COMP225

Algorithms and Data Structures

S1 Day 2016

Dept of Computing

Contents

General Information

Unit convenor and teaching staff
Lecturer
Mark Dras
mark.dras@mq.edu.au
Contact via mark.dras@mq.edu.au
E6A 380
By appointment.

Tutor
Oldooz Dianat
oldooz.dianat@mq.edu.au

Tutor
Scott Buckley
scott.buckley@mq.edu.au

Lecturer
Mehmet Orgun
mehmet.orgun@mq.edu.au
Contact via mehmet.orgun@mq.edu.au
E6A319
By appointment

Tutor
Kym Haines
kym.haines@mq.edu.au

Credit points
3

Prerequisites
COMP125 and 3cp from MATH132-MATH136 or DMTH137)

Corequisites

Co-badged status

Unit description
This unit provides a study of algorithms, data structures and programming techniques. The topics covered include: trees; graphs and heaps; advanced sorting techniques; elements of storage management; and complexity. The presentation emphasises the role of data abstraction and correctness proofs.

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:

Be familiar with a variety of algorithm design techniques and understand how they can improve either efficiency or clarity.

Be aware of the importance of correctness for algorithms, and able to apply strategies for achieving correctness.

Be able to apply commonly used data structures (including trees, graphs, lists and their variations).

Carrying out advanced and broadly based problem solving - most particularly when designing and writing programs in Java to meet a given specification.

Be able to describe results of analysing algorithms.

General Assessment Information

Standards and Grading

Your **final grade** will depend on your overall performance**, but note that** your performance in each part separately will also be taken into account.

To be eligible for **special consideration** for the final examination you must have been performing satisfactorily in the unit prior to any unavoidable disruption.

Extension requests: If you cannot submit on time because of illness or other circumstances, please contact the lecturer **before** the due date.

Summary of achievement required corresponding to each final grade

- **HD** and **D**

  Overall the quality of the work demonstrates a mature and considered appreciation of the programming and algorithmic concepts, and an excellent technical mastery of Java programming (sufficient to complete the advanced programming tasks). A systematic

demonstration of the ability to problem solve independently and a thorough knowledge of how to critique the proposed solution, in terms of performance, correctness and other technical issues.

- **Cr**
  Overall the quality of the work demonstrates a reasonable appreciation of the programming and algorithmic concepts, and a good technical mastery of Java programming (sufficient to complete the required programming tasks). A systematic demonstration of the ability to solve basic problems and to present the solutions clearly with an attempt to give reasons why they meet their stated objectives. Some knowledge of how to critique the proposed solution, in terms of performance, correctness and other technical issues is demonstrated, but the answers given might not cover all cases.
- **P** The quality of work demonstrates a basic technical mastery of the Java language, a basic understanding of how to program using the studied algorithms and a knowledge of how to implement and use the basic algorithmic data structures and programming techniques introduced in the course. The assessment work demonstrates a basic understanding of performance and correctness issues relative to all of the algorithms and data structures studied in the unit, and the appropriateness of a particular algorithm relative to a given data structure.

Assessment Tasks

Name	Weighting	Due
Assignment 1	15%	Week 7
Assignment 2	15%	Week 12
Weekly class activities	10%	Weekly
Formal Examination	60%	Examination period

Assignment 1

Due: **Week 7**
Weighting: **15%**

In this assignment you will be asked to design,implement and analyse an algorithm based on the material from the first half of the unit. Your algorithm will be implemented in the Java programming language using some of the design techniques taught in lectures and the weekly

exercises.

Submission method: via iLearn.

On successful completion you will be able to:

- Be familiar with a variety of algorithm design techniques and understand how they can improve either efficiency or clarity.
- Be aware of the importance of correctness for algorithms, and able to apply strategies for achieving correctness.
- Be able to apply commonly used data structures (including trees, graphs, lists and their variations).
- Carrying out advanced and broadly based problem solving - most particularly when designing and writing programs in Java to meet a given specification.

Assignment 2

Due: **Week 12**
Weighting: **15%**

You will be asked to design and implement an algorithm in Java based on the material in the second half of the unit, with a focus on graph data structures and on using some of the more advanced techniques discussed in lectures.

Submission method: via iLearn.

On successful completion you will be able to:

- Be familiar with a variety of algorithm design techniques and understand how they can improve either efficiency or clarity.
- Be aware of the importance of correctness for algorithms, and able to apply strategies for achieving correctness.
- Be able to apply commonly used data structures (including trees, graphs, lists and their variations).
- Carrying out advanced and broadly based problem solving - most particularly when designing and writing programs in Java to meet a given specification.

Weekly class activities

Due: **Weekly**
Weighting: **10%**

Each week you will be asked to complete a selection of activities in class, either individually or in a small group.

Submission method: via iLearn.

On successful completion you will be able to:

- Be familiar with a variety of algorithm design techniques and understand how they can improve either efficiency or clarity.
- Be aware of the importance of correctness for algorithms, and able to apply strategies for achieving correctness.
- Be able to apply commonly used data structures (including trees, graphs, lists and their variations).
- Carrying out advanced and broadly based problem solving - most particularly when designing and writing programs in Java to meet a given specification.

Formal Examination

Due: **Examination period**
Weighting: **60%**

A formal written examination based on lectures, class work and activities and assignments.

Submission method: Formal examination organised by the University.

On successful completion you will be able to:

- Be familiar with a variety of algorithm design techniques and understand how they can improve either efficiency or clarity.
- Be aware of the importance of correctness for algorithms, and able to apply strategies for achieving correctness.
- Be able to apply commonly used data structures (including trees, graphs, lists and their variations).
- Carrying out advanced and broadly based problem solving - most particularly when designing and writing programs in Java to meet a given specification.
- Be able to describe results of analysing algorithms.

