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FIT2069 Computer architecture - Semester 1, 2011

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This unit covers the internal mechanism of computers and how they are organised and programmed. Topics include combinatorial and sequential logic, Boolean Algebra, Karnaugh maps, counters, ripple adders, tree adders, memory/addressing, busses, speed, DMA, data representation, machine arithmetic, microprogramming, caches and cache architectures, virtual memory and translation look-aside buffers, vectored interrupts, polled interrupts, pipelined architecture, superscalar architecture, data dependency, hazards, CISC, RISC, VLIW machine architectures.

Mode of Delivery

Clayton (Day)

Contact Hours

2 hrs lectures/wk, 3 hr laboratory/fortnight, 1 hr tutorial/fortnight

Workload

- Lectures: 2 hrs per week
- Laboratory: 3 hrs per fortnight
- Tutorial: 1 hr per fortnight

This is a technically oriented unit where content in any given week depends strongly on content in preceding weeks. Therefore students should plan and commit 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. Laboratory work will require preparation before attendance.

The unit content requires a strong focus on understanding content through the semester.

Unit Relationships

Prerequisites

FIT1031 or FIT1001 and FIT1008 or FIT1015

Chief Examiner

Carlo Kopp

Campus Lecturer

Clayton

Dr Carlo Kopp

Contact hours: By appointment / email (part time staff)
Learning Objectives

At the completion of this unit students will have -
A knowledge and understanding of:

- combinatorial and sequential logic, Boolean Algebra, Karnaugh maps, and hazards;
- counters, ripple adders, tree adders, memory/addressing, computer busses, logic and bus speed, and Direct Memory Access;
- data representation for integers and floating point operands;
- machine arithmetic, microprogramming;
- storage hierarchies, caches and cache architectures, performance impact of caching;
- virtual memory and translation look-aside buffers, performance impact of TLB caching;
- vectored and polled interrupt handling;
- pipelined architecture, superscalar architecture, data dependency, and hazards;
- CISC, RISC, VLIW machine architectures.

Developed the skills to:

- model combinatorial and sequential logic circuits using a simulator tool;
- perform programming tasks in assembly code.

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 (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>Laboratory Exercises</td>
<td>5% of total mark each</td>
<td>In weeks 2,4,6,8,10 and 12</td>
</tr>
<tr>
<td>Tutorial Exercises</td>
<td>Total 10%; 1.667% each</td>
<td>In weeks 1,3,5,7,9 and 11</td>
</tr>
<tr>
<td>Examination 1</td>
<td>60%</td>
<td>To be advised</td>
</tr>
</tbody>
</table>
Teaching Approach

- **Lecture and tutorials or problem classes**
  This teaching and learning approach provides facilitated learning, practical exploration and peer learning.
- **Laboratory-based classes**
  This teaching approach is practical 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
- Test results and feedback

**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:

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](https://emuapps.monash.edu.au/unitevaluations/index.jsp)

Recommended Resources

- Logisim software (free)
- Xspim/Spim software (free)

