solving tasks. ULO2 using tasks requiring the analysis, design and implementation of multi-steps approaches. ULO3 through the development, reflection and review of study plans. ULO4 through efficient use of and reflection on relevant internal and external learning resources.
This task assesses your achievement of these Graduate Learning Outcome(s)	GLO1 through applying knowledge of discrete mathematics to develop methodologies to solve given problems. GLO3 through reporting and reflecting on external and internal learning content. GLO4 through analysing problems and evaluating and describing problem solving strategies GLO6 through developing, revising and reporting on your own study plan.
How and when you will receive feedback on your work	You will be required to work on and submit tasks for formative feedback each week. The teaching team will then review your progress and provide you with individual feedback to assist you in completing the tasks and achieving your target grade for the unit.
When and how to submit your work	At the end of the unit you will use OnTrack to combine together the artefacts you have created and a learning summary report into a single portfolio for assessment. This will be due by the end of week 12, Friday 5 June 2020, 5:00 pm (AEST).

- Summative assessment task 2

	Examination
Brief description of assessment task	This closed book examination will assess student's knowledge of linear programming, combinatorial optimisation, heuristic and metaheuristic methods and constraint programming techniques. Students must demonstrate an ability to apply the principles and techniques necessary to solve these problems under exam conditions.
Detail of student output	Written closed-book exam paper which requires applying discrete mathematics to solve mathematical problems and analyse and explain these solutions.
Grading and weighting (% total mark for unit)	20%

This task assesses your achievement of these Unit Learning Outcome(s)	ULO1 through producing computationally viable models of simple word problems. ULO2 through solving problems using optimisation and constraint programming techniques
This task assesses your achievement of these Graduate Learning Outcome(s)	GLO1 through the use of discrete mathematics for problem solving tasks. GLO4 through the analysis and description of problem solving strategies.
How and when you will receive feedback on your work	Deakin University will release the final assessment results at the stipulated timeframe. Students will receive a mark, which is an indicator of their coverage of the core topics within the unit.
When and how to submit your work	Students will be required to attend a supervised 2-hour written examination during the end of trimester examination period. It is the responsibility of students to review their examination timetable when it is released.

Your learning experiences in this Unit - and your expected commitment

To be successful in this unit, you must:

- Read all materials in preparation for your classes or seminars, and follow up each with further study and research on the topic;
- Start your assessment tasks well ahead of the due date;
- Read or listen to all feedback carefully, and use it in your future work;
- Attend and engage in all timetabled learning experiences as follows:

Scheduled learning activities - campus

1 x 3 hour class per week.

Scheduled learning activities - cloud

2 x 1 hour scheduled online workshops per week.

This unit is divided into learning modules each targeting one or more learning outcomes. For each module you will engage with online learning activities, which may include interactive presentations, online tutorials, formative quizzes, short videos and reading material. The material will be provided on the CloudDeakin unit site, and any external activity will be linked from there. You will progress through a sequence of modules through the term to cover the unit's content. You are expected to progress at your own pace, under the supervision of the teaching team, and you will be allowed to repeat a module if necessary. However, you will need to demonstrate your progress at key points during the trimester, and you will be required to complete all the core modules in order to pass the unit.

Besides the core modules, there will be additional optional modules for students wishing to investigate certain topics further. Completion of the optional modules is not required for passing the unit, but you will need to demonstrate a deeper engagement with the content by completing optional modules in order to obtain higher grades.

You will on average spend 150 hrs over the trimester on learning and assessment activities in this unit. For campus students this includes class time, designated activities, assessment tasks, readings and study time. For cloud students the time should be divided between online learning activities, discussion boards, designated activities, assessment tasks, readings and study time.

Campus-enrolled students will engage in 3 hours of face-to-face activities.

