



FACULTY OF ENGINEERING
SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

COMP3211/COMP9211

COMPUTER ARCHITECTURE

SESSION 1, 2011

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Course staff

- Lecturer
 - Dr. Annie Guo (huig), K17-501F, Ext 57136
 - Consultation time: Tues. 2–5pm
 - Outside of consultation times please email for an appointment
- Tutors
 - Mr. Ji Gu (jigu), K17-510-04, Ext. 54869
 - Ms. Mei Hong (meihong), K17-510-04, Ext. 54869

Course overview

- Units of Credit: 6
- Prerequisite: COMP3222 or ELEC2142
- Lecture: 3 hours per week:
 - Mondays 11:00-13:00, Quadrangle G031
 - Wednesdays, 13:00-14:00, Central Lecture Block 4
- Tutorial and Lab: 2 hours per week
 - Students are expected to attend tutorial and laboratory each week after week 1. These are scheduled into 2 hour blocks consisting of one tutorial hour followed by one lab hour:
 - Mondays, 18:00 - 20:00
 - Tuesdays, 10:00 - 12:00
 - Wednesdays, 14:00 - 16:00
 - Students must enroll in and attend one of these three available blocks. This is essential in order to carry out and complete the project work.

Course objectives

- The objectives of this course are to:
 - develop a deeper understanding of computer systems design with emphasis on pipelined RISC machines;
 - know basic design principles and techniques for performance improvement;
 - know to use some simulation tools and appreciate the importance of simulation as the primary means of validating designs; and
 - practice professional skills in design and analysis, project management, and presentation.
- The course and its aims relate to other fields of study within the discipline in the following ways:
 - Computer Architecture is concerned with the design of computer systems. It deals with the design and implementation of the interface between the software and

- hardware layers of computer systems. We therefore discuss aspects of both layers and the interplay between them.
- Computer Architecture builds upon previous study of digital circuits and systems design, assembly language, microprocessor operations, VHDL programming and simulation.
 - A study of Computer Architecture complements the study of languages and algorithms, compilers, and operating systems on the software side of the interface, as well as embedded systems, FPGA and VLSI design on the hardware side of the interface.

Student learning outcomes

- The intended learning outcomes for this course are to:
 - learn how computing systems are structured. We mainly focus on the processor, cache, memory and system buses. We examine single-cycle and pipelined uni-processors
 - learn why computers are structured the way they are; understand the importance of maximising performance as a driver for engineering enhancement
 - develop skills in designing architectural solutions and describing designs using VHDL; become acquainted with the use of simulation for studying architectures and performance; develop skills in obtaining and describing simulation results
 - practice professional skills including project management, results analysis, critical discussion, structuring of information, oral and written presentation, and report writing

The rationale behind our approach to learning and teaching

- Our approach to learning and teaching:

We have a lot to cover in engineering study: understanding scientific theory, learning how to apply theory to design, developing designs, implementing and testing designs, creating products, and gaining an appreciation for professional issues; we want to try to integrate many of these as you progress to Years 3 & 4.

- Provide theoretical foundation for knowledge
 - Develop theory from observations of natural phenomena
 - Apply methodical approach to obtaining, recording, classifying and analysing observations
 - Instill a sense of the intrinsic value of the scientific method
 - We therefore encourage enquiry especially questions in class
- Develop skills in design and critical analysis/evaluation of design options. These need to be gained over time from being exposed

to lots of good and bad designs, from reflecting upon and discussing them, and most importantly, from practicing and learning from mistakes.

- We will primarily make use of tute and lab times and the vehicle of your project to practice these skills. You will work closely with your peers.
- We want to emphasize the difference between design and implementation.
- We would like to provide you with opportunities to practice and develop your professional skills, particularly those that relate to the presentation of ideas.

Teaching strategies

- The course consists of lectures, tutorials, and laboratory sessions. You will need to work outside of these formal hours to complete your project and to study and reflect upon the course material.
- Lectures will be used for presenting the background material, explaining the motivation behind computer designs, drawing comparisons between competing architectures, connecting material with prior knowledge, illustrating avenues for extension to the presented material, and guiding the direction of the course.
- Tutorials are intended to provide a forum for interaction and discussion. Tutes will focus on the discussion of design concepts and one or two architectural/design issues. Problems will be made available to motivate the discussion. Tutorials will also be used for project presentations and evaluation. All tute participants will be engaged in assessing the project work and presentations of others.
- Labs provide a venue for developing and exercising design, description, and simulation skills. They are the primary venue for group meetings and work. You will be expected to build on provided code and gain proficiency at gathering and interpreting simulation results.
- In this course you will work on a major project that contains both individual and group work components. You need to present your design in your tute/lab class block and submit a final project report.