Examination material or equipment

Non-programmable scientific calculators will be permitted.
Unit Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date*</th>
<th>Activities</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>21/02/11</td>
<td>No formal assessment or activities are undertaken in week 0</td>
<td>No formal assessment or activities are undertaken in week 0</td>
</tr>
<tr>
<td>1</td>
<td>28/02/11</td>
<td>Intro/History/Background; Boolean Algebra</td>
<td>Tutorial</td>
</tr>
<tr>
<td>2</td>
<td>07/03/11</td>
<td>Karnaugh maps, Hazards; Data Representation</td>
<td>Laboratory</td>
</tr>
<tr>
<td>3</td>
<td>14/03/11</td>
<td>Counters, Adders, Shifters, Sequential Logic</td>
<td>Tutorial</td>
</tr>
<tr>
<td>4</td>
<td>21/03/11</td>
<td>Basic Machine Organisation</td>
<td>Laboratory</td>
</tr>
<tr>
<td>5</td>
<td>28/03/11</td>
<td>Control Unit Design</td>
<td>Tutorial</td>
</tr>
<tr>
<td>6</td>
<td>04/04/11</td>
<td>Instruction Sets and Design</td>
<td>Laboratory</td>
</tr>
<tr>
<td>7</td>
<td>11/04/11</td>
<td>I/O, Interrupts, DMA</td>
<td>Tutorial</td>
</tr>
<tr>
<td>8</td>
<td>18/04/11</td>
<td>Cache Organisation</td>
<td>Laboratory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mid semester break</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>02/05/11</td>
<td>Mass Storage/Memory Management</td>
<td>Tutorial</td>
</tr>
<tr>
<td>10</td>
<td>09/05/11</td>
<td>CPU Organisation/Pipelined Architectures</td>
<td>Laboratory</td>
</tr>
<tr>
<td>11</td>
<td>16/05/11</td>
<td>Superscalar Architectures</td>
<td>Tutorial</td>
</tr>
<tr>
<td>12</td>
<td>23/05/11</td>
<td>CISC, RISC, VLIW, Other Machine Architectures</td>
<td>Laboratory</td>
</tr>
<tr>
<td>30/05/11</td>
<td>SWOT VAC</td>
<td>No formal assessment is undertaken SWOT VAC</td>
<td>SWOT VAC</td>
</tr>
</tbody>
</table>

*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

6 Laboratory Exercises each worth 5% of the total mark (compulsory and assessed, preparation required)
6 Tutorial Exercises each worth 1.667% of the total mark (compulsory and assessed)

Tutorials and Laboratories are scheduled in alternating weeks

- **Assessment task 1**

  **Title:** Laboratory Exercises
  **Description:** 6 Laboratory Exercises
  **Weighting:** 5% of total mark each
  **Criteria for assessment:** Compulsory. Preparation required. Individual assessment per task.

  The criteria used to assess laboratory tasks are:

  1. All programs must assemble and execute correctly. Evidence of testing is required.
  2. Programs must meet the problem specification.
  3. Assembly code should be readable and maintainable.
  4. Programs should be documented.
  5. All algorithms should follow the style presented in laboratory examples and be correct.
  6. Logic simulator circuits must comply with the specified truth table or other functional definition.

  **Due date:** In weeks 2, 4, 6, 8, 10 and 12

- **Assessment task 2**

  **Title:** Tutorial Exercises
  **Description:** 6 Tutorial Exercises
  **Weighting:** Total 10%; 1.667% each
  **Criteria for assessment:** Compulsory.

  The criteria used to assess submissions are:

  1. Correctness and understanding - there may be more than one "right" answer in many cases. We will look for answers that reflect understanding of the underlying principles and theories.
  2. Completeness - that you have answered all parts of each question. Presentation - that you have presented your answers in a suitably formatted style.
  3. Use of evidence and argument - you are able to explain your position by using logical argument drawing on the theory presented in the unit.

  **Due date:** In weeks 1, 3, 5, 7, 9 and 11
Examinations

- Examination 1

  Weighting: 60%
  Length: 3 hours
  Type (open/closed book): Closed book
  Electronic devices allowed in the exam: Non programmable scientific calculators permitted

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:

Returning assignments

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

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:

Key educational policies include:

- Plagiarism
  (http://www.policy.monash.edu/policy-bank/academic/education/conduct/plagiarism-policy.html)
- Assessment
- Special Consideration
  (http://www.policy.monash.edu/policy-bank/academic/education/assessment/special-consideration-policy.html)
- Grading Scale
  (http://www.policy.monash.edu/policy-bank/academic/education/assessment/grading-scale-policy.html)
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- 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/);
  and
- Academic and Administrative Complaints and Grievances Policy
  (http://www.policy.monash.edu/policy-bank/academic/education/management/complaints-grievance-policy.html)

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.

READING LIST

Recommended Reading:


Supplementary Recommended Reading: