

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

**Unit guide**

**Semester 1, 2009**

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# **FIT4012 Advanced topics in computational science - Semester 1, 2009**

## **Unit leader :**

Jon McCormack

## **Lecturer(s) :**

### **Clayton**

- Jon McCormack
- Alan Dorin

## **Introduction**

Welcome to FIT4012 for 2009. This is an honours-level unit for students enrolled in BCS or BSE honours. The unit looks at evolutionary processes and how these may be used in computer science for the purposes of problem-solving, optimisation, simulation and synthesis. The unit also examines biologically-inspired computational processes and their implementation in the form of simulations and for computer graphics or procedural animation.

## **Unit synopsis**

ASCED classification: 020107 Computational Theory

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.

Topics for this unit include:

Simulation, Visualization and Modelling Evolutionary Algorithms Evolutionary Synthesis Artificial Life

## **Learning outcomes**

Knowledge and Understanding

With successful completion of the unit the students will understand the place of computational methods in the chosen field of specialisation and their relation to non-computational approaches.

Attitudes, Values and Beliefs

With successful completion of the unit the students

compare and contrast alternative computational approaches in this domain, critically evaluate the limits and capabilities of these methods, will be able to select, design and test computer programs in the domain, will, where appropriate, be able to use the standard computational packages in the chosen domain effectively for practical problem solving.

## 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

Before attempting this unit you must have satisfactorily completed

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.

### Relationships

FIT4012 is a core or elective unit in the Bachelor of Computer Science Honours degree. It may also be taken as an elective by Honours students in the Bachelor of Software Engineering degree.

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.

## Continuous improvement

Monash is committed to 'Excellence in education' (Monash Directions 2025 - <http://www.monash.edu.au/about/monash-directions/directions.html>) and strives for the highest possible quality in teaching and learning.

To monitor how successful we are in providing quality teaching and learning Monash regularly seeks feedback from students, employers and staff. One of the key formal ways students have to provide feedback is through Unit Evaluation Surveys. The University's Unit Evaluation policy (<http://www.policy.monash.edu/policy-bank/academic/education/quality/unit-evaluation-policy.html>) requires that every unit offered is evaluated each year. Students are strongly encouraged to complete the surveys as they are an important avenue for students to "have their say". The feedback is anonymous and provides the Faculty with evidence of aspects that students are satisfied and areas for improvement.

Faculties have the option of administering the Unit Evaluation survey online through the my.monash portal or in class. Lecturers will inform students of the method being used for this unit towards the end of the semester.

## Student Evaluations

If you wish to view how previous students rated this unit, please go to <http://www.adm.monash.edu.au/cheq/evaluations/unit-evaluations/>

## Improvements to this unit

Updated lecture notes with current material.

Added new visual references.

## Unit staff - contact details

### Unit leader

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Associate Professor

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#### **Lecturer(s) :**

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#### Dr Alan Dorin

Senior Lecturer

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## Teaching and learning method

Teaching consists of a weekly 2-hour lecture. Course lecturers are available for individual consultation hours as advertised in the unit MUSO page.

## Tutorial allocation

There are no tutorials or supervised laboratory classes for this unit.

## Communication, participation and feedback

Monash aims to provide a learning environment in which students receive a range of ongoing feedback throughout their studies. You will receive feedback on your work and progress in this unit. This may take the form of group feedback, individual feedback, peer feedback, self-comparison, verbal and written feedback, discussions (on line and in class) as well as more formal feedback related to assignment marks and grades. You are encouraged to draw on a variety of feedback to enhance your learning.

It is essential that you take action immediately if you realise that you have a problem that is affecting your study. Semesters are short, so we can help you best if you let us know as soon as problems arise. Regardless of whether the problem is related directly to your progress in the unit, if it is likely to interfere with your progress you should discuss it with your lecturer or a Community Service counsellor as soon as possible.

## Unit Schedule

Week	Topic	Key dates
1	Introduction to Procedural Modelling, Animation & Artificial Life	
2	Plant Models	
3	Flocks, Herds, Swarms & Schools: Distributed Models of Behaviour	
4	Animals: Form & Function	
5	Cells & Pix-cells	
6	Artificial (Virtual) Ecosystems	Programming Exercise due
Mid semester break		
7	Evolution & Evolutionary Algorithms	
8	Genetic Algorithms, Evolutionary Strategies	Programming Exercise due
9	Evolutionary and Genetic Programming	
10	Adaptive Intelligence, Learning Classifier Systems	Programming Exercise due
11	Multimodal Problems, Spatial Distribution	
12	Developmental Models	
13	Special Forms of Evolution, Advanced Applications	Written assignment due

## Unit Resources

### Prescribed text(s) and readings

The unit focuses on current research and the particular methods addressed may change. Up-to-date literature (books, journals papers, conference articles, standards, etc) will be referenced throughout the unit and will be made available to the students.

Text books are available from the [Monash University Book Shops](#). Availability from other suppliers cannot be assured. The Bookshop orders texts in specifically for this unit. You are advised to purchase your text book early.

