MONASH University

FIT4001
Parallel and distributed systems

Unit Guide

Semester 2, 2009

Last updated : 16 Jul 2009

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FIT4001 Parallel and distributed systems - Semester 2, 2009

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Dr Sita Ramakrishnan and Mr Quazi Mamun - Distributed Systems component

Introduction

Welcome to FIT4001 Parallel systems. This 6 point unit comprises two modules - *Parallel architectures* and *Distributed Systems*. Each of these two modules caters for half of the lectures, work and assessment of FIT4001.

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.

Unit synopsis

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 and languages. Students will program in these paradigms.

Learning outcomes

At the completion of this unit, students will have knowledge and understaning of:

1. a variety of parallel architectures, such as bus-based, massively parallel, cluster, vector;
2. a variety of parallel programming paradigms, synchronization and parallelization primitives, message passing, data parallel, tuple space.;
3. concurrency, synchronicity and parallelism;
4. the design issues of parallel systems.

On completion of this unit students will have skills in:

1. designing, developing and debugging parallel programs using a variety of paradigms.

Contact hours

Lectures 2hrs/week

Workload

Workload commitments for FIT4001 are:

- two-hour lecture
- one-hour unsupervised tute in the MUSE lab (G.13/Bldg 26, Clayton) to work on assignments, any hurdles etc, and contact lecturer on campus if required
- upto 3 hours / week of preparation/personal study including lecture material
- upto 3 hours / week surveying existing literature in the library, on-line resources etc; hands-on lab exercises
- a minimum of 4 hours / week per 2 hour contact time in order to satisfy the reading and assignment expectations

Unit relationships

Prerequisites

FIT2022, or CSE2302 and CSE2/3324; in addition students must have completed 24 points of level 3 units

Prohibitions

CSE4333

Relationships

FIT4001 is a core unit in the Bachelor of Software Engineering Degree and is an elective unit for BCS and Postgraduate courses in the Faculty of IT.

Teaching and learning method

FIT4001 provides students with a comprehensive set of study guides and references to facilitate your learning. The lectures will build on these teaching resources rather than reproduce them, and are an opportunity for you to raise questions.

Lectures: You are advised to read through the study guide prior to the lecture, as two hours is far too short to cover all the important concepts. Emphasis in lectures will be given to providing examples of the concepts and discussing some of the questions that these ideas may provoke.

Students are strongly encouraged to attend the lectures and participate in the discussions.

Some of the assignment work in the Distributed systems component will be team based and peer assessed for some aspects.

Timetable information

For information on timetabling for on-campus classes please refer to MUTTS, http://mutts.monash.edu.au/MUTTS/

Tutorial allocation

On-campus students should register for tutorials/laboratories using the Allocate+ system:
http://allocate.cc.monash.edu.au/

Unit Schedule

Week	Topic	Study guide	References/Readings	Key dates
1	Distributed systems - Introduction to Concurrency & parallelism, Java's model of concurrency with built-in model of monitor, Shared memory synchronisation - week 1	Materials on FIT4001/CSE4333 Blackboard site	Refer to Blackboard site for references to Chapters in the Topic column for Parallel architectures	
2	Distributed systems - Shared memory synchronisation (contd), Monitors and deadlocks - week 2	Materials on FIT4001/CSE4333 Blackboard site		
3	Distributed systems - concurrent program analysis - Deadlock, Safety & Liveness properties - week 3	Materials on FIT4001/CSE4333 Blackboard site		
4	Distributed systems - Message passing concepts - week 4	Materials on FIT4001/CSE4333 Blackboard site		
5	Distributed systems - Principles and Issues in	Materials on FIT4001/CSE4333		Distributed systems assignment 1 due

	Message passing programming, Synchronous & asynchronous semantics -Case study - MPI, Java, Linda - week 5	Blackboard site		Monday Aug 17th 5pm.
6	Distributed systems - Parallel programming libraries - week 6	Materials on FIT4001/CSE4333 Blackboard site		
7	Parallel Architectures Lectures - Review of instruction level pipelining - Chapters 4 & 7 - week 7	Materials on FIT4001/FIT4001 Blackboard site	Refer to Blackboard site for references to Chapters in the Topic column for Parallel architectures	
8	Parallel Architectures Lectures -Review of instruction level pipelining - Chapter 7 - week 8	Materials on FIT4001/FIT4001 Blackboard site		
9	Introduction to Parallel Architectures - Chapter 10 SIMD Architectures - Chapter 11 Vector Architectures - Chapter 14 VLIW Architectures - Chapter 6 Introduction to MIMD - week 9	Materials on FIT4001/FIT4001 Blackboard site		Distributed systems assignment 2 due Monday September 14th 5pm.
10	Distributed Memory MIMD Architectures - Chapter 17 - week 10	Materials on FIT4001/FIT4001 Blackboard site		Parallel architectures assignment 3 due Friday 25th September, 12PM
Mid semester break				
11	Shared Memory MIMD Architectures - Chapter 18 - week 11	Materials on FIT4001/FIT4001 Blackboard site		
12	Parallel architectures - week 12	Materials on FIT4001/FIT4001 Blackboard site		Parallel architectures Quiz, Mon 12/Oct, 12PM
13	Week 13 - Review session			Parallel architectures assignment 4 due Friday 23rd October, 12PM

Unit Resources

Prescribed text(s) and readings

Reading material including research papers, programming manuals and system specifications, will be distributed electronically or in hardcopy.

