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**FIT5139 Advanced distributed and parallel systems - Semester 1, 2015**

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FIT5139 Advanced distributed and parallel systems - Semester 1, 2015

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. This 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. This unit draws on units in distributed databases and grid computing. It will also cover the technology and application of cloud computing with particular reference to programming frameworks (e.g. MapReduce, Hadoop etc).

Mode of Delivery

Caulfield (Day)

Workload Requirements

Minimum total expected workload equals 12 hours per week comprising:

(a.) Contact hours for on-campus students:

- Two hours of lectures
- One 2-hour tutorial

(b.) Additional requirements (all students):

- A minimum of 8 hours independent study per week for completing tutorial and project work, private study and revision.

See also Unit timetable information

Unit Relationships

Prerequisites

FIT5046

Chief Examiner

Dr Asad Khan

Campus Lecturer
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
Academic Overview

Learning Outcomes

On successful completion of this unit students should be able to:

- solve basic problems in distributed computing, especially in relation to synchronisation, distributed transactions, concurrency control, distributed consensus;
- explain the differences between various distributed computing models and widely used distributed computing schemes;
- describe a variety of parallel programming paradigms, synchronisation and parallelisation primitives, message passing, data parallel, tuple space;
- identify computational tasks that benefit from parallelism;
- design and implement a parallel-distributed software system.
### Unit Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Activities</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Unit Introduction on web (no lecture). Register for lab sessions</td>
<td>No formal assessment or activities are undertaken in week 0</td>
</tr>
<tr>
<td>1</td>
<td>Introduction to parallel patterns, distributed systems, and important metrics</td>
<td>No lab</td>
</tr>
<tr>
<td>2</td>
<td>Big data and cloud computing</td>
<td>Weekly lab-group submissions from Week 3 to Week 10 (both Weeks inclusive). Lab0: Programming and OS Primer (not graded)</td>
</tr>
<tr>
<td>3</td>
<td>Map-reduce applications</td>
<td>Lab1: Hadoop system</td>
</tr>
<tr>
<td>4</td>
<td>GPU processing model and programming with OpenCL</td>
<td>Lab2: Hadoop application</td>
</tr>
<tr>
<td>5</td>
<td>Parallel processing models and languages</td>
<td>Lab3: GPU Programming</td>
</tr>
<tr>
<td>6</td>
<td>Message Passage Library (MPI)</td>
<td>Lab4: Open MP Exercise</td>
</tr>
<tr>
<td>7</td>
<td>Interprocess communication and remote procedure call</td>
<td>Lab5: MPI Data Structures 1</td>
</tr>
<tr>
<td>8</td>
<td>Synchronisation, MUTEX, Deadlocks</td>
<td>Lab6: MPI Data Structures 2</td>
</tr>
<tr>
<td>9</td>
<td>Election Algorithms, Distributed Transactions, Concurrency Control</td>
<td>Lab7: MPI Data Structures 3</td>
</tr>
<tr>
<td>10</td>
<td>Faults, Distributed Consensus, and Security</td>
<td>Lab8: MPI Master Slave</td>
</tr>
<tr>
<td>11</td>
<td>Instruction Level Parallelism</td>
<td>(1) Assignment project written submission in Moodle is due on Mon 18/May, 2PM. (2) Assignment project code demonstrations during Week 11 labs (attendance is essential)</td>
</tr>
<tr>
<td>12</td>
<td>Vector and superscaler architectures</td>
<td>Assignment project code demonstrations during Week 12 labs (attendance is essential)</td>
</tr>
<tr>
<td></td>
<td>SWOT VAC</td>
<td>No formal assessment is undertaken during SWOT VAC</td>
</tr>
</tbody>
</table>

*Unit Schedule details will be maintained and communicated to you via your learning system.

### Teaching Approach

**Lecture and tutorials or problem classes**

This teaching and learning approach helps students to initially encounter information at lectures, discuss and explore the information during lecture and lab classes, and practice in a hands-on lab environment.
### Assessment Summary

Examination (3 hours): 60%, In-semester assessment: 40%

<table>
<thead>
<tr>
<th>Assessment Task</th>
<th>Value</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment Project</td>
<td>25%</td>
<td>Code demonstrations during Week 11 or 12 labs. Assignment Project write-up due in Week 11, Mon 18/May, 2PM</td>
</tr>
<tr>
<td>The assessed laboratory/tutorial work</td>
<td>12%</td>
<td>Weekly group submissions Week 3 to Week 10 (both Weeks inclusive)</td>
</tr>
<tr>
<td>Lecture feedback</td>
<td>3%</td>
<td>During weekly lectures</td>
</tr>
<tr>
<td>Examination 1</td>
<td>60%</td>
<td>To be advised</td>
</tr>
</tbody>
</table>
Assessment Requirements

Assessment Policy

Faculty Policy - Unit Assessment Hurdles

Academic Integrity - Please see resources and tutorials at
http://www.monash.edu/library/skills/resources/tutorials/academic-integrity/

Assessment Tasks

Participation

• Assessment task 1

  Title: Assignment Project
  Description: The students will develop parallel program/s that correctly and efficiently meet with the specified task/s using the programming model/s of their choice. The program/s will be demonstrated in week11 and 12. They will explain the programming methodology and the code in the form of a write-up to be submitted in Moodle. The students will demonstrate their practical skills in developing and documenting parallel distributed applications through this assessment.
  Weighting: 25%
  Criteria for assessment: Individual assessment. This work will be assessed on a mix of programming tasks and theoretical write-up.
  Due date: Code demonstrations during Week 11 or 12 labs. Assignment Project write-up due in Week 11, Mon 18/May, 2PM

• Assessment task 2

  Title: The assessed laboratory/tutorial work
  Description: Assessed laboratory/tutorial work submissions. The code developed during the lab from week 3 to week 10 (both weeks inclusive) will be demonstrated and the results submitted at the end of each laboratory/tutorial session or as advised by the tutor.
  Weighting: 12%
  Criteria for assessment: The laboratory work is group-based and it is assessed on correctness and on the quality of the solutions and on the quality of presentation/documentation. Individual marks for each group member will be derived from (i) the peer assessments made by the group under the supervision of the tutor and (ii) the overall marks achieved by the group.
  The students will email their group’s working to their respective tutor at the end of each lab or as specified by the tutor.
Assessment Requirements

Due date:
Weekly group submissions Week 3 to Week 10 (both Weeks inclusive)

• Assessment task 3

Title:
Lecture feedback

Description:
Students will be expected to remain engaged during all the lectures. The engagement will be measured by occasional feedback exercises, where students will be asked to discuss selected concepts covered in the current or previous lectures.

Weighting:
3%

Criteria for assessment:
This is an individual assessment, which aims to gauge a student's level of engagement in this unit over the semester. Regular lecture attendance and participation in Q&A will be the two key indicators for measuring engagement and assigning credit.

Due date:
During weekly lectures

Examinations

• Examination 1

Weighting:
60%

Length:
3 hours

Type (open/closed book):
Electronic devices allowed in the exam:
None

Learning resources

Reading list


Monash Library Unit Reading List (if applicable to the unit)
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

Extensions and penalties

Submission must be made by the due date otherwise penalties will be enforced.


Returning assignments

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

Assignment submission

It is a University requirement ([http://www.policy.monash.edu/policy-bank/academic/education/conduct/student-academic-integrity-managing-plagiarism-collusion-procedures.html](http://www.policy.monash.edu/policy-bank/academic/education/conduct/student-academic-integrity-managing-plagiarism-collusion-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/](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 electronic submission). Please note that it is your responsibility to retain copies of your assessments.

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.
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

Faculty resources and policies

Important student resources including Faculty policies are located at http://intranet.monash.edu.au/infotech/resources/students/

Graduate Attributes Policy

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

Student Charter


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 Malaysia 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 Malaysia, visit the Library and Learning Commons at http://www.lib.monash.edu.my/. At South Africa visit http://www.lib.monash.ac.za/.

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.html
- Telephone: 03 9905 5704 to book an appointment with a DLO; or contact the Student Advisor, Student Community Services at 03 55146018 at Malaysia
- Email: dlu@monash.edu
- Drop In: Equity and Diversity Centre, Level 1, Building 55, Clayton Campus, or Student Community Services Department, Level 2, Building 2, Monash University, Malaysia Campus