



MONASH University
Information Technology

FIT4012
Advanced topics in computational science

Unit Guide

Semester 2, 2011

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.

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FIT4012 Advanced topics in computational science - Semester 2, 2011

All sciences are increasingly relying on computational support and the growth of many branches of science has only become possible due to the availability of efficient computational methods. The common basis of such methods are; numerical methods and high performance computing. Topics for this unit include: Numerical Methods, High Performance and Parallel Computing, Optimisation and Operations Research Bioinformatics, Simulation, Visualisation and Modelling.

Mode of Delivery

Clayton (Day)

Contact Hours

2 hrs lectures/wk

Workload

Weekly workload commitments are:

- 2 hour lecture
- a minimum of 5 hours personal study and lecture preparation
- a minimum of 5 hours for working on programming and written assessments

Unit Relationships

Prerequisites

Completion of the Bachelor of Computer Science or equivalent to the entry requirements for the Honours program. Students must also have enrolment approval from the Honours Coordinator.

Chief Examiner

Associate Professor Jon McCormack

Campus Lecturer

Clayton

Jon McCormack

Alan Dorin

Academic Overview

Learning Objectives

At the completion of this unit students will:

- understand the place of computational methods in the chosen field of specialisation and their relation to non-computational approaches;
- compare and contrast alternative computational approaches in this domain;
- critically evaluate the limits and capabilities of these methods;
- be able to select, design and test computer programs in the domain;
- where appropriate, be able to use the standard computational packages in the chosen domain effectively for practical problem solving.

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

Assignment and Examination, relative weight depending on topic composition. When no exam is given students will be expected to demonstrate their knowledge by solving practical problems and maybe required to give an oral report.

Assessment Task	Value	Due Date
Programming Exercises	30%	Week 4, Friday 5pm
Written Essay	20%	Week 7, Friday, 5pm
Procedural Modelling and Visualisation Programming Exercise	50%	Week 12

Teaching Approach

Research activities

Students are encourage to explore research literature, combined with practical problem-solving and learning support from their lecturers.

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 with comments

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

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

Recommended Resources

Access to a C,C++ or Java compiler and IDE environment.

These are available in University computer labs.

Unit Schedule

Week	Activities	Assessment
0	Review recommended reading	No formal assessment is undertaken in week 0
1	Introduction to Evolutionary Simulation and Synthesis	
2	Evolutionary Algorithms	
3	Genetic Algorithms / Evolutionary Strategies	
4	Adaptive Intelligence	
5	Learning Classifiers	Programming exercise due week 4
6	Hybrid Models / Special Forms of Evolution	
7	Introduction to Procedural Modelling, Animation and Artificial Life	Written Essay due week 7
8	Plants	
9	Flocks, Herds, Swarms & Schools: Distributed Models of Behaviour	
10	Animals: Form and Function	
11	Cells and Pixels	
12	Artificial (Virtual) Ecosystems	Procedural Modelling and Visualisation Programming Exercise due week 12
		No formal assessment is undertaken in SWOT VAC
	Examination period	LINK to Assessment Policy: http://policy.monash.edu.au/policy-bank/academic/education/assessment/assessment-in-coursework-policy.html

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

Assessment Requirements

Assessment Tasks

Participation

• Assessment task 1

Title:

Programming Exercises

Description:

Short programming exercises on evolutionary simulation and synthesis.

Weighting:

30%

Criteria for assessment:

Correctness; accuracy; efficiency; quality of documentation; quality of results; evidence of testing; statistical analysis; coding use; inventiveness of solutions.

Due date:

Week 4, Friday 5pm

• Assessment task 2

Title:

Written Essay

Description:

Write a short academic paper on a topic in evolutionary simulation and synthesis. The lecturer will provide a list of possible topics.

Weighting:

20%

Criteria for assessment:

Marks will be awarded based on the criteria listed below. The questions listed indicate the kind of questions that will be asked when your work is assessed.

- ◆ Logical structure: is the paper well structured (e.g. title, abstract, introduction, body, conclusion, references)? Does it present its material in a logical and clear way?
- ◆ Writing quality: Does every word count? Has the author avoided 'padding out' the text with waffle in order to get to the necessary word count? Are the main points of the paper clear and convincing, with solid arguments and proper referencing to the literature.
- ◆ Language, spelling and grammar: has the paper been proof-read? Are there spelling mistakes? Do sentences make sense? Are there any grammatical errors? Is it easy to establish what the writer is trying to say?
- ◆ Quality of analysis: how well has the topic being researched? How clearly does it establish the important points and arguments. Are the references appropriate and adequate?
- ◆ Original contribution: what does the paper contribute to the topic beyond just listing opinions or work done by others? How original is the paper?

Please note that it is important to correctly attribute material that is not your own. Your paper will contain a bibliography, listing the work of others that you have consulted. The

Assessment Requirements

number of references you consult is up to you, as a rough guide most papers of this size will have somewhere between 6-20 references. Do not 'bulk up' your bibliography with unnecessary references or ones that you have not actually read.

Do not rely solely on the Internet for your information. Favour books, journals and conference proceedings over web pages.

At least 80% of your references should originate from sources other than the Internet.

Due date:

Week 7, Friday, 5pm

• **Assessment task 3**

Title:

Procedural Modelling and Visualisation Programming Exercise

Description:

Write a software simulation and visualisation demonstrating the principles discussed during lectures. Further details will be published along with the unit materials.

Weighting:

50%

Criteria for assessment:

See detailed specification provided with unit materials. In general, for code:

1. The degree to which programs meet the problem specification
2. How well the code is written and how easy it is to understand
3. How well the program is documented

In general, for text:

1. How well underlying principles and theories are demonstrated in the student's answer
2. The appropriateness of the formatted report style
3. The quality of the student's argument

Due date:

Week 12

Examinations

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).

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:

Assessment Requirements

<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. 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. Students who have a disability or medical condition are welcome to contact the Disability Liaison Unit to discuss academic support services. Disability Liaison Officers (DLOs) visit all Victorian campuses on a regular basis

- Website: <http://adm.monash.edu/sss/equity-diversity/disability-liaison/index.html>;
- Telephone: 03 9905 5704 to book an appointment with a DLO;
- Email: dlu@monash.edu
- Drop In: Equity and Diversity Centre, Level 1 Gallery Building (Building 55), Monash University, Clayton Campus.

RECOMMENDED READING LIST:

Sean Luke (2009): "Essentials of Metaheuristics", Lulu, Available for free download at: <http://www.cs.gmu.edu/~sean/book/metaheuristics/>

A.E. Eiben and J.E. Smith (2007): "Introduction to Evolutionary Computing", (2nd ed.) Springer, Natural Computing Series