Reference Material:

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.

Text books are available from the <u>Monash University Book Shops</u>. 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

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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.

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

Equipment and consumables required or provided

Students 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 **8** 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:

- Weekly detailed lecture notes outlining the learning objectives, discussion of the content, required readings and exercises;

- Weekly exercises - refer to relevant chapters in Andrews & Magee's Text for Distributed Systems' component ;
- Assignment specifications;
- Discussion groups;
- This Unit Guide outlining the administrative information for the unit;
- The unit web site on MUSO, where resources outlined above will be made available.

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Assessment

Overview

Assignments 100%

Faculty 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 44% then a mark of no greater than 44-N will be recorded for the unit.

The unit is made up of 2 components, distributed and parallel computing, and parallel architectures.

Each component is assessed with two assignments. In addition, the parallel architectures lectures will include a quiz in week 12.

To pass the unit you must:

- attempt both assignments in each of the 2 components (Parallel architectures & Distributed Systems)
- achieve no less that 40% of the possible marks in each component
- achieve no less than 50% of possible marks.

Marks breakdown:

Distributed systems (Quazi Mamun) - assignment 1 - 25% + assignment 2 - 25%

 Parallel architectures (Asad Khan) - assignment 3 - 20% + assignment 4 - 20% + assignment 5 Week 12 Quiz 10%

Assignment tasks

Assignment coversheets

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.

Assignment submission and return procedures, and assessment criteria will be specified with each assignment.

- ### Assignment task 1

    Title:
        Distributed Systems - Assignment 1
    Description:

Assignment spec on Blackboard site for the unit.

Weighting:

25%

Due date:

Distributed systems assignment 1 due Week 5 - Monday Aug 17th 5pm

• Assignment task 2

Title:

Distributed Systems - Programming Assignment 2

Description:

Write parallel programs using message passing. Assignment spec on Blackboard site for the unit.

Weighting:

25%

Due date:

Distributed systems assignment 2 due - Monday September 14th 5pm

• Assignment task 3

Title:

Parallel architectures - Assignment 3

Description:

In this assignment you are asked to write a research paper on how high performance machines are applied to a range of different application areas. You should read sufficient material to give you some understanding of the outcomes for the area, and the underlying computational methods (for example, the numerical methods involved, or the computer science algorithms employed) and how it is solved using a high performance computer.

Weighting:

20%

Due date:

Week 10 - 25/Sep, 12PM

• Assignment task 4

Title:

Parallel architectures - Assignment 4

Description:

In this assignment you are to write a research paper on various multi-core architectures and discuss the design choices and alternatives available in the current commercial products.

Weighting:

20%

Due date:

Week 13 - 23/Oct, 12PM

• Assignment task 5

Title:

Week 12 Quiz

Description:

Students will be given a 30 minutes quiz on materials presented in the lectures from week 7 to week 11 during week 12's lecture.

Weighting:

10%

Due date:

Week 12 lecture slot

Due dates and extensions

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 not regarded as appropriate reasons for granting extensions. Students are advised to NOT assume that granting of an extension is a matter of course.

Students requesting an extension for any assessment during semester (eg. Assignments, tests or presentations) are required to submit a Special Consideration application form (in-semester exam/assessment task), along with original copies of supporting documentation, directly to their lecturer within two working days before the assessment submission deadline. Lecturers will provide specific outcomes directly to students via email within 2 working days. The lecturer reserves the right to refuse late applications.

A copy of the email or other written communication of an extension must be attached to the assignment submission.

Refer to the Faculty Special consideration webpage or further details and to access application forms:
http://www.infotech.monash.edu.au/resources/student/equity/special-consideration.html

Late assignment

Assignments received after the due date will be subject to a penalty **for late submission as described in the MUSO site for cse4333 assignments.**

Return dates

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

Appendix

Please visit the following URL: http://www.infotech.monash.edu.au/units/appendix.html for further information about:

- Continuous improvement
- Unit evaluations
- Communication, participation and feedback
- Library access
- Monash University Studies Online (MUSO)
- Plagiarism, cheating and collusion
- Register of counselling about plagiarism
- Non-discriminatory language
- Students with disability
- End of semester special consideration / deferred exams