FIT5174
Parallel and distributed systems

Unit Guide

Semester 2, 2013

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: 25 Jul 2013
# Table of Contents

**FIT5174 Parallel and distributed systems - Semester 2, 2013**

- Mode of Delivery ........................................................................................................... 1  
- Contact Hours .................................................................................................................. 1  
- Workload requirements .................................................................................................... 1  
- Unit Relationships ........................................................................................................... 1  
  - Prohibitions .................................................................................................................... 1  
  - Prerequisites .................................................................................................................. 2  
- Chief Examiner .................................................................................................................. 2  
- Campus Lecturer ............................................................................................................... 2  
  - Caulfield ......................................................................................................................... 2  
- Tutors ............................................................................................................................... 2  
  - Caulfield .......................................................................................................................... 2  

## Academic Overview

- Learning Outcomes ........................................................................................................... 3

## Unit Schedule

- Assessment Summary ....................................................................................................... 8  
- Teaching Approach ........................................................................................................... 8

## Assessment Requirements

- Assessment Policy ............................................................................................................. 9  
- Assessment Tasks .............................................................................................................. 9  
- Participation ....................................................................................................................... 9

- Learning resources ......................................................................................................... 10  
- Reading list ....................................................................................................................... 10  
- Feedback to you .............................................................................................................. 11  
- Extensions and penalties ................................................................................................. 11  
- Returning assignments .................................................................................................... 11  
- Resubmission of assignments ......................................................................................... 11  
- Referencing requirements ............................................................................................... 11  
- Assignment submission ................................................................................................... 11  
- Online submission .......................................................................................................... 11  
- Required Resources ......................................................................................................... 12

## Other Information

- Policies ............................................................................................................................ 13  
  - Graduate Attributes Policy ......................................................................................... 13  
- Student services .............................................................................................................. 13  
- Monash University Library ............................................................................................... 13  
- Disability Liaison Unit .................................................................................................... 14  
- Your feedback to Us ....................................................................................................... 14  
- Previous Student Evaluations of this Unit .................................................................... 14  
- Other ............................................................................................................................. 14
Modern computer systems contain parallelism in both hardware and software. This unit covers parallelism in both general purpose and application specific computer architectures and the programming paradigms that allow parallelism to be exploited in software. This unit examines both shared memory and message passing paradigms in both hardware and software; concurrency, multithreading and synchronicity; parallel, clustered and distributed supercomputing models and languages. Students will program in these paradigms.

Mode of Delivery

Caulfield (Evening)

Contact Hours

2 hrs lectures/wk, 2 hrs laboratories/wk

Workload requirements

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

- two-hour lecture in H block (H238, Caulfield) Wednesdays 6-8PM.
- two-hour lab/tutorial in B block (B3.44, Caulfield) to study the background material and to work on assignments and tutorial exercises and discuss lecture material.
- up to 2 hours per week of preparation including reviewing the lecture materials
- up to 3 hours per week surveying existing literature in the library, online resources etc; hands-on lab exercises
- a minimum of 3 hours per week personal study in order to satisfy the reading and assignment expectations

In addition a consultation session with the lecturer is scheduled for Wednesdays 5-6PM in (H7.84, Caulfield)

Scheduling of lectures, lab/tutorial sessions and consultation times are subject to change.

While it is strongly recommended you attend lectures and lab/tutorials, lecture and other supplementary teaching material will be made available on-line and Dr. Pose can be contacted by phone and e-mail for assistance. The assignments and tutorial lab exercises can all be done at home if you have suitable facilities, but by attending lab/tutorials on campus you may get assistance from Dr. Pose and learn through discussion with fellow students. Lectures will be recorded but sometimes the recording technology doesn't work properly and not everything presented in lectures (such as things on overhead projectors or whiteboards) will appear on recordings.

Unit Relationships

Prohibitions

CSE4333
Prerequisites

Recommended knowledge: operating systems, including synchronisation and interprocess communication mechanisms; advanced computer architecture, including pipelining techniques.