Assessment

- Assessment in COMP3211/9211 will be based upon the following components to test your understanding of processor design, design simulation, and teamwork skills as stated in the course objectives:
 - A 50 minute Quiz in the lecture class on Wednesday, 6 April (Week 6), worth 20% of your final mark and covering materials addressed in the first five weeks.
 - A two-hour Exam worth 40% of your final mark at the conclusion of the course on all materials. You must obtain at least 40% of the available marks in the final exam in order to pass the course.

- Project work and progressive assessment worth 35% of the final mark in this course.
- Participation of tutorials and labs worth 5% of the final mark.

Academic honesty and plagiarism

What is Plagiarism?

Plagiarism is the presentation of the thoughts or work of another as one's own.*
Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed. †

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does not amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle † Adapted with kind permission from the University of Melbourne

- Please refer to further specific instructions regarding plagiarism with respect to the course project. In this course you are permitted to make use of IP (intellectual property) e.g. code, designs, diagrams, formats, layouts, etc. that you have not created under the following conditions:
 - Any IP you or your partner(s) have not created must clearly identify the source of the IP, be it another group in this class, a previous year's student, the internet, or from texts, etc – any unoriginal design or code **MUST** be attributed to its source in a clearly marked comment *where the material is included* indicating the extent of the externally sourced material e.g. start and end of copied code – if you do not do so, your submission will be treated as having been plagiarised. **Note:** Templates generated by the WebPACK/ISE tools are excluded from this requirement.

Course schedule

Week	Event	Topic
1	Lectures start	intro, ISA design
2	Tutes/Labs start Project groups formed	single cycle datapath
3	Project one released Project planning, presentation practice	single cycle datapath VHDL modeling, performance
4	project work	ALU design Multi-cycle datapath
5	Project work	pipelining
6	P1 group presentation Quiz	pipelining
7	Project two released	Pipelining
8	Project work	memory
9	Project work	memory
10	P2 presentation	Bus systems
11		Advanced topics
12	Project report due	Advanced topics, review

Resources for students

- **Text:** Computer Organization and Design: The Hardware/Software Interface, D.A. Patterson and J.L. Hennessy, 4th Ed., Morgan Kaufmann, 2009.
- **Computer Architecture References:**

- Computer Architecture: A Quantitative approach, J.L. Hennessy and D.A. Patterson, 3rd Ed., Morgan Kaufmann, 2003.
 - Structured Computer Organisation, A.S. Tanenbaum, 5th Ed., Prentice-Hall, 2006.
 - Computer Organization & Architecture: Designing for Performance, W. Stallings, 6th Ed., Prentice-Hall, 2003.
 - Computer Organization, C. Hamacher, Z. Vranesic, and S. Zaky, 5th Ed., McGraw Hill, 2002.
 - Digital Design: Principles and Practices, J.F. Wakerly, 3rd Ed., Prentice-Hall, 2001.
- **VHDL References:**
 - VHDL Starter's Guide, S. Yalamanchili, 2nd Ed., Prentice Hall, 2005.
 - A VHDL Primer, J. Bhasker, 3rd Ed., Prentice Hall, 1999.
 - The Designer's Guide to VHDL, P.J. Ashenden, 2nd Ed., Morgan Kaufmann, 2001.
 - On-line resources
- The course website: <http://www.cse.unsw.edu.au/~cs3211>
 - You can also obtain assistance from the UNSW Library. One starting point for assistance is:
info.library.unsw.edu.au/web/services/services.html

Course evaluation and development

- Your feedback is welcome anytime. Simply email or speak to a member of the course staff.
- At the conclusion of the course, you will be asked to complete the online Course and Teaching Evaluation and Improvement (CATEI) survey. We would very much like to hear your thoughts on how to improve the course. We rely upon such feedback to update the course structure, format, and content.

Any Questions?

- Please contact any of the course staff.