

**FIT4012**  
**Advanced topics in computational science**

**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*

# Table of Contents

|   |          |
|---|----------|
| <b><u>FIT4012 Advanced topics in computational science - Semester 2, 2012</u></b> ..... | <b>1</b> |
| <u>Mode of Delivery</u> .....   | 1        |
| <u>Contact Hours</u> .....  | 1        |
| <u>Workload</u> .....   | 1        |
| <u>Unit Relationships</u> .....   | 1        |
| <u>Prerequisites</u> .....  | 1        |
| <u>Chief Examiner</u> .....   | 1        |
| <u>Campus Lecturer</u> .....  | 1        |
| <u>Clayton</u> .....  | 1        |
| <b><u>Academic Overview</u></b> .....   | <b>2</b> |
| <u>Outcomes</u> .....   | 2        |
| <u>Graduate Attributes</u> .....  | 2        |
| <u>Assessment Summary</u> .....   | 2        |
| <u>Teaching Approach</u> .....  | 3        |
| <u>Feedback</u> .....   | 3        |
| <u>Our feedback to You</u> .....  | 3        |
| <u>Your feedback to Us</u> .....  | 3        |
| <u>Previous Student Evaluations of this unit</u> .....                                  | 3        |
| <u>Recommended Resources</u> .....  | 3        |
| <b><u>Unit Schedule</u></b> .....   | <b>4</b> |
| <b><u>Assessment Requirements</u></b> .....   | <b>5</b> |
| <u>Assessment Policy</u> .....  | 5        |
| <u>Assessment Tasks</u> .....   | 5        |
| <u>Participation</u> .....  | 5        |
| <u>Assignment submission</u> .....  | 7        |
| <u>Online submission</u> .....  | 7        |
| <u>Extensions and penalties</u> .....   | 7        |
| <u>Returning assignments</u> .....  | 7        |
| <b><u>Other Information</u></b> .....   | <b>8</b> |
| <u>Policies</u> .....   | 8        |
| <u>Student services</u> .....   | 8        |
| <u>Reading list</u> .....   | 9        |

# **FIT4012 Advanced topics in computational science - Semester 2, 2012**

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

## Outcomes

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.

| <b>Assessment Task</b>   | <b>Value</b> | <b>Due Date</b>      |
|--|--------------|----------------------|
| Programming Exercises  | 30%          | Week 8, Friday, 5pm  |
| Written Essay  | 20%          | Week 12, Friday, 5pm |
| Procedural Modelling, Simulation and / or Visualisation Programming Exercise | 50%          | Week 6               |

## Teaching Approach

### Research activities

Students are encouraged to explore the 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

Student feedback has shown the unit is structured well. To make sure materials are current lecture notes have been updated and new visual references have been added.

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 or activities are undertaken in week 0   |
| 1    | Introduction to Procedural Modelling, Animation and Artificial Life |   |
| 2    | Plants  |   |
| 3    | Flocks, Herds, Swarms & Schools: Distributed Models of Behaviour    |   |
| 4    | Animals: Form and Function  |   |
| 5    | Cells and Pixels  |   |
| 6    | Artificial (Virtual) Ecosystems                                     | Procedural Modelling, Simulation and / or Visualisation Programming Exercise due Week 6   |
| 7    | Introduction to Evolutionary Simulation and Synthesis               |   |
| 8    | Evolutionary Algorithms   |   |
| 9    | Genetic Algorithms / Evolutionary Strategies                        | Programming Exercises due Week 8, Friday, 5pm   |
| 10   | Adaptive Intelligence   |   |
| 11   | Learning Classifiers  |   |
| 12   | Hybrid Models / Special Forms of Evolution                          | Written Essay due Week 12, Friday, 5pm  |
|      |   | No formal assessment is undertaken in SWOT VAC  |
|      | Examination period  | LINK to Assessment Policy:<br><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:**

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 8, 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?

## Assessment Requirements

- ◆ 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?

**Due date:**

Week 12, Friday, 5pm

**Remarks:**

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 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.

Consider the authority and origin of your research sources. Favour books, journals and conference proceedings that are peer reviewed and from reputable publishers over web pages, for example.

At least 80% of your references should originate from sources other than the Internet (electronic versions of journal or conference papers can count towards this quota).

### • Assessment task 3

**Title:**

Procedural Modelling, Simulation and / or 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 6



## **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

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

S. Levy (1992): "Artificial Life, the quest for a new creation", Penguin Books