Course Outline

Student

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COMP4141 Course Outline

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Course Details

Course Code	COMP4141
Course Title	Theory of Computation
Convenor	Paul Hunter (https://webcms3.cse.unsw.edu.au/users/z3520914)
Tutors	Paul Hunter (https://webcms3.cse.unsw.edu.au/users/z3520914)
	Daniel Brownlow
	Sidney Pham
Classes	**Lectures** : Mon 10-12, OMB G31, Weeks 1-8, 10-11 Tue 11-13, TETB G16, Week 11 Fri 11-12, TETB G16, Weeks 1-7, 9-10
Course Website	http://www.cse.unsw.edu.au/~cs4141 (http://www.cse.unsw.edu.au/%7Ecs4141)

Handbook Entry	http://www.handbook.unsw.edu.au/undergraduate/courses/current/COMP4141.html (http://www.handbook.unsw.edu.au/undergraduate/courses/current/COMP4141.html)

Course Summary

After successfully completing this course, you will appreciate the fundamental questions of computer science:

- What problems can be solved by a computation?
- How hard is it to compute solutions?
- How can we express computation?

You will also be aware of some concrete answers to these and related great questions of computer science, the reasons why some questions in this area will remain unanswered forever, and that some answers are still being sought.

Course Timetable

The course timetable is available here. (https://webcms3.cse.unsw.edu.au/COMP2111/19T1/timetable)

Course Aims

After successfully completing this course, you will appreciate the fundamental questions of computer science:

- What problems can be solved by a computation?
- How hard is it to compute solutions?
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You will also be aware of some concrete answers to these and related great questions of computer science, the reasons why some questions in this area will remain unanswered forever, and that some answers are still being sought.

Student Learning Outcomes

After According to UNSW policy, graduate attributes *are important because the disciplinary knowledge that students develop at university is not adequate in itself as the basis for their future lives. Instead, graduates need qualities and skills that equip them for lifelong learning. These include critical thinking and problem-solving skills as well as communication skills and information literacy skills.*

This course contributes to the development of the following graduate capabilities:

Graduate Capability	Acquired in
scholarship: understanding of their discipline in its interdisciplinary context	lectures
scholarship: capable of independent and collaborative enquiry	tutorials, assignments
scholarship: rigorous in their analysis, critique, and reflection	tutorials, assignments
scholarship: able to apply their knowledge and skills to solving problems	assignments
scholarship: capable of effective communication	forum
scholarship: information literate	lectures, tutorials, assignments

scholarship: digitally literate	lectures
professionalism: capable of independent, self-directed practice	assignments
professionalism: capable of operating within an agreed Code of Practice	all course-work, by doing it yourself
global citizens: culturally aware and capable of respecting diversity and acting in socially just/responsible ways	interaction with your fellow students

Assumed Knowledge

Prequisites:

- For Undergraduate students: MATH1081, and COMP1927 or COMP2521.
- For Postgraduate students: COMP9020 and COMP9024

Students should note that the content of the course involves use of discrete mathematics. Students are assumed to be comfortable with the structure of mathematical arguments and the basics of set theory, and you will struggle without such a background. You will be expected to prove correctness of your problem solutions in this course. An intuitive understanding of programming and algorithms is also important when taking this course. The course is not recommended for postgraduate students who have not yet taken COMP9020 or have equivalent background in discrete mathematics, or who have not taken at least one session of computer science courses. If you have any doubt whether you have an adequate background, consult the instructor. After mastering this subject, students may want to follow on with other subjects that have a theoretical slant. These include:

- COMP4121 Advanced and Parallel Algorithms
- COMP3151 Foundations of Concurrency
- COMP3153 Algorithmic Verification
- COMP4161 Advanced Topics in Software Verification
- COMP4181 Language-based Software Safety
- COMP3152 Comparative Concurrency Semantics
- COMP4442 Advanced Computer Security

(Not all of these subjects are available in any given year.)

Textbook

The required textbook for this course is M Sipser, *Introduction to the Theory of Computation* (http://www-math.mit.edu/~sipser/book.html) , 3rd edition.

Additional notes are made available on the course website.

Other useful references for the material covered are:

- H.R. Lewis and C.H. Papadimitriou, Elements of the Theory of Computation
- J.E. Hopcroft and J.D. Ullman, Introduction to the Theory of Computation

Teaching Rationale

Lectures will include exercises where we examine the practice of formulating and proving mathematical properties of relevance to Computer Science. Weekly tutorials aim to cement understanding and provide immediate and ongoing feedback for students to assess their understanding of the course material. Assignments aim to deepen analysis and understanding via additional examples and problems. There are no laboratory classes for this subject.

Teaching Strategies

- **Lectures** introduce concepts and show examples
- **Tutorials** reinforce concepts, provide feedback for students to self-assess progress
- **Assignments** provide additional examples and allow students to solve problems

See also the section on Special Consideration .