Chief Examiner

Dr Asad Khan

Campus Lecturer

Caulfield

Dr. Ronald Pose [Ronald.Pose@monash.edu] (home phone: 9527 1331):

Consultation hours: Wednesdays 5-6PM, Room 784, H Block, Caulfield. (or by arrangement via e-mail/telephone)

Tutors

Caulfield

Dr Ronald Pose [Ronald.Pose@monash.edu] (home phone: 9527 1331)

Consultation hours: Wednesdays 5-6PM, Room 784, H Block, Caulfield. (or by arrangement via e-mail/phone)
Academic Overview

Learning Outcomes

At the completion of this unit students will have:

- knowledge of a variety of parallel architectures, such as bus-based, massively parallel, cluster, vector;
- knowledge of a variety of parallel programming paradigms, synchronisation and parallelisation primitives, message passing, data parallel, tuple space;
- understanding of concurrency, synchronicity and parallelism;
- understanding of the design issues of parallel systems;
- skills in designing, developing and debugging parallel programs using a variety of paradigms.
# Unit Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Activities</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Unit Introduction on web (no lecture). Register for lab sessions. Prepare a summary of your educational background and knowledge and experience of parallel/distributed computing. Also provide some idea of why you enrolled in FIT5174, what you expect to learn, and how it fits in with the other units in your masters degree. Note that the schedule of topics and activities may change depending on the educational backgrounds and experience of enrolled students.</td>
<td>No formal assessment or activities are undertaken in week 0</td>
</tr>
<tr>
<td>1</td>
<td>In the lecture there will be an introduction to Parallel and Distributed systems. The logistics of how we are organizing lecture and lab/tutorial sessions will be explained and an outline of the topics to be covered over the semester will be given. There will also be an explanation of the unit assessment methodology and</td>
<td>Assessable lab/tutorial work is spread over exercises that have been allocated 2 weeks. In this first week we will be mostly getting to know one another and learning how to use the software environment of virtual machines running Linux which will be used for the programming exercises to come.</td>
</tr>
</tbody>
</table>
suggestions of how to approach this unit. In the lab/tutorial sessions in this first week, Dr. Pose will meet with each student individually and go over their background and expectations that should have been prepared (see week 0). We will also learn how to set up the virtual machines most students will be using for their lab programming work, either in the Monash labs or at home.

2 In order to create a distributed system one needs to have physical communication links or networking between the various computers as well as suitable software interprocess communication mechanisms. In the lecture we will look at Interprocess Communication (IPC) and Remote Procedure Calls (RPC) as suitable building blocks.

In weeks 2 and 3 the first assessable laboratory/tutorial work will take place. This will take the form of simple programming exercises allowing students to learn the C programming language if they don't already know it, and in particular to learn how to use programming libraries providing parallel programming primitives.

3 The lecture will examine the message-passing paradigm and the Message Passage Library (MPI)

The first assessable laboratory/tutorial work is due.

4 The lecture will examine

In weeks 4 and 5 the second assessable laboratory/tutorial work will take place. This will take the form of a parallel, multi-process system constructed using MPI.
<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Topics</th>
<th>Assessment Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Synchronisation, MUTEX and other locking mechanisms, deadlocks and other synchronisation problems.</td>
<td>The second assessable laboratory/tutorial work is due.</td>
</tr>
<tr>
<td>6</td>
<td>The lecture will look at various distributed computing application areas and algorithms, and how they map onto various kinds of distributed systems.</td>
<td>Assignment 1 due Wednesday 4 September 2013, 6PM. The assignment specification will be posted on the unit web site. The assignment will take the form of a written research report on an aspect of distributed computing.</td>
</tr>
<tr>
<td>7</td>
<td>In this lecture we will study parallel computer architectures beginning with instruction level parallelism and super-scalar processing.</td>
<td>The third assessable laboratory/tutorial work is due.</td>
</tr>
<tr>
<td>8</td>
<td>The lecture will examine different categories of parallel computer architectures including Flynn's classification of SIMD, MIMD. We will look at Vector and Array architectures.</td>
<td>In weeks 8 and 9 the fourth assessable laboratory/tutorial work will take place. This will be an exploration of the interaction between programmed algorithms and the underlying parallel or distributed computer architecture.</td>
</tr>
<tr>
<td>9</td>
<td>This lecture will examine data-parallel architectures,</td>
<td>The fourth assessable laboratory/tutorial work is due.</td>
</tr>
</tbody>
</table>
In the next two lectures we will bring together distributed and parallel computer architectures into complete systems and examine how everything fits together. This week we will concentrate on a massively-parallel distributed general-purpose computer system that Dr. Pose and colleagues designed and built.

