CS 342  Computer Organization and Design

Fall 2010

Catalog Description

This course provides computer science and computer engineering students with an in-depth look at computer architecture and the hardware/software interface. The major topics are: computer abstractions and technology; the role of performance and measuring performance; SPEC computer arithmetic; machine language: a comparative analysis of instruction sets of current processors using the debuggers, simulators and by the partial reverse engineering of executables. The processor: datapath and control; RISC versus CISC; design, implementation (using VHDL), and verification (in simulation) of a simplified RISC processor using CAD tools. Enhancing performance with pipelining. Memory hierarchy, cache, virtual memory, performance issues. Interfacing processors and peripherals; PCI chipset. Overview of multiprocessors, grid computing.

Organization and Schedule

<table>
<thead>
<tr>
<th>Semester</th>
<th>Meeting Type</th>
<th>Location</th>
<th>Days</th>
<th>Dates</th>
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</thead>
<tbody>
<tr>
<td>Fall 2010</td>
<td>Lecture</td>
<td>NAC 5-109</td>
<td>M,W</td>
<td>Aug. 28 – Dec. 16</td>
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<td>Dec. 16</td>
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<tr>
<td>Fall 2010</td>
<td>Laboratory</td>
<td>NAC 5-103</td>
<td>Friday</td>
<td>Aug. 28 – Dec. 16</td>
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<td>10:15 – 1:15 PM</td>
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Prerequisites

Required: Cs210.

Corequisites

CS 343

Course Goals

This course teaches you interaction between hardware and software at a variety of levels. The emphasis in this course is to show relashionship between hardware and software and to analyze the concepts that are basis for current computers.

Course Audience

This is a core course for Computer Science and Computer Engineering majors. The students are expected to have little experience in assembly language and logic design.
Technology and Tools Used In This Course

Microsoft Windows XP, Vista (operating system used in the laboratory)

LINUX (operating system used in the laboratory)

Microsoft Visual Studio(C++ compiler, linker, assembler)

Microsoft Visual Studio (debugger)

Gnu C++ compiler (gcc) on LINUX

SPIM –MIPS instruction set simulator

Intel\* Streaming SIMD Extensions (SSE) (for accelerating vector operations)

OPTIONAL: NVIDIA\* CUDA\* parallel compute engine in NVIDIA graphics processing units (GPUs) (for parallel computing)

Course Coordinator

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<tr>
<th>Name</th>
<th>Office</th>
<th>Email Address</th>
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<tbody>
<tr>
<td>Izidor Gertner</td>
<td>NAC 8-202F</td>
<td><a href="mailto:csicg@cs.ccny.cuny.edu">csicg@cs.ccny.cuny.edu</a></td>
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Office Hours

M,W 4:00-5:00 PM

Required Textbook


Recommended References

Intel, Microsoft, Altera, NVIDIA documentation and papers available on their websites.

Major Topics Covered in the Course

1. Computer Abstractions and Technology (1 hour)

2. The Role of Performance and Measuring Performance, SPEC Benchmarks and Performance of Recent Processors (1 hour)
3. Computer Arithmetic (3 hours)

4. Machine Language: Comparative study of Pentium, MIPS instruction sets using debuggers, simulators and by partial reverse engineering of executables. (6 hours)

5. The Processor: Datapath and Control; RISC versus CISC; Design, implementation (using VHDL), and verification (in simulation) of simplified RISC processor using software tools from ALTERA Corp. (6 hours)

6. Enhancing performance with pipelining, SSE –Streaming SIMD Extension (4 hours)

7. Memory Hierarchy, Cache, Virtual Memