



## UNSW Course Outline

# COMP4121 Advanced Algorithms - 2024

Published on the 12 Sep 2024

## General Course Information

**Course Code :** COMP4121

**Year :** 2024

**Term :** Term 3

**Teaching Period :** T3

**Is a multi-term course? :** No

**Faculty :** Faculty of Engineering

**Academic Unit :** School of Computer Science and Engineering

**Delivery Mode :** In Person

**Delivery Format :** Standard

**Delivery Location :** Kensington

**Campus :** Sydney

**Study Level :** Postgraduate, Undergraduate

**Units of Credit :** 6

### Useful Links

[Handbook Class Timetable](#)

## Course Details & Outcomes

### Course Description

This course is a continuation of our introductory algorithms courses

COMP3121/3821/9101/9801. We will cover some of the basic randomised algorithms and data structures, such as randomised hashing, skip-lists, order statistics and Karger's randomised Min

Cut algorithm. We will then look at the Markov chains and the Google PageRank algorithm, the Hidden Markov Models and the Viterbi Algorithm, and then cover in quite a detail a variety of other algorithms important to the present day practice, such as the recommender systems as well as some of the algorithms used in Data Science. We will cover parts of three books: our COMP3121/3821/9101/9801 textbook Algorithm Design by Kleinberg and Tardos, Networked Life by Mung Chiang and Foundations of Data Science by Blum, Hopcroft and Kannan. The first two books are available in the bookstore. A preprint of the third book is available for free at <https://www.cs.cornell.edu/jeh/book.pdf>.

## Course Aims

The aims of the course are

- to familiarise students with more advanced algorithms design techniques such as randomisation, Markov chains and random walks on graphs.
- to teach students how to apply these techniques to real life problems
- to further improve students' problem solving skills.

## Relationship to Other Courses

This course is a continuation of our introductory algorithms courses

COMP3121/3821/9101/9801.

# Course Learning Outcomes

Course Learning Outcomes
CLO1 : Understand more advanced algorithms employed by modern industry, especially those used in Data Science and Machine Learning
CLO2 : Apply randomisation to real life problems
CLO3 : Employ numerical algorithms such as Singular Value Decomposition and Fast Fourier transform
CLO4 : Acquiring necessary skills and use them for advanced algorithms design
CLO5 : Improved problem solving skills

Course Learning Outcomes	Assessment Item
CLO1 : Understand more advanced algorithms employed by modern industry, especially those used in Data Science and Machine Learning	<ul style="list-style-type: none"><li>• Major Project</li><li>• Final Exam</li></ul>
CLO2 : Apply randomisation to real life problems	<ul style="list-style-type: none"><li>• Final Exam</li></ul>
CLO3 : Employ numerical algorithms such as Singular Value Decomposition and Fast Fourier transform	<ul style="list-style-type: none"><li>• Final Exam</li></ul>
CLO4 : Acquiring necessary skills and use them for advanced algorithms design	<ul style="list-style-type: none"><li>• Final Exam</li></ul>
CLO5 : Improved problem solving skills	<ul style="list-style-type: none"><li>• Final Exam</li></ul>

## Learning and Teaching Technologies

Moodle - Learning Management System

## Assessments

### Assessment Structure

Assessment Item	Weight	Relevant Dates
Major Project Assessment Format: Individual	50%	
Final Exam Assessment Format: Individual	50%	Start Date: Not Applicable Due Date: Not Applicable

# **Assessment Details**

## **Major Project**

### Assessment Overview

Students will be expected to write an essay of about 15-20 single spaced pages on a topic chosen in consultation with the lecturer. Assessment will measure the depth and completeness of presentation. Completing the project should take 30-40 hours of work. Feedback will be given in an email to student.

### Course Learning Outcomes

- CLO1 : Understand more advanced algorithms employed by modern industry, especially those used in Data Science and Machine Learning

### Generative AI Permission Level

#### **No Assistance**

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.

For more information on Generative AI and permitted use please see [here](#).

## **Final Exam**

### Assessment Overview

The final will be open book and it will take 3 hours to complete. It will consist of 4-6 problems designed to test understanding of the material.

### Course Learning Outcomes

- CLO1 : Understand more advanced algorithms employed by modern industry, especially those used in Data Science and Machine Learning
- CLO2 : Apply randomisation to real life problems
- CLO3 : Employ numerical algorithms such as Singular Value Decomposition and Fast Fourier transform
- CLO4 : Acquiring necessary skills and use them for advanced algorithms design
- CLO5 : Improved problem solving skills

### Generative AI Permission Level

#### **No Assistance**

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate

information or answers.

For more information on Generative AI and permitted use please see [here](#).

## General Assessment Information

### Grading Basis

Standard

## Course Schedule

### Attendance Requirements

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

## Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
	Aleksandar Ignjatovic					No	Yes

## Other Useful Information

### Academic Information

#### I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's [Special Consideration page](#).

#### II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and policies. In particular, students should be familiar with the following:

- [Attendance](#)
- [UNSW Email Address](#)
- [Special Consideration](#)
- [Exams](#)
- [Approved Calculators](#)
- [Academic Honesty and Plagiarism](#)
- [Equitable Learning Services](#)

### III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

### IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: <https://www.unsw.edu.au/engineering/student-life/student-resources/program-design>.

*Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.*

### Academic Honesty and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website

with a wealth of resources to support students to understand and avoid plagiarism, visit: [student.unsw.edu.au/plagiarism](http://student.unsw.edu.au/plagiarism). The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

[www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf](http://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)

## Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that

- has an absolute submission date; and,
- Pass/Fail assessment tasks.

## Faculty-specific Information

[Engineering Student Support Services](#) – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

[Engineering Industrial Training](#) – Industrial training questions

[UNSW Study Abroad](#) – study abroad student enquiries (for inbound students)

[UNSW Exchange](#) – student exchange enquiries (for inbound students)

[UNSW Future Students](#) – potential student enquiries e.g. admissions, fees, programs, credit transfer

### Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

## School Contact Information

CSE Help! - on the Ground Floor of K17

- For assistance with coursework assessments.

The Nucleus Student Hub - <https://nucleus.unsw.edu.au/en/contact-us>

- Course enrolment queries.

Grievance Officer - [grievance-officer@cse.unsw.edu.au](mailto:grievance-officer@cse.unsw.edu.au)

- If the course convenor gives an inadequate response to a query or when the courses convenor does not respond to a query about assessment.

Student Reps - [stureps@cse.unsw.edu.au](mailto:stureps@cse.unsw.edu.au)

- If some aspect of a course needs urgent improvement. (e.g. Nobody responding to forum

queries, cannot understand the lecturer)

You should **never** contact any of the following people directly:

- Vice Chancellor
- Pro-vice Chancellor Education (PVCE)
- Head of School
- CSE administrative staff
- CSE teaching support staff

They will simply bounce the email to one of the above, thereby creating an unnecessary level of indirection and a delay in the response.