Cloud students will be engage in 2 hours of synchronous activities, scheduled at times convenient to them, with other cloud students. The nature of cloud education means that it is not possible for all cloud students to attend a single session scheduled at a specific time. Instead, you will interact with the teaching team asynchronously through discussion forums and email, and will be provided with regular feedback on your progress, and additional resources based on your demand.

Note

At Deakin,

- *Lectures* are referred to as *classes* (definition: a general meeting for all students, for which students do not need to register and where students are engaged through presentations and learning activities)
- *Tutorials, workshops and seminars* are referred to as seminars (definition: more interactive meetings for smaller groups of students).
- For the complete list of agreed definitions for learning experiences, see the Course Design and Delivery Procedure.

UNIT LEARNING RESOURCES

Your unit learning resources are available in your unit site accessed in DeakinSync.

Prescribed text(s): Oscar Levin, 2019, Discrete Mathematics: An Open Introduction, 3rd Edition (or 2nd Edition), Createspace Independent Publishing Platform (freely available online).
The texts and reading list for the unit can be found on the University Library via the link below: SIT192 Note: Select the relevant trimester reading list. Please note that a future teaching period's reading list may not be available until a month prior to the start of that teaching period so you may wish to use the relevant trimester's prior year reading list as a guide only.

Essential learning resources

The prescribed text for this unit is listed above, *it is freely available as pdf online, under a creative commons license*.
Other learning resources will be provided or linked from the CloudDeakin Unit Site. They will include interactive presentations, online tutorial formative quizzes, short videos and reading material.

Recommended learning resources

We recommend the following reference book. It is freely available as pdf online, under a creative commons license:

- James Aspnes, 2018, Notes on Discrete Mathematics, Yale University.

Textbooks, reference books, general books and software may be ordered from the bookshop:
phone 1800 686 681 (freecall);
email to DUSA-Bookshop@deakin.edu.au; or
order online from the University bookshop web site at http://www.dusabookshop.com.au/

KEY DATES FOR THIS TRIMESTER

Trimester begins (classes begin)	Monday 9 March 2020

Intra-trimester break (a short break during trimester)	Friday 10 April - Sunday 19 April 2020
Trimester ends (classes cease)	Friday 29 May 2020
Study period (examination preparation period)	Monday 1 June - Friday 5 June 2020
Examinations begin	Monday 8 June 2020
Examinations end	Friday 19 June 2020
Inter-trimester break (the period between trimesters)	Monday 22 June - Friday 10 July 2020
Unit results released	Thursday 9 July 2020 (6pm)

UNIT WEEKLY ACTIVITIES

The due dates and times for each assignment are available on the unit site in the assignment details folder which relates to your mode/campus of study.

Week	Commencing	Topic	Assessment activity
1#	9 March 2020	Introduction to the Unit	Learning Plans
2	16 March	Greatest common divisor: algorithm and Proof	Portfolio Update Reflective Task
3	23 March	Greatest common divisor: algorithm and Proof	Portfolio Update Reflective Task
4	30 March	Deduction through the Ages: A History of Truth	Portfolio Update
5^	6 April	Deduction through the Ages: A History of Truth	Portfolio Update Reflective Task
6	20 April	An Introduction to Symbolic Logic	Portfolio Update
7*	27 April	An Introduction to Symbolic Logic	Portfolio Update Reflective Task
8	4 May	Pascal's Triangle and Mathematical Induction	Portfolio Update
9	11 May	Pascal's Triangle and Mathematical Induction	Portfolio Update
10	18 May	Early Writings on Graph Theory: Euler Circuits and The KönigsbergBridge Problem	Portfolio Update Reflective Task
11	25 May	Early Writings on Graph Theory: Euler Circuits and The KönigsbergBridge Problem	
12	1 June	Study period	Final Portfolio

#Victorian Labour Day public holiday: **Monday 9 March** – University open
^Easter vacation/intra-trimester break: **Friday 10 April - Sunday 19 April 2020** (between weeks 5 and 6)
*ANZAC Day observed, **Monday 27 April (in lieu of 25 April)** - University closed