MONASH University
Information Technology

FIT3143
Parallel computing

Unit Guide

Semester 1, 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: 04 Mar 2013

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FIT3143 Parallel computing - Semester 1, 2013

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. The unit examines both shared memory and message passing paradigms in both hardware and software; concurrency, multithreading and synchronicity; parallel, clustered and distributed supercomputing models, languages and software tools and development environments. Students will program in these paradigms.

Mode of Delivery

Clayton (Day)

Contact Hours

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

Workload requirements

This unit is offered to on-campus students. Workload commitments per week are:

- 2 hour lecture
- 2 hour lab
- 1 hour tutorial
- minimum of 7 hours of personal study in order to satisfy the reading and assignment expectations.

Unit Relationships

Prohibitions

FIT4001, CSE4333

Prerequisites

FIT2004

Chief Examiner

Dr Asad Khan

Campus Lecturer

Clayton

Asad Khan

Consultation hours: By appointment

Tutors

Clayton

Mark Gleeson

Consultation hours: By appointment

Mehran Vahid

Consultation hours: By appointment

Academic Overview

Learning Outcomes

At the completion of this unit students will have -A knowledge and understanding of:

- a variety of parallel architectures, such as bus-based, massively parallel, cluster, vector, GPU;
- a variety of parallel programming paradigms, synchronisation and parallelisation primitives, message passing, data parallel, tuple space;

concurrency, synchronicity and parallelism;

- software development environments and tools (including performance tools);
- the design issues of parallel systems.

An appreciation of:

- the needs of parallel applications.

Developed skills in:

- designing, developing and debugging parallel programs using a variety of paradigms;
- measuring the performance of parallel applications and tuning implementation.

Unit Schedule

Week	Activities	Assessment
0	Unit Introduction on Moodle	No formal assessment or activities are undertaken in week 0
1	Unit Introduction; Distributed Systems Lecture (no lab or tute)	
2	Inter Process Communications; Remote Procedure Calls	Weekly lab work assessments begin in week 2
3	Message Passing Library	
4	Synchronisation, MUTEX, Deadlocks	
5	Election Algorithms, Distributed Transactions, Concurrency Control	Assignment 1 due Mon 8-April-2013, 12PM (mid-day)
6	Faults, Distributed Consensus, Security, Parallel Computing	
7	Parallel Computing Alternatives	
8	Instruction Level Parallelism	
9	Vector Architecture	
10	Data Parallel Architectures, SIMD Architectures	
11	Introduction to MIMD, Distributed Memory MIMD Architectures	Assignment 2 (Theory) due on 20-May-2013, 12PM (mid-day). Assignment 2 In-lab assessments
12	Super Scalar Processing, Exam Revision	Assignment 2 In-lab assessments.
	SWOT VAC	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 learning system.

Assessment Summary

Examination (3 hours): 50%; In-semester assessment: 50%

Assessment Task	Value	Due Date
Assignment 1	15%	Mon 08-April-2013, 12PM
Assignment 2	25%	In-lab assessments week 11 and 12, Theory due Mon 20-May-2013, 12PM
Lab work assessments	10%	Weekly submissions
Examination 1	50%	To be advised

Teaching Approach

Lecture and tutorials or problem classes

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

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:
  > Individual assignment. A research paper, of 3000 words, on topics selected from the
  > weekly lectures.

  Weighting:
  > 15%

  Criteria for assessment:
  > The work will be assessed on the basis of the quality of the write-up (e.g. easy to read,
  > logical and systematic presentation of concepts, formatting, figures, tables), relevance and
  > accuracy of information, and literature search.

  Due date:
  > Mon 08-April-2013, 12PM

- **Assessment task 2**

  Title:
  > Assignment 2

  Description:
  > Individual assignment. The work will comprise two parallel distributed programming tasks
  > and a 1500-word write-up. The programming tasks will be assessed in the lab class, with
  > each student demonstrating the written programs to the tutor in week 11 and week 12.
  > The write-up will be submitted in week 11.

  Weighting:
  > 25%

  Criteria for assessment:
  > Detailed marking guide will be provided with the assessment. As a general guide to
  > assessing the programming tasks:
  >
  > 1. All programs must compile and run correctly.
  > 2. Programs must meet the problem specification.
  > 3. Source code should be readable and maintainable.
  > 4. The underlying algorithms are clearly explained.
  > 5. Programs should be documented.

  Due date:
  > In-lab assessments week 11 and 12, Theory due Mon 20-May-2013, 12PM

- **Assessment task 3**

  Title:
  Lab work assessments
  Description:
  Students will complete the weekly lab and tutorial exercises in groups of 4-5 and submit their group work on weekly basis.
  Weighting:
  10%
  Criteria for assessment:
  The assessment will be based on the demonstration of work during the lab and evidence of learning in the weekly submissions.

  The tutor will monitor individual contributions to the group when allocating marks to members of the group.
  Due date:
  Weekly submissions

Examinations

- **Examination 1**

  Weighting:
  50%
  Length:
  3 hours
  Type (open/closed book):
  Closed book
  Electronic devices allowed in the exam:
  None

Learning resources

Monash Library Unit Reading List
http://readinglists.lib.monash.edu/index.html

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
- Other: Solutions to tutes and labs

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.

Resubmission of assignments

Resubmission of assignments, lab, and tutorial work will not be allowed.

Referencing requirements

Refer to 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).

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.

The standard operating environment provided in FIT computer labs is considered adequate for most purposes. However, most of the tutorial exercises require the use of an open source Linux environment, which is provided in the assigned FIT computer laboratory.

Software may be:

- downloaded from the resources page on the unit web site
- or purchased at academic price at good software retailers

Recommended Resources

Portable personal computer and access to a broadband Internet connection.

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: www.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 in Coursework Programs; http://www.policy.monash.edu/policy-bank/academic/education/assessment/assessment-in-coursework-po
- Special Consideration; http://www.policy.monash.edu/policy-bank/academic/education/assessment/special-consideration-policy.ht
- 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.h
- Code of Practice for Teaching and Learning; http://www.policy.monash.edu.au/policy-bank/academic/education/conduct/suppdocs/code-of-practice-tea

Graduate Attributes Policy

http://www.policy.monash.edu/policy-bank/academic/education/management/monash-graduate-attributes-policy.ht

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/.

Other Information

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.htmlTelephone: 03 9905 5704 to book an appointment with a DLO; or contact the Student Advisor, Student Commuity Services at 03 55146018 at SunwayEmail: dlu@monash.eduDrop 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

Previous student feedback shows that most students, typically 50 percent or more, rated this unit very highly. There are no significant changes planned based on feedback results.

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

Other

NB: Students who attend fewer than 80% of the lectures will need to rely on the reading list.

For Part 1: Parallel Computing Schemes and Software:

A.S. Tanenbaum, T. Austin: Structured Computer Organization, 6th Ed, Prentice Hall (PEARSON), 2012.

G.R. Andrews: Foundations of Multithreaded, Parallel and Distributed Programming, Addison-Wesley, 2000.

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

M. Maekawa, A.E. Oldehoeft, R.R. Oldehoeft: Operating Systems Advanced Concepts, Benjamin/Cummings, 1987.

For Part 2: Parallel Distributed Computing Architectures:

Other Information

Advanced Computer Architectures: A Design Space Approach, Sima, Fountain and Kacsuk , Addison Wesley Publishers.

W. Stallings: Computer Organization Architecture, 9th Ed, Prentice Hall (Pearson Hall), 2013.