

# Course Outline

## Introduction to Computer Systems      **COMP 273**

(Winter 2016;      MW 2:35:-3:55;      ENGMC 304)

Instructor:                      Professor Michael Langer  
Office:                              McConnell Engineering, rm. 329  
Tel:                                  514-398-3740  
Email:                                langer@cs.mcgill.ca  
Course Web Page:                [www.cim.mcgill.ca/~langer/273.html](http://www.cim.mcgill.ca/~langer/273.html)  
Office Hours:                      MW 4 pm - 5 pm

Teaching Assistants (T.A.)      TBD (see Course Web Page)  
Office hours:                        TBD

## Introduction

The course gives a bottom up view of how a computer works. It begins with a overview of digital logic, and then builds up the main architectural and system elements of a typical modern computer. We use a specific RISC computer architecture and assembly language, MIPS, to illustrate the main concepts.

## List of Topics

1. Digital Logic (7 lectures)
  - Number representations
    - binary, twos complement, floating point, hexadecimal
  - Combinational logic
    - truth tables, gates, adders, encoders, decoders, multiplexors, ROM
  - Sequential logic
    - latches, flop flops, registers, integer multiplication and division.
2. MIPS assembly language    (5 lectures)
  - instruction representations, absolute vs. immediate addressing
  - procedures, the stack, recursive procedures
  - SPIM simulator: directives, pseudoinstructions
  - multiplication, division, floating point instructions

### 3. MIPS CPU architecture (3 lectures)

- datapath and control
- fetch-execute, pipelining
- exceptions and the kernel

### 4. Memory (3 lectures)

- RAM,
- virtual memory, page tables, TLB
- cache

### 5. I/O (4 lectures)

- system bus
- interrupts and exceptions, memory mapped I/O, direct memory access
- synchronous vs. asynchronous I/O

## Lecture Notes and Lecture Recordings

All material covered in the lectures will be made available as PDFs on the course web page. In addition, lectures will be recorded and made available.

## Reference Textbooks

There is no textbook for the course. If you wish to do further background reading, then I would recommend the following which is available on *two hour reserve in the Schulich Library*. Call Numbers can be found from the McGill libraries website (see MUSE, Course Reserves).

For further details on MIPS, see:

- “Computer organization and design: the hardware/software interface” by David A. Patterson and John L. Hennessey.
- “See MIPS run”, by D. Sweetman

## Co-requisites

- COMP 250 *Introduction to Computer Science* (unofficial, but strongly recommended)
- COMP 206 *Introduction to Software Systems* (official)

If you have not taken 206 or you are not taking it currently, then you should not take COMP 273. The only exception would be if you have some experience with C or C++ programming.

## Evaluation

- 20 %          in-class quizzes

There will be 6 quizzes. The schedule will be announced soon. Each will be 15 minutes, at start of class. I will count your best 5 scores ( $5 \times 4\%$  each = 20 %)

- 30 %          Programming Assignments

There will be 4 assignments in total: one assignment using Logisim and 3 programming assignments using the MIPS assembly language, specifically the MARS simulator.

**[MODIFIED JAN. 14 2016. I had originally announced there would be only 3 assignments. But we've decided to add a logisim assignment. The total assignment workload will be the same i.e. the MIPS assignments will be slightly shorter to compensate.]**

- 50 %          Final Exam (during Final Examination Period in April)
  - It will cover the whole course.
  - You may use the Final Exam to replace your Quiz grades. In that case, the Final Exam will be worth 70 % of your grade.

*In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.*

## McGill policy on academic integrity

*McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offenses under the Code of Student Conduct and Disciplinary Procedures. See <http://www.mcgill.ca/students/srr/honest/> and See [www.mcgill.ca/integrity](http://www.mcgill.ca/integrity) for more information*

## MyCourses Discussion Board

The instructor will moderate the discussion board. Please obey the following. Posting that do not conform will be deleted.

- Be clear: Make sure that what you have written makes sense.
- If you would like your posting to be deleted, just add a request within the thread. No problem.
- Choose a suitable subject line.
- If you have multiple questions that are unrelated, then use multiple threads.
- Use the search feature to see if your question has been asked before.
- Do not email me with a technical question about the course material. Instead, post the question on the discussion board so that everyone can benefit from the correspondence.
- Be polite.
- Keep clutter down. e.g. "Thank you" notes should be sent privately.

## My Miscellaneous Policies

**Re-grading:** Mistakes can occur when grading. Not surprisingly, requests for re-grading always involve those mistakes in which the student received fewer points than they deserved, rather than more points than they deserved. With that in mind: if you wish me to re-grade a question on an exam or assignment, I will do so. However, to avoid grade ratcheting, I reserve the right to re-grade other questions as well.

**Bonus points:** If you inform me of errors in the lecture slides, exercises, or assignments, then I will be very appreciative and I will make a note of it. If your final grade is just below some threshold, then your contributions will elevate your grade over that threshold.

**Final grade:** There are many factors that determine your grades including how hard you work, how talented you are in this area, how much time you have available because of other commitments, what your academic background is, what your health situation or family situation is, etc. However, when I assign your final course grade, I will not take these other factors into account. I assign the final grade only based on your assignment and exam scores.

**Additional Work:** Students with grades of D, F or J will *not* be given the opportunity to complete additional work to upgrade their grade.

**Supplemental Exam:** It will take place in August. It will cover the same material as the Final Exam and will replace the Final Exam grade. For information on Supplemental Exams, see <http://www.mcgill.ca/artscisao/general/exams/supplemental/>.

**Cheating/Collaboration:** I encourage you to discuss the assignments with each other. But no sharing code ! And your discussion should be *public* in the sense that anyone including me should be allowed to listen in.