Delivery and Resources

Technology required

- Eclipse - download Eclipse IDE for Java Developers: The practical work in this unit involves programming in Java (www.java.com) using the Eclipse Integrated Development Environment (www.eclipse.org)
- Java SE JDK - download Java SE 8 to be compatible with the labs: Note that you need the Java JDK which includes the compiler tools, rather than the Java Runtime Environment (JRE) which you might already have installed on your computer to allow

you to run Java applications.

- Any additional Java libraries will be made available for download.
- Learning Management System iLearn : This will be used primarily to enable email broadcasts and give access to Assessment marks.
- The lecture audio will be recorded, and will be available via iLearn.

Classes

Each week you should attend **3 hours of lectures** and **a two-hour mixed class**. For details of days, times and rooms consult the timetables webpage.

You should have selected one two-hour mixed class session at enrolment. **You must attend the session you are enrolled in**.

Please note that you are **expected** to attend most of the mixed classes and **required** to submit work by the stated deadlines. Failure to do so may result in you failing the unit or being excluded from the exam.

Required and Recommended Texts

The textbook for Java programming used this semester is:

Adam Drozdek [2005]. *Data Structures and Algorithms in Java* (2nd ed. or 3rd edition). Boston: Thomson Course Technology.

This textbook is available from the University Co-op Bookshop.

There is also a companion website by the publisher, containing data files for exercises. In addition, Drozdek has Java code from the book available on his webpage. (Note that these are written for Java 1.4.)

Unit Pages

The unit will make use of discussions hosted within iLearn. Please post questions there, they will be monitored by the staff on the unit.

Teaching and Learning Strategy

COMP225 is taught via lectures and mixed classes in the laboratory. Lectures are used to introduce new theoretic material, give examples of the use these techniques and put them in a wider context. Mixed classes give you the opportunity to interact with your peers. You will be given problems to solve each week prior to each session; preparing solutions is important because it will allow you to discuss the problems effectively with your tutor and maximise the feedback you get on your work. The aim of the mixed classes is to help you to develop problem-solving skills and teamwork, and you will be expected to work on problems in class. Mixed classes give you an opportunity to practice your programming skills, and to implement many of the ideas discussed in lectures. Each week you will be given a number of problems to work on; it is important that you keep up with these problems as doing so will help you understand the material in the unit and prepare you for the work in assignments. Some of the questions are

designated **compulsory** and they contribute to your total grade via the weekly exercise assessment. These must be completed and submitted by the deadline.

Lecture notes will be made available each week but these notes are intended as an outline of the lecture only and are not a substitute for your own notes or the textbook.

Unit Schedule

Week 1	Review of algorithms and related concepts
Week 2	Algorithm Correctness and Efficiency; Algorithm Complexity
Week 3	Algorithm Design Strategies
Week 4	Linked Lists and Recursion
Week 5	Binary Trees
Week 6	Binary Trees (cont.)
April 11--22	**Mid-Semester Break**
Week 7	Sorting
Week 8	Priority Queues, Heaps and Heapsort
Week 9	Programming with Maps and Hashtables
Week 10	Graph Algorithms
Week 11	Graph Algorithms (cont.)
Week 12	An Introduction to Computability
Week 13	Revision

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of 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/support/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.

Department of Computing special Consideration: http://comp.mq.edu.au/undergrad/policies/special_consideration_policy.htm

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

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- Be aware of the importance of correctness for algorithms, and able to apply strategies for achieving correctness.
- Be able to apply commonly used data structures (including trees, graphs, lists and their variations).
- Carrying out advanced and broadly based problem solving - most particularly when designing and writing programs in Java to meet a given specification.

Assessment tasks

- Assignment 1
- Assignment 2

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcome

- Carrying out advanced and broadly based problem solving - most particularly when designing and writing programs in Java to meet a given specification.

Assessment task

- Weekly class activities

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcome

- Be able to describe results of analysing algorithms.

Assessment task

- Weekly class activities

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Be familiar with a variety of algorithm design techniques and understand how they can improve either efficiency or clarity.
- Be aware of the importance of correctness for algorithms, and able to apply strategies for achieving correctness.
- Be able to apply commonly used data structures (including trees, graphs, lists and their variations).

Assessment tasks

- Assignment 1
- Assignment 2
- Formal Examination

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to

critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Be familiar with a variety of algorithm design techniques and understand how they can improve either efficiency or clarity.
- Be able to apply commonly used data structures (including trees, graphs, lists and their variations).
- Carrying out advanced and broadly based problem solving - most particularly when designing and writing programs in Java to meet a given specification.

Assessment tasks

- Assignment 1
- Assignment 2
- Weekly class activities
- Formal Examination

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Be familiar with a variety of algorithm design techniques and understand how they can improve either efficiency or clarity.
- Be aware of the importance of correctness for algorithms, and able to apply strategies for achieving correctness.
- Be able to apply commonly used data structures (including trees, graphs, lists and their variations).
- Carrying out advanced and broadly based problem solving - most particularly when designing and writing programs in Java to meet a given specification.

Assessment tasks

- Assignment 1

- Assignment 2
- Weekly class activities
- Formal Examination

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcome

- Be able to describe results of analysing algorithms.

Assessment tasks

- Weekly class activities
- Formal Examination

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Assessment task

- Formal Examination

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Assessment task

- Weekly class activities

Changes from Previous Offering

Some small changes from last offering have been made to streamline the assessment tasks. Some topics have been moved from COMP125 to allow a fuller treatment here, and one topic dropped.