In weeks 10 and 11 the fifth assessable laboratory/tutorial work will take place. This will be an exploration of the overheads in running parallel and distributed systems.

The fifth assessable laboratory/tutorial work is due.

Class Test in lecture Week 12, 23 October 2013, 6PM. Final laboratory/tutorial sessions will be used to catch up with any unfinished work and with any difficulties with Assignment 2.

No formal assessment is undertaken in SWOT VAC.

Assignment 2 due Monday 4 November 2013, 12Noon. The assignment specification and topics will be posted on the unit web site. The assignment will take the form of a written research report on an aspect of parallel computing architectures.


*Unit Schedule details will be maintained and communicated to you via your learning system.
Unit Schedule

Assessment Summary

In-semester assessment: 100%

<table>
<thead>
<tr>
<th>Assessment Task</th>
<th>Value</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment 1 - Distributed Systems</td>
<td>25%</td>
<td>Wednesday 4 September 2013, 6PM</td>
</tr>
<tr>
<td>Assignment 2 - Parallel Architectures</td>
<td>25%</td>
<td>Monday 4 November 2013, 12 Noon</td>
</tr>
<tr>
<td>Class Test</td>
<td>25%</td>
<td>Week 12 lecture (Wednesday 23 October 2013, 6PM)</td>
</tr>
<tr>
<td>The assessed laboratory/tutorial work.</td>
<td>25%</td>
<td>The 5 submissions of lab work are due in weeks 3, 5, 7, 9 and 11</td>
</tr>
</tbody>
</table>

Teaching Approach

Lecture and tutorials or problem classes

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

The lectures expound on the topics in the curriculum linking the lecturer's real-world experience with experimental and commercial systems with theoretical principles. There will be freedom to interact with the lecturer to focus on aspects of particular interest to the students or on aspects relating to assessment tasks.

The laboratory/tutorial sessions provide an environment in which students can explore aspects of the curriculum through practical exercises, learning through experience. Having the academic staff member present enables assistance and explanation of unexpected behaviour. The laboratory/tutorial sessions also provide a forum where students can compare experiences and help one another to reach an understanding of the material, and where the tutor can elaborate on material covered in lectures.
Assessment Requirements

Assessment Policy

Faculty Policy - Unit Assessment Hurdles

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 - Distributed Systems

  Description:  
  A theoretical assignment in the form of a research paper. The students will demonstrate their understanding of multi-process algorithms by researching and writing about their distributed systems topics.

  The detailed assignment specification and topics will be provided on the unit web site.

  Weighting:  
  25%

  Criteria for assessment:  
  Individual assessment. Marks will be allocated, roughly equally, against the areas listed in the assignment specification. Further marks will be allocated for the quality of the writing, how clearly and thoroughly the ideas are explained, and the number, quality and appropriateness of the references.

  Due date:  
  Wednesday 4 September 2013, 6PM

• Assessment task 2

  Title:  
  Assignment 2 - Parallel Architectures

  Description:  
  A research paper on modern parallel computer architectures focusing on hardware parallelism.

  The detailed assignment specification and topics will be provided on the unit web site.

  Weighting:  
  25%

  Criteria for assessment:  
  Individual assessment. Marks will be allocated, roughly equally, against the areas listed in the assignment specification. Further marks will be allocated for the quality of the writing, how clearly and thoroughly the ideas are explained, and the number, quality and appropriateness of the references.

  Due date:  
  Monday 4 November 2013, 12 Noon
Assessment Requirements

• Assessment task 3

Title:
Class Test

Description:
Students will be given a class test during the Week 12 lecture.

The test will cover a selection of topics from the unit's curriculum to verify that the unit learning objectives have been achieved.

Weighting:
25%

Criteria for assessment:
Individual assessment. Correct answers to questions.

Due date:
Week 12 lecture (Wednesday 23 October 2013, 6PM)

Remarks:
The test will be closed book. No calculators or computers will be required.

• Assessment task 4

Title:
The assessed laboratory/tutorial work.

Description:
There are 5 assessed laboratory/tutorial work submissions.

Weighting:
25%

Criteria for assessment:
The laboratory work is individually assessed based both on correctness and on the quality of the solutions and on the quality of documentation.

Due date:
The 5 submissions of lab work are due in weeks 3, 5, 7, 9 and 11

Learning resources

Reading list

The following are some books that may be of interest. There is no single text book covering the content of FIT5174 at a suitable level. Sufficient material will be provided on the unit web site to cater for FIT5174 students. If students have interests in specific areas of parallel or distributed computing they should contact the lecturer for advice on suitable references.


I.T. Foster: Designing and Building Parallel Programs, Addison-Wesley, 1995.


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
- Test results and feedback

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.monash.edu.au/exams/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.

Resubmission of assignments

Resubmission of assignments after the due date will not be allowed, however assignments handed-in early for feedback may be resubmitted by the due date.

Referencing requirements

Formatting and referencing information will provided on the unit website.

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). Please note that it is your responsibility to retain copies of your assessments.

Online submission

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

VMPlayer (Freeware) or VMWare Workstation (VMWare Fusion for Mac users) software. This is available in University computer labs, but access to a personal computer with this software installed is highly recommended.
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:


Key educational policies include:

- Academic integrity;  
  http://www.policy.monash.edu/policy-bank/academic/education/conduct/student-academic-integrity-policy.html
- Assessment in Coursework Programs;  
- Special Consideration;  
  http://www.policy.monash.edu/policy-bank/academic/education/assessment/special-consideration-policy.html
- 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/dates/
- Orientation and Transition;  
  http://intranet.monash.edu.au/infotech/resources/students/orientation/
- Academic and Administrative Complaints and Grievances Policy;  
  http://www.policy.monash.edu/policy-bank/academic/education/management/complaints-grievance-policy.html
- Code of Practice for Teaching and Learning;  
- Graduate Attributes Policy  
  http://www.policy.monash.edu/policy-bank/academic/education/management/monash-graduate-attributes-policy.html

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 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/.

Monash University Library

The Monash University Library provides a range of services, resources and programs that enable you to save time and be more effective in your learning and research. Go to 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/.
Disability Liaison Unit

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://www.monash.edu/equity-diversity/disability/index.html
Telephone: 03 9905 5704 to book an appointment with a DLO; or contact the Student Advisor, Student Community Services at 03 55146018 at Sunway
Email: dlu@monash.edu
Drop In: Equity and Diversity Centre, Level 1, Building 55, Clayton Campus, or Student Community Services Department, Level 2, Building 2, Monash University, Sunway Campus

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 the Student Evaluation of Teaching and Units (SETU) survey. 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, see:
www.monash.edu.au/about/monash-directions and on student evaluations, see:
www.policy.monash.edu/policy-bank/academic/education/quality/student-evaluation-policy.html

Previous Student Evaluations of this Unit

Based on previous feedback the number of assignments has been reduced from three to two, and supervised and assessed lab/tutorial sessions have been included to allow more personal guidance of students and more focused practical experience of parallel/distributed programming.

Online MonQuest Evaluations and Online Unit Evaluations will continue to be requested, and encouraged, to be done by as many students as possible as usual in Semester 2, 2013.

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

Other

Reading material including research papers, programming manuals and system specifications, will be distributed electronically as part of the background reading material for FIT5174.

A web site for this unit should be consulted regularly. It will contain lecture material as well as other material such as software and links to relevant web sites.
http://www.csse.monash.edu.au/~rdp/FIT5174

Moodle will also be used as appropriate.

Feel free to e-mail the lecturer, Dr. Ronald Pose, with any queries. Please include "FIT5174" in the subject line to ensure prompt responses. Dr. Pose’s e-mail address is:
Other Information

Ronald.Pose@monash.edu