Assessment

The final mark is determined as the sum of the marks for the assessible components for this course:

- 50% final exam, 30% assignments, 20% mid-term exam:
  - 8 weekly assignments, best 6 count
  - Mid-term assessment (1 hour)
  - a final written exam (2 hours)
- Your final overall mark for this course will be taken from the total of your assignment marks and your final exam mark.
- To pass the course, you must achieve:
  - An overall score of 50% or higher, **AND**
  - At least 40% in the final exam.
- UNSW has a 'fit-to-sit' policy - if you undertake an assessment item, you are declaring yourself fit enough (both physically and mentally) to complete the assessment to the best of your ability. Supplementary exams will *only* be granted to students that are granted Special Consideration.
- Assignments are due by 5pm on Tuesdays, prior to the weekly tutorials.
  - Late submissions will not be accepted - allowances for minor illnesses and misadventures has been factored in with the best 6 assignments constituting the final grade.
  - Assignments should be submitted through webCMS or give as a single pdf file. **Prose should be typewritten** , diagrams and illustrations may be hand drawn and scanned.
  - Each assignment will consist of multiple parts and partial solutions will be accepted.
  - If you have any reasonable grounds for failure to submit that is not protected by this policy, you should submit an official request for Special Consideration.

Student Conduct

The **Student Code of Conduct** (Information (https://student.unsw.edu.au/conduct) , Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)) sets out what the University expects from students as members of the UNSW community. As well as the learning, teaching and research environment, the University aims to provide an environment that enables students to achieve their full potential and to provide an experience consistent with the University's values and guiding principles. A condition of enrolment is that students *inform themselves* of the University's rules and policies affecting them, and conduct themselves accordingly.

In particular, students have the responsibility to observe standards of equity and respect in dealing with every member of the University community. This applies to all activities on UNSW premises and all external activities related to study and research. This includes behaviour in person as well as behaviour on social media, for example Facebook groups set up for the purpose of discussing UNSW courses or course work. Behaviour that is considered in breach of the Student Code Policy as discriminatory, sexually inappropriate, bullying, harassing, invading another's privacy or causing any person to fear for their personal safety is serious misconduct and can lead to severe penalties, including suspension or exclusion from UNSW.

If you have any concerns, you may raise them with your lecturer, or approach the School Ethics Officer (mailto:ethics-officer@cse.unsw.edu.au) , Grievance Officer (mailto:grievance-officer@cse.unsw.edu.au) , or one of the student representatives (mailto:stureps.ug@cse.unsw.edu.au) .

Plagiarism is defined as (https://student.unsw.edu.au/plagiarism) using the words or ideas of others and presenting them as your own. UNSW and CSE treat plagiarism as academic misconduct, which means that it carries penalties as severe as being excluded from further study at UNSW. There are several on-line sources to help you understand what plagiarism is and how it is dealt with at UNSW:

- Plagiarism and Academic Integrity (https://student.unsw.edu.au/plagiarism)
- UNSW Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)

Make sure that you read and understand these. Ignorance is not accepted as an excuse for plagiarism. In particular, you are also responsible that your assignment files are not accessible by anyone but you by setting the correct permissions in your CSE directory and code repository, if using. Note also that plagiarism includes paying or asking another person to do a piece of work for you and then submitting it as your own work.

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. 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.

If you haven't done so yet, please take the time to read the full text of

- UNSW's policy regarding academic honesty and plagiarism (https://student.unsw.edu.au/plagiarism)

The pages below describe the policies and procedures in more detail:

- Student Code Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)
- Student Misconduct Procedure (https://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)
- Plagiarism Policy Statement (https://www.gs.unsw.edu.au/policy/documents/plagiarismpolicy.pdf)
- Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)

You should also read the following page which describes your rights and responsibilities in the CSE context:

- Essential Advice for CSE Students (https://www.engineering.unsw.edu.au/computer-science-engineering/about-us/organisational-structure/student-services/policies/essential-advice-for-cse-students)

Special Consideration

If your work in this course is affected by unforeseen adverse circumstances, you should apply for Special Consideration through MyUNSW, including documentation on how your have been affected. If your request is reasonable and your work has clearly been impacted, then

- for an assignment, you may be granted an extension
- for the Final Exam, you may be offered a Supplementary Exam

Note the use of the word "may". None of the above is guaranteed. It depends on you making a convincing case that the circumstances have clearly impacted your ability to work.

If you are registered with Disability Services, please forward your documentation to Paul Hunter (mailto:pwhunter.work@gmail.com) within the first two weeks of semester.

Course Schedule

The following is a **tentative** schedule of when topics will be covered.

Week	Topic	Reading in Sipser
1	Sets, functions, languages, finite automata	Chapters 0 & 1

Week	Topic	Reading in Sipser
2	Regular languages	Chapter 1
3	Context-Free languages, PDAs, non-CFLs	Chapters 2 & 4
4	Turing Machines, Recursive and Recursively enumerable languages	Chapter 3
5	Undecidability, Halting Problem, Reductions, Rice's Theorem	Chapters 3 & 4
6	"Flexibility week"	
7	Time and space complexity, P and NP	Chapter 7
8-9	NP-completeness, SAT, PTIME reductions	Chapter 7
10	PSPACE, LogSPACE, Savitch's Theorem, Alternation	Chapters 8 & 9
11	Probabilistic complexity, Approximation and Optimization	Chapter 10

Course Evaluation and Development

This course is being continuously improved and we will conduct a survey through the CATEI (Course and Teaching Evaluation and Improvement) process at the end of session to obtain feedback on the quality of the various course components. Your participation in the survey will be greatly appreciated. Students are also encouraged to provide informal feedback during the session, and to notify the lecturer-in-charge of any problems as soon as they arise.

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Comments

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