



**MONASH** University  
Information Technology

**FIT2004**  
**Algorithms and data structures**

**Unit Guide**

**Semester 2, 2012**

The information contained in this unit guide is correct at time of publication. The University has the right to change any of the elements contained in this document at any time.

*Last updated: 18 Jul 2012*

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# **FIT2004 Algorithms and data structures - Semester 2, 2012**

This unit introduces students to problem solving concepts and techniques fundamental to the science of programming. In doing this it covers problem specification, algorithmic design, analysis and implementation. Detailed topics include analysis of best, average and worst-case time and space complexity; introduction to numerical algorithms; recursion; advanced data structures such as heaps and B-trees; hashing; sorting algorithms; searching algorithms; graph algorithms; and numerical computing.

## **Mode of Delivery**

Clayton (Day)

## **Contact Hours**

2 hrs lectures/wk, 3 hr laboratory/fortnight, 1 hr tutorial/fortnight

## **Workload**

Students will be expected to spend a total of 12 hours per week during semester on this unit as follows:

- Lectures: 2 hours per week
- Tutorials/Lab Sessions: 4 hours **fortnightly** (1 hour tutorial, 3 hours lab)
- Reading: 4 hours per week
- Lab Preparation: 4 hours per week.

## **Unit Relationships**

### **Prohibitions**

CSE2304, FIT2009

### **Prerequisites**

One of FIT1008, FIT1015 or CSE1303 and 6 points of Level 1 mathematics.

### **Chief Examiner**

Professor Geoff Webb

### **Campus Lecturer**

### **Clayton**

**Geoff Webb**

Consultation hours: Mondays 12:00pm - 1:00pm

## **Sunway**

**Loke Kar Seng**

# Academic Overview

## Outcomes

At the completion of this unit students will have:

- understanding of a formal specification;
- ability to create a formal specification for an informal problem;
- knowledge and understanding of algorithmic properties such as correctness, termination and complexity;
- ability to, given a non-trivial algorithm, formally prove certain properties, such as correctness and termination;
- ability, given a non-trivial algorithm, to determine its best, average and worst-case, time and space-complexity;
- knowledge and understanding of reasonably complex data structures such as minimum spanning trees, and Directed and Undirected, Weighted and Unweighted Graphs;
- ability to design and implement new non-trivial algorithms using complex data structures;
- knowledge of and ability to use algorithmic paradigms such as divide and conquer, greedy, dynamic programming and so on;
- ability to identify these paradigms in diverse algorithms;
- knowledge and understanding of the issues involved in implementing a non-trivial algorithm efficiently.

Developed attitudes that enable them to:

- carefully design and/or analyse the algorithms they are using in order to verify important properties such as correctness, termination, and complexity;
- identify the key features of a brief informal problem description and abstract the underlying formal problem.

Developed the skills to:

- create their own data structures.
- create a new algorithm to solve a new problem.
- make a formal argument about desirable properties of the solution.
- adapt an existing algorithm and/or data-structure where that is possible and appropriate.
- implement a non-trivial algorithm efficiently.

Demonstrated the communication skills necessary to:

- make a formal argument that an algorithm and/or data-structure has a given property, such as correctness, termination or complexity.

## Graduate Attributes

Monash prepares its graduates to be:

1. responsible and effective global citizens who:
  - a. engage in an internationalised world
  - b. exhibit cross-cultural competence
  - c. demonstrate ethical values

critical and creative scholars who:

- a. produce innovative solutions to problems
- b. apply research skills to a range of challenges
- c. communicate perceptively and effectively

## Assessment Summary

Examination (3 hours): 70%; In-semester assessment: 30%

<b>Assessment Task</b>	<b>Value</b>	<b>Due Date</b>
Assignment 1	6 %	Week 4
Assignment 2	6 %	Week 6
Assignment 3	6 %	Week 8
Assignment 4	6 %	Week 10
Assignment 5	6 %	Week 12
Examination 1	70%	To be advised

## Teaching Approach

### Lecture and tutorials or problem classes

This teaching and learning approach provides facilitated learning, practical exploration and peer learning.

## Feedback

### Our feedback to You

Types of feedback you can expect to receive in this unit are:

- Informal feedback on progress in labs/tutes
- Graded assignments without comments
- Solutions to tutes, labs and assignments

### Your feedback to Us

Monash is committed to excellence in education and regularly seeks feedback from students, employers and staff. One of the key formal ways students have to provide feedback is through SETU, Student Evaluation of Teacher and Unit. The University's student evaluation policy requires that every unit is evaluated each year. Students are strongly encouraged to complete the surveys. The feedback is anonymous and provides the Faculty with evidence of aspects that students are satisfied and areas for improvement.

For more information on Monash's educational strategy, and on student evaluations, see:

<http://www.monash.edu.au/about/monash-directions/directions.html>

<http://www.policy.monash.edu/policy-bank/academic/education/quality/student-evaluation-policy.html>

## Previous Student Evaluations of this unit

Student feedback has informed a substantive revision to the unit that includes reorienting the content to be supported by a single principal text book and reorganisation to improve the incremental progression of unit content.

If you wish to view how previous students rated this unit, please go to <https://emuapps.monash.edu.au/unitevaluations/index.jsp>

## Required Resources

Please check with your lecturer before purchasing any Required Resources. Limited copies of prescribed texts are available for you to borrow in the library, and prescribed software is available in student labs.

Java (latest version) installed in the labs, you can download a free copy from Sun Microsystems.

## Prescribed text(s)

Limited copies of prescribed texts are available for you to borrow in the library.

Mark Allen Weiss. (2012). *Data Structures and Algorithm Analysis in Java*. (3rd) Pearson (ISBN: 9780132576277).

## Recommended text(s)

Michael T. Goodrich and Roberto Tamassia. (2010). *Data Structures and Algorithms in Java*. (5th) Wiley (ISBN: 978-0-470-38326-1).

## Examination material or equipment

Closed book. No calculators.

## Unit Schedule

Week	Activities	Assessment
0		No formal assessment or activities are undertaken in week 0
1	Overview and Revision of Required Concepts	
2	Algorithm Analysis	
3	Trees I	
4	Trees II	Assignment 1
5	Trees III	
6	Disjoint Sets	Assignment 2
7	Graphs and Graph Search	
8	Path Problems	Assignment 3
9	Flow Problems and Minimum Spanning Trees	
10	Algorithm Design I	Assignment 4
11	Algorithm Design II	
12	Selected Topics	Assignment 5
	SWOT VAC	No formal assessment is undertaken SWOT VAC
	Examination period	LINK to Assessment Policy: <a href="http://policy.monash.edu.au/policy-bank/academic/education/assessment/assessment-in-coursework-policy.html">http://policy.monash.edu.au/policy-bank/academic/education/assessment/assessment-in-coursework-policy.html</a>

\*Unit Schedule details will be maintained and communicated to you via your MUSO (Blackboard or Moodle) learning system.



# Assessment Requirements

## Assessment Policy

Faculty Policy - Unit Assessment Hurdles

(<http://www.infotech.monash.edu.au/resources/staff/edgov/policies/assessment-examinations/unit-assessment-hu>)

Academic Integrity - Please see the Demystifying Citing and Referencing tutorial at

<http://lib.monash.edu/tutorials/citing/>

## Assessment Tasks

### Participation

#### • Assessment task 1

**Title:**

Assignment 1

**Description:**

Practical problems arising from the material covered in lectures and tutorials.

**Weighting:**

6 %

**Criteria for assessment:**

- ◆ Demonstrate code where applicable
- ◆ Explain your solutions

**Due date:**

Week 4

#### • Assessment task 2

**Title:**

Assignment 2

**Description:**

Practical problems arising from the material covered in lectures and tutorials.

**Weighting:**

6 %

**Criteria for assessment:**

- ◆ Demonstrate code where applicable
- ◆ Explain your solutions

**Due date:**

Week 6

#### • Assessment task 3

**Title:**

Assignment 3

**Description:**

Practical problems arising from the material covered in lectures and tutorials.

**Weighting:**

## Assessment Requirements

6 %

### Criteria for assessment:

- ◆ Demonstrate code where applicable
- ◆ Explain your solutions

### Due date:

Week 8

### • Assessment task 4

#### Title:

Assignment 4

#### Description:

Practical problems arising from the material covered in lectures and tutorials.

#### Weighting:

6 %

### Criteria for assessment:

- ◆ Demonstrate code where applicable
- ◆ Explain your solutions

### Due date:

Week 10

### • Assessment task 5

#### Title:

Assignment 5

#### Description:

Practical problems arising from the material covered in lectures and tutorials.

