COMP781

Advanced Algorithms

S1 Day 2018

Dept of Computing

Contents

General Information

Unit convenor and teaching staff

Convenor

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Lecturer

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Credit points

4

Prerequisites

Admission to MRes

Corequisites

Co-badged status

Unit description

Algorithms are the essence of computer science. In this unit we build on the undergraduate understanding of algorithms and look at interesting and useful algorithms, both fundamental and cutting edge. The particular material covered will depend on the cohort but may include topics such as approximation algorithms, exponential-time exact and parameterized algorithms, linear and constraint programming and fundamental graph algorithms such as max-flow algorithms, matching algorithms an so on. The unit will also employ appropriate tools from complexity theory to analyse the performance of the algorithms studied.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

Explain key ideas in the field of algorithmics and the workings of key algorithms, and compare and evaluate algorithmic solutions for computational problems.

Understand and formally analyse algorithms.

Implement key algorithms.

Develop algorithmic solutions for computational problems by constructing new algorithms

and combining existing algorithms.

Investigate topics in advanced algorithms and synthesise the output for presentation in oral and written form.

General Assessment Information

COMP781 will be assessed and graded according to the University assessment and grading policies.

Submission Deadlines

Assessment deadlines are strict, unless an application for special consideration is received (preferably in advance) accompanied by appropriate documentary evidence. Late submissions will be penalised at the rate of 20% of the full marks for the assessment per day or part thereof late.

Standards

The following general standards of achievement will be used to assess each of the assessment tasks with respect to the letter grades.

Pass: Has a basic understanding of the algorithms and concepts as discussed in class. Can describe and reproduce definitions and fundamental algorithms. Can perform a basic research investigation in the area and present the results of that research in rudimentary written and oral forms.

Credit: As for Pass plus: Is able to apply the algorithmic techniques we have discussed to derive solutions to computational problems. Can develop, generalise and apply the concepts discussed in class to address basic theoretical and practical questions, and can effectively communicate these insights. Shows more than basic insights into the results of a research investigation and is able to communicate those insights.

Distinction/High Distinction: As for Credit plus: Is able to generalise and synthesise knowledge to address more complex topics beyond the material discussed in class. Can critically evaluate the limits of the techniques and algorithms discussed.

Assessment Process

These assessment standards will be used to give a numeric mark out of 100 to each assessment submission during marking. The mark will correspond to a letter grade for that task according to the University guidelines. The final raw mark for the unit will be calculated by combining the marks for all assessment tasks according to the percentage weightings shown in the assessment summary.

Assessment Tasks

Name	Weighting	Hurdle	Due
Presentation	10%	No	Week 13

Name	Weighting	Hurdle	Due
Weekly tests	36%	No	Week 1 to week 12.
Projects	54%	No	Week 3 to week 12.

Presentation

Due: **Week 13**
Weighting: **10%**

An oral presentation supported by appropriate presentation materials will be conducted in week 13.

On successful completion you will be able to:

- Explain key ideas in the field of algorithmics and the workings of key algorithms, and compare and evaluate algorithmic solutions for computational problems.
- Investigate topics in advanced algorithms and synthesise the output for presentation in oral and written form.

Weekly tests

Due: **Week 1 to week 12.**
Weighting: **36%**

Each week students will be asked to complete some exercises in class to test understanding of the material.

On successful completion you will be able to:

- Explain key ideas in the field of algorithmics and the workings of key algorithms, and compare and evaluate algorithmic solutions for computational problems.
- Understand and formally analyse algorithms.
- Develop algorithmic solutions for computational problems by constructing new algorithms and combining existing algorithms.

Projects

Due: **Week 3 to week 12.**
Weighting: **54%**

Students will be asked to complete 4 projects. These will consist of a combination of programming, program analysis and report writing.

On successful completion you will be able to:

- Explain key ideas in the field of algorithmics and the workings of key algorithms, and compare and evaluate algorithmic solutions for computational problems.
- Understand and formally analyse algorithms.
- Implement key algorithms.
- Develop algorithmic solutions for computational problems by constructing new algorithms and combining existing algorithms.

Delivery and Resources

Classes

Each week has three hours of face-to-face class. These classes will be a mixture lecture material, discussion and in class tests.

Recommended Reading and References

There is no set text for the course, but the following *far from exhaustive* list of texts may be useful for reference, study and further reading:

- Skiena, Algorithm Design Manual, Spinger.
- Cormen, Leiserson, Rivest and Stein. Introductions to algorithms, Prentice Hall.
- Papadimitriou, Computational Complexity, Addison Wesley.
- Sipser, Introduction to the Theory of Computation, Thomson.

Unit Webpage, Materials and Technologies Used

The materials for the unit including notes, discussion fora, electronic submission links etc. will be through the iLearn system.

The programming projects can be done in any programming language subject to prior approval of the course convener. Languages can include Java and Python.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public

- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/study/getting-started/student-conduct

Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

Learning outcomes

- Explain key ideas in the field of algorithmics and the workings of key algorithms, and compare and evaluate algorithmic solutions for computational problems.
- Understand and formally analyse algorithms.
- Implement key algorithms.

Assessment tasks

- Weekly tests
- Projects

PG - Critical, Analytical and Integrative Thinking

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:

Learning outcomes

- Explain key ideas in the field of algorithmics and the workings of key algorithms, and compare and evaluate algorithmic solutions for computational problems.
- Understand and formally analyse algorithms.
- Implement key algorithms.
- Develop algorithmic solutions for computational problems by constructing new algorithms and combining existing algorithms.

Assessment tasks

- Presentation
- Weekly tests

- Projects

PG - Research and Problem Solving Capability

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

Learning outcomes

- Explain key ideas in the field of algorithmics and the workings of key algorithms, and compare and evaluate algorithmic solutions for computational problems.
- Understand and formally analyse algorithms.
- Implement key algorithms.
- Develop algorithmic solutions for computational problems by constructing new algorithms and combining existing algorithms.
- Investigate topics in advanced algorithms and synthesise the output for presentation in oral and written form.

Assessment tasks

- Weekly tests
- Projects

PG - Effective Communication

Our postgraduates will be able to communicate effectively and convey their views to different social, cultural, and professional audiences. They will be able to use a variety of technologically supported media to communicate with empathy using a range of written, spoken or visual formats.

This graduate capability is supported by:

Learning outcomes

- Explain key ideas in the field of algorithmics and the workings of key algorithms, and compare and evaluate algorithmic solutions for computational problems.
- Develop algorithmic solutions for computational problems by constructing new algorithms and combining existing algorithms.
- Investigate topics in advanced algorithms and synthesise the output for presentation in oral and written form.

Assessment tasks

- Presentation
- Weekly tests
- Projects

PG - Engaged and Responsible, Active and Ethical Citizens

Our postgraduates will be ethically aware and capable of confident transformative action in relation to their professional responsibilities and the wider community. They will have a sense of connectedness with others and country and have a sense of mutual obligation. They will be able to appreciate the impact of their professional roles for social justice and inclusion related to national and global issues

This graduate capability is supported by:

Learning outcome

- Investigate topics in advanced algorithms and synthesise the output for presentation in oral and written form.

Assessment task

- Presentation