MONASH University
Information Technology

FIT4001
Parallel and distributed systems

Unit Guide

Semester 2, 2010

Last updated: 12 Jul 2010

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FIT4001 Parallel and distributed systems - Semester 2, 2010

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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 -
A knowledge and understanding of:

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

Developed the skills in:

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

Contact hours

2 hrs lectures/wk

Workload

Workload commitments for FIT4001 are:

- two-hour lecture
- one-hour unsupervised tute in the MUSE lab (G.16/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 CSE2324/CSE3324; in addition students must have completed 24 points of level 3 units

Prohibitions

CSE4333

Teaching and learning method

Teaching approach

The approach to teaching and learning include a weekly two-hour lecture and a one-hour (tutorial/laboratory). Additionally, each student should spend a minimum of 8 to 12 hours for personal study every week and should allocate up to 5 hours per week in some weeks for use of a computer, including time for newsgroup and discussion.

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.its.monash.edu.au/

Unit Schedule

Week	Date*	Topic	Study guide	Key dates
1	19/07/10	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	
2	26/07/10	Distributed systems - Shared memory synchronisation (contd), Monitors and deadlocks - week 2	Materials on FIT4001/CSE4333 Blackboard site	
3	02/08/10	Distributed systems - concurrent program analysis - Deadlock, Safety & Liveness properties - week 3	Materials on FIT4001/CSE4333 Blackboard site	
4	09/08/10	Distributed systems - Message passing concepts - week 4	Materials on FIT4001/CSE4333 Blackboard site	
5	16/08/10	Distributed systems - Principles and Issues in Message passing programming, Synchronous & asynchronous semantics -Case study - MPI, Java, Linda - week 5	Materials on FIT4001/CSE4333 Blackboard site	Distributed systems assignment 1 of 2 due Monday August 16th 12PM.
6	23/08/10	Distributed systems - Parallel programming libraries - week 6	Materials on FIT4001/CSE4333 Blackboard site	
7	30/08/10	Parallel Architectures Lectures - Review of instruction level pipelining - Chapters 4 & 7 - week 7	Materials on FIT4001/FIT4001 Blackboard site	
8	06/09/10	Parallel Architectures Lectures -Review of instruction level pipelining - Chapter 7 - week 8	Materials on FIT4001/FIT4001 Blackboard site	

9	13/09/10	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 of 2 due Monday September 13th 12PM.
10	20/09/10	Distributed Memory MIMD Architectures - Chapter 17 - week 10	Materials on FIT4001/FIT4001 Blackboard site	
Mid semester break				
11	04/10/10	Shared Memory MIMD Architectures - Chapter 18 - week 11	Materials on FIT4001/FIT4001 Blackboard site	
12	11/10/10	Parallel architectures - week 12	Materials on FIT4001/FIT4001 Blackboard site	Parallel architectures assignment due Friday 15th October, 12PM. Parallel architectures class test (during the lecture).
13	18/10/10	Week 13 - Review session		

*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.

Improvements to this unit

Based on the feedback, the number of assignments has been reduced from four (in the previous offering) to three in this semester.

Online MonQuest Evaluation and Online Unit Evaluations will continue to be requested (and encouraged) to be done by as many students as possible as usual in sem 2 2010.

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 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.

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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

Required software and/or hardware

VMPLAYER (free for MS Windows). On-campus students may use this software which is installed in the MUSE lab.

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 lecture notes;
- Assignment specifications;
- Sample Unit Test;
- This Unit Guide outlining the administrative information for the unit;
- The unit web site on MUSO, where resources outlined above will be made available.

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 50% then a mark of no greater than 49-N will be recorded for the unit.

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 submission and preparation requirements will be detailed in each assignment specification. 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.

- **Assignment task 1**

  Title:
  Distributed Systems - Assignment 1 of 2
  Description:
  A theoretical assignment in the form of a research paper.
  Weighting:
  25%
  Criteria for assessment:
  Demonstrate through your submission, the theoretical understanding of multi-process algorithms.
  Due date:
  Mon 16/Aug, 12PM (week05)

- **Assignment task 2**

  Title:
  Distributed Systems - Programming Assignment 2 of 2
  Description:
  Write parallel programs using message passing.
  Weighting:
  25%
  Criteria for assessment:
  Demonstrate through your submission, the practical skills in developing parallel distributed applications.
  Due date:
  Mon 13/Sep, 12PM (week9)

- **Assignment task 3**

  Title:
  Parallel architectures Assignment
  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:
  25%
  Criteria for assessment:
  Each case study should contain the following sections:

  1. A description of the problem.

  2. The science or engineering outcomes of the application.

  3. How the problem is solved on parallel machines.

  Marks will be allocated, roughly equally, against the application areas listed in the assignment specification. Further marks will be allocated for the length of the paper (against the word limit) and the number of references.

  Students should see the assignment specification for more detailed description of the requirements.
  Due date:
  Fri 15/Oct, 12PM (week12)

- **Assignment task 4**

  Title:
  Parallel architectures class test (during the lecture)
  Description:
  Students will be given a 60 minutes class test, based on the parallel architecture lecture notes, comprising several short questions.
  Weighting:
  25%
  Criteria for assessment:

Demonstration of knowledge (understanding) gained during the weekly lectures in parallel architectures.

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

Return dates

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

Feedback

Types of feedback you can expect to receive in this unit are:

Graded assignments with comments

Test results and feedback

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