### Recommended text(s) and readings

The unit focuses on current research and the particular methods addressed may change. Up-to-date literature (books, journals papers, conference articles, standards, etc) will be referenced throughout the unit and will be made available to the students.

For Weeks 1-6...

Recommended reading:

Eiben, A.E. and J.E. Smith, *Introduction to Evolutionary Computing*, Springer, Berlin 2003.

Other reading:

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Mitchell, M., *An Introduction to Genetic Algorithms*, MIT Press, Boston, Mass. 2002.

Engelbrecht, A.P., *Computational Intelligence: an introduction*, John Wiley & Sons, Chichester, England 2002

Dawkins, R., *The Selfish Gene*, Oxford UP, 2nd ed., 1990

Maynard Smith, J. and E. Szathmáry, *The major transitions in evolution*. Oxford ; New York, W.H. Freeman Spektrum, 1995

For weeks 7 -13... (some introductory texts on Artificial Life)

Terzopoulos, D., (1999), Artificial Life For Computer Graphics, in *Communications of the ACM*, Vol 42, No. 8, p32-42

Levy, S., "Artificial Life - The Quest For A New Creation" Jonathan Cape 1992

## Required software and/or hardware

UNIX or UNIX-like operating system with standard gnu development tools (gcc, gdb, Make).

## Equipment and consumables required or provided

Students studying off-campus are required to have the minimum system configuration specified by the Faculty as a condition of accepting admission, and regular Internet access. On-campus students, and those studying at supported study locations may use the facilities available in the computing labs. Information about computer use for students is available from the ITS Student Resource Guide in the Monash University Handbook. You will need to allocate up to **n** hours per week for use of a computer, including time for newsgroups/discussion groups.

## Study resources

Study resources we will provide for your study are:

Lecture notes

Visual and Audio examples

Assignment specifications

This Unit Guide outlining the administrative information for the unit;

The unit web site on MUSO, where resources outlined above will be made available.

## Library access

The Monash University Library site contains details about borrowing rights and catalogue searching. To learn more about the library and the various resources available, please go to <http://www.lib.monash.edu.au>.

The Educational Library and Media Resources (LMR) is also a very resourceful place to visit at <http://www.education.monash.edu.au/library/>

## Monash University Studies Online (MUSO)

All unit and lecture materials are available through MUSO (Monash University Studies Online). Blackboard is the primary application used to deliver your unit resources. Some units will be piloted in Moodle. If your unit is piloted in Moodle, you will see a link from your Blackboard unit to Moodle (<http://moodle.monash.edu.au>) and can bookmark this link to access directly. In Moodle, from the Faculty of Information Technology category, click on the link for your unit.

You can access MUSO and Blackboard via the portal: <http://my.monash.edu.au>

Click on the Study and enrolment tab, then Blackboard under the MUSO learning systems.

In order for your Blackboard unit(s) to function correctly, your computer needs to be correctly configured.

For example:

- Blackboard supported browser
- Supported Java runtime environment

For more information, please visit: <http://www.monash.edu.au/muso/support/students/downloadables-student.html>

You can contact the MUSO Support by phone : (+61 3) 9903 1268

For further contact information including operational hours, please visit:  
<http://www.monash.edu.au/muso/support/students/contact.html>

Further information can be obtained from the MUSO support site:  
<http://www.monash.edu.au/muso/support/index.html>

## Assessment

### Unit assessment policy

To pass this unit, a student must obtain:

- 40% or more in the first assignment (50% weight)
- 40% or more in the programming exercises and written assignment
- an overall unit mark of 50% or more

### Assignment tasks

- **Assignment Task**

**Title :** Programming Exercises

**Description :**

Short programming exercises on evolutionary simulation

**Weighting :**

**Criteria for assessment :**



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

**Due date :** Weeks 3 and 5

• **Assignment Task**

**Title :** Written Essay

**Description :**

Write a short academic paper on a topic in evolutionary simulation and synthesis.

**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 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

• **Assignment Task**

**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 :**

**Due date :** Week 13

## Assignment submission

Assignments should be submitted directly to the appropriate lecturer. See the unit web site for details.

## Assignment coversheets

The programming assignment for weeks 1-6 must be submitted electronically on CD-ROM or DVD.

Programming assignments for weeks 7-13 are submitted by email to the lecturer. The written assignment is submitted to the CSIT general office.

Each file of your source code must contain the following comment at the top:

```
/*  
* This software is the original work of <Your Full Name>. ID: <Your ID>  
* This software is submitted in partial fulfillment of the  
* requirements for the degree of <Your Degree>,  
* Monash University  
*/
```

## University and Faculty policy on assessment

### Due dates and extensions

The due dates for the submission of assignments are given in the previous section. Please make every effort to submit work by the due dates. It is your responsibility to structure your study program around assignment deadlines, family, work and other commitments. Factors such as normal work pressures, vacations, etc. are seldom regarded as appropriate reasons for granting extensions. Students are advised to NOT assume that granting of an extension is a matter of course.

