FIT3143
Parallel computing

Unit Guide

Semester 1, 2011

Table of Contents

FIT3143 Parallel computing - Semester 1, 2011

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

This unit is offered to on campus students, workload commitments are:

- two-hour lecture and
- two-hour lab
- one-hour tutorial
- a minimum of 2-3 hours of personal study per one hour of supervised contact time in order to satisfy the reading and assignment expectations.
- You will need to allocate up to 5 hours per week in some weeks, for use of a computer, including time for newsgroups/discussion groups.

Unit Relationships

Prohibitions

FIT4001, CSE4333

Prerequisites

FIT2004

Chief Examiner

Asad Khan

Campus Lecturer

Clayton

Asad Khan

Contact hours: Thursday 11am-2pm, by appointment

Learning Objectives

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.

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

Examination: 50%; In-semester assessment: 50%

Assessment Task	Value	Due Date
Assignment 1	15%	Monday 28 March 2011, 12PM
Assignment 2	25%	Monday 23 May 2011, 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.

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
- Other: Solutions to tutes and labs

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

Required Resources

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
- purchased at academic price at good software retailers

Recommended Resources

Portable personal computer and access to a broadband Internet connection.

Unit Schedule

Week	Date*	Activities	Assessment
0	21/02/11	Unit introduction on the website (No Lecture)	No formal assessment or activities are undertaken in week 0
1	28/02/11	Distributed Systems Lecture (no lab or tute)	
2	07/03/11	IPC & RPC	
3	14/03/11	Message Passing Library	
4	21/03/11	Synchronization, MUTEX, Deadlocks	
5	28/03/11	Election Algorithms, Distributed Transactions, Concurrency Control	Assignment 1 due Monday March 28, 12PM
6	04/04/11	Faults, Distributed Consensus, Security, Parallel Computing	
7	11/04/11	Parallel Computing Alternatives	
8	18/04/11	Instruction Level Parallelism	
		Mid semester break	
9	02/05/11	Vector Architecture	
10	09/05/11	Data Parallel Architectures, SIMD Architectures	
11	16/05/11	Introduction to MIMD, Distributed Memory MIMD Architectures	Assignment 2 in-lab assessments
12	23/05/11	Super Scaler Processing, Exam Preps	Assignment 2 in-lab assessments. Assignment 2 (theory) due Monday 23 May, 12PM
	30/05/11	SWOT VAC	No formal assessment is undertaken in SWOT VAC

*Please note that these dates may only apply to Australian campuses of Monash University. Off-shore students need to check the dates with their unit leader.

Assessment Policy

To pass a unit which includes an examination as part of the assessment a student must obtain:

- 40% or more in the unit's examination, and
- 40% or more in the unit's total non-examination assessment, and
- an overall unit mark of 50% or more.

If a student does not achieve 40% or more in the unit examination or the unit non-examination total assessment, and the total mark for the unit is greater than 50% then a mark of no greater than 49-N will be recorded for the unit

Assessment Tasks

Participation

- **Assessment task 1**

  Title:
    Assignment 1
  Description:
    A 2000-word research paper on topics selected from the weekly lectures.
  Weighting:
    15%
  Criteria for assessment:
    Individual 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:
    Monday 28 March 2011, 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 at the end of week 12.
  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:
Monday 23 May 2011, 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.
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

Assignment submission

Assignment coversheets are available via "Student Forms" on the Faculty website:
http://www.infotech.monash.edu.au/resources/student/forms/
You MUST submit a completed coversheet with all assignments, ensuring that the plagiarism declaration section is signed.

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.

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-po
- 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.

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.

Reference Material

For Part 1: Parallel Computing Schemes and Software:

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

J. Magee and J. Kramer: Concurrency: State models & Java Programming; John-Wiley & Sons, 2006.

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:

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