

159.735 Paper Outline – 2009 Semester 1

MASSEY UNIVERSITY COLLEGE OF SCIENCES

Paper Number & Title: Studies in Parallel and Distributed Systems (with practical emphasis on cluster computing)

Points Value: 15

Semester: S1

Campus: Albany

Mode: Internal

Paper Coordinator

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Other Contributing Staff : None

Aim

To allow students to gain an understanding of the science concepts of parallel programming and to provide practical experience in cluster computing.

Pre-requisites: C/C++ programming ability and knowledge and familiarity with OS and network concepts.

Calendar Prescription: Selected advanced topics including: Parallel computing; network security; client-server computing; compression; web applications; wireless and mobile computing.

Objectives/learning outcomes

On completion of this course, students should be able to:

- Write MPI programs and implement them on a cluster computer
- Describe the different paradigms and architectures of parallel and distributed systems
- Describe the different parallelization techniques and strategies
- Describe the various load balancing and termination strategies
- Analyze a given application/problem and implement a parallelization strategy

Course outline

- Parallel system architectures: grand challenge problems, shared and distributed memory, interconnection networks, clusters, grids, Flynn's classifications, performance measures
- Message passing programming: principles, MPI and its uses
- Parallelization techniques and strategies: embarrassingly parallel, partitioning, pipelining, synchronous and asynchronous methods
- Load balancing: static and dynamic load balancing, termination detection algorithms
- Algorithms and applications: sorting, searching, numerical, image processing, genetic algorithms

Lectures

The course will be presented as a mix of formal lectures, tutorials, demonstrations and discussions.

- Thursday 10:00 – 12:00 IIMS LAB 1
- Friday 12:00 – 14:00 IIMS LAB 1

Assessment

Assignments 30%

Three assignments on parallel programming problems will be given. Students are to submit their working code solutions electronically.

Seminar 20%

Students will chose a subject or problem either relevant to their academic research or any area where they have a particular interest. Students then give a short presentation to the class together with a brief (no more than 8 pages) written report. A list of possible subjects will be given early in the course but students are welcome (and indeed encouraged) to propose their own topics.

Final exam 50%

A final exam will be given at the end of the semester to test students understanding of the subject matter presented in the lectures together with practical knowledge gained.

Requirements to Successfully Complete the Paper:

A satisfactory performance in the assignments and exam are required to pass this paper. Students **MUST** also participate in the seminar.

Course material

Course notes will be placed on the course web site (URL to be announced during lectures).

Textbook

- B. Wilkinson and M. Allen, *Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers*, Prentice Hall.

Web resources

- Course website: <http://cs-alb-pc3.massey.ac.nz>

Student Time Budget:

Assessment – related:	
• Assignment 1	10
• Assignment 2	10
• Assignment 3	10
• Seminar	15
• Final examination	3
Formal Scheduled Learning:	
• Lectures	30
• Tutorials (15 @ 1 hour)	15
Non-Scheduled Learning	
• Personal study and reading (5-6 hours per week)	71
• Preparation for final examination	22
TOTAL	186

Deadlines and Penalties:

Deadlines for assignments will be given when the assignments are distributed. You will be given 4 weeks to complete each assignment. Late submissions (up to 1 week) will be penalised by 10%.

Proposed Feedback and Support for Student Learning:

The turnaround time for assignments will be no more than three weeks from the due date. It is important to note that the specified timeframe applies only to those assignments submitted by the due date, and does not necessarily apply to those submitted late.

All staff contributing to this paper will be available within “office hours” specified by the individuals concerned. Students are encouraged to access staff by personal approach. The paper co-ordinator can also be contacted by email (M.J.Johnson@massey.ac.nz)

Additional Costs: None

Grievance Procedures:

A student who claims that he/she has sustained academic disadvantage as a result of the actions of a University staff member should use the University Grievance Procedures. Students, whenever practicable, should in the first instance approach the University staff member concerned. If the grievance is unresolved with the staff member concerned, the student should then contact the College of Sciences office on his/her campus for further information on the procedures, or read the procedures in the University Calendar.