Requests for extensions must be made to the unit lecturer at your campus at least two days before the due date. You will be asked to forward original medical certificates in cases of illness, and may be asked to provide other forms of documentation where necessary. A copy of the email or other written communication of an extension must be attached to the assignment submission.

### Late assignment

For weeks 7-13:

Late assignments will incur mark penalties according to the Fibonacci sequence multiplied by a lecturer-determined scaling factor (e.g. 0.5, 1 or 100). An assignment that is one day late will receive a one mark penalty multiplied by the scaling factor. Assignments two days late will receive a 2 mark penalty, three days late, 3 marks, each multiplied by the factor. The sequence is [1],1,2,3,5,8,13,21... (times the factor). This applies for all days including public holidays and weekends so please submit your assignments punctually!

For weeks 1-6:

Assignments received after the due date will be subject to a penalty of 5% per day, including weekends. Assignments received later than one week (seven days) after the due date will not normally be accepted. In some

cases, this period may be shorter if there is a need to release sample solutions.

This policy is strict because comments or guidance will be given on assignments as they are returned, and sample solutions may also be published and distributed, after assignment marking or with the returned assignment.

## Return dates

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

Assessment for the unit as a whole is in accordance with the provisions of the Monash University Education Policy at <http://www.policy.monash.edu/policy-bank/academic/education/assessment/>

We will aim to have assignment results made available to you within two weeks after assignment receipt.

## Plagiarism, cheating and collusion

Plagiarism and cheating are regarded as very serious offences. In cases where cheating has been confirmed, students have been severely penalised, from losing all marks for an assignment, to facing disciplinary action at the Faculty level. While we would wish that all our students adhere to sound ethical conduct and honesty, I will ask you to acquaint yourself with the University Plagiarism policy and procedure (<http://www.policy.monash.edu/policy-bank/academic/education/conduct/plagiarism-procedures.html>) which applies to students detected plagiarising.

In this University, cheating means seeking to obtain an unfair advantage in any examination or any other written or practical work to be submitted or completed by a student for assessment. It includes the use, or attempted use, of any means to gain an unfair advantage for any assessable work in the unit, where the means is contrary to the instructions for such work.

When you submit an individual assessment item, such as a program, a report, an essay, assignment or other piece of work, under your name you are understood to be stating that this is your own work. If a submission is identical with, or similar to, someone else's work, an assumption of cheating may arise. If you are planning on working with another student, it is acceptable to undertake research together, and discuss problems, but it is not acceptable to jointly develop or share solutions unless this is specified by your lecturer.

Intentionally providing students with your solutions to assignments is classified as "assisting to cheat" and students who do this may be subject to disciplinary action. You should take reasonable care that your solution is not accidentally or deliberately obtained by other students. For example, do not leave copies of your work in progress on the hard drives of shared computers, and do not show your work to other students. If you believe this may have happened, please be sure to contact your lecturer as soon as possible.

Cheating also includes taking into an examination any material contrary to the regulations, including any bilingual dictionary, whether or not with the intention of using it to obtain an advantage.

Plagiarism involves the false representation of another person's ideas, or findings, as your own by either copying material or paraphrasing without citing sources. It is both professional and ethical to reference clearly the ideas and information that you have used from another writer. If the source is not identified, then you have plagiarised work of the other author. Plagiarism is a form of dishonesty that is insulting to the reader and grossly unfair to your student colleagues.

## **Register of counselling about plagiarism**

The university requires faculties to keep a simple and confidential register to record counselling to students about plagiarism (e.g. warnings). The register is accessible to Associate Deans Teaching (or nominees) and, where requested, students concerned have access to their own details in the register. The register is to serve as a record of counselling about the nature of plagiarism, not as a record of allegations; and no provision of appeals in relation to the register is necessary or applicable.

## **Non-discriminatory language**

The Faculty of Information Technology is committed to the use of non-discriminatory language in all forms of communication. Discriminatory language is that which refers in abusive terms to gender, race, age, sexual orientation, citizenship or nationality, ethnic or language background, physical or mental ability, or political or religious views, or which stereotypes groups in an adverse manner. This is not meant to preclude or inhibit legitimate academic debate on any issue; however, the language used in such debate should be non-discriminatory and sensitive to these matters. It is important to avoid the use of discriminatory language in your communications and written work. The most common form of discriminatory language in academic work tends to be in the area of gender inclusiveness. You are, therefore, requested to check for this and to ensure your work and communications are non-discriminatory in all respects.

## **Students with disabilities**

Students with disabilities that may disadvantage them in assessment should seek advice from one of the following before completing assessment tasks and examinations:

- Faculty of Information Technology Student Service staff, and / or
- your Unit Coordinator, or
- [Disabilities Liaison Unit](#)

## **Deferred assessment and special consideration**

Deferred assessment (not to be confused with an extension for submission of an assignment) may be granted in cases of extenuating personal circumstances such as serious personal illness or bereavement. Information and forms for Special Consideration and deferred assessment applications are available at <http://www.monash.edu.au/exams/special-consideration.html>. Contact the Faculty's Student Services staff at your campus for further information and advice.