#### Weighting:

6 %

### Criteria for assessment:

- ◆ Demonstrate code where applicable
- ◆ Explain your solutions

### Due date:

Week 12

## Examinations

### • Examination 1

#### Weighting:

70%

#### Length:

3 hours

#### Type (open/closed book):

Closed book

#### Electronic devices allowed in the exam:

None

## **Assignment submission**

It is a University requirement

(<http://www.policy.monash.edu/policy-bank/academic/education/conduct/plagiarism-procedures.html>) for students to submit an assignment coversheet for each assessment item. Faculty Assignment coversheets can be found at <http://www.infotech.monash.edu.au/resources/student/forms/>. Please check with your Lecturer on the submission method for your assignment coversheet (e.g. attach a file to the online assignment submission, hand-in a hard copy, or use an online quiz).

## **Online submission**

If Electronic Submission has been approved for your unit, please submit your work via the VLE site for this unit, which you can access via links in the my.monash portal.

## **Extensions and penalties**

Submission must be made by the due date otherwise penalties will be enforced.

You must negotiate any extensions formally with your campus unit leader via the in-semester special consideration process:

<http://www.infotech.monash.edu.au/resources/student/equity/special-consideration.html>.

## **Returning assignments**

Students can expect assignments to be returned within two weeks of the submission date or after receipt, whichever is later.

## Other Information

### Policies

Monash has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University's academic standards, and to provide advice on how they might uphold them. You can find Monash's Education Policies at:

<http://policy.monash.edu.au/policy-bank/academic/education/index.html>

Key educational policies include:

- Plagiarism  
(<http://www.policy.monash.edu/policy-bank/academic/education/conduct/plagiarism-policy.html>)
- Assessment  
(<http://www.policy.monash.edu/policy-bank/academic/education/assessment/assessment-in-coursework-p>)
- Special Consideration  
(<http://www.policy.monash.edu/policy-bank/academic/education/assessment/special-consideration-policy.h>)
- Grading Scale  
(<http://www.policy.monash.edu/policy-bank/academic/education/assessment/grading-scale-policy.html>)
- Discipline: Student Policy  
(<http://www.policy.monash.edu/policy-bank/academic/education/conduct/student-discipline-policy.html>)
- Academic Calendar and Semesters (<http://www.monash.edu.au/students/key-dates/>);
- Orientation and Transition (<http://www.infotech.monash.edu.au/resources/student/orientation/>);  
and
- Academic and Administrative Complaints and Grievances Policy  
(<http://www.policy.monash.edu/policy-bank/academic/education/management/complaints-grievance-policy>)
- Codes of Practice for Teaching and Learning  
(<http://www.policy.monash.edu.au/policy-bank/academic/education/conduct/suppdocs/code-of-practice-tea>)

### Student services

The University provides many different kinds of support services for you. Contact your tutor if you need advice and see the range of services available at [www.monash.edu.au/students](http://www.monash.edu.au/students). For Sunway see <http://www.monash.edu.my/Student-services>, and for South Africa see <http://www.monash.ac.za/current/>

The Monash University Library provides a range of services and resources that enable you to save time and be more effective in your learning and research. Go to <http://www.lib.monash.edu.au> or the library tab in my.monash portal for more information. At Sunway, visit the Library and Learning Commons at <http://www.lib.monash.edu.my/>. At South Africa visit <http://www.lib.monash.ac.za/>.

Academic support services may be available for students who have a disability or medical condition. Registration with the Disability Liaison Unit is required. Further information is available as follows:

- Website: <http://monash.edu/equity-diversity/disability/index.html>;
- Email: [dlu@monash.edu](mailto:dlu@monash.edu)
- Drop In: Equity and Diversity Centre, Level 1 Gallery Building (Building 55), Monash University, Clayton Campus, or Student Community Services Department, Level 2, Building 2, Monash University, Sunway Campus
- Telephone: 03 9905 5704, or contact the Student Advisor, Student Community Services at 03 55146018 at Sunway

## Reading list

### PRESCRIBED TEXT

Mark Allen Weiss:  
Data Structures and Algorithm Analysis in Java. 3rd ed  
Pearson.

### ADDITIONAL READING

Michael Goodrich and Roberto Tamassia.  
Data Structures and Algorithms in Java, 3rd ed  
John Wiley.

Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein. Introduction to Algorithms, 2nd Edition, EHT MIT Press & McGraw Hill

Duane Bailey. Java Structures: Data Structures in Java for the Principled Programmer. International Edition, May 1999, Mc Graw Hill. This book is available for free online at <http://www.cs.williams.edu/~bailey/JavaStructures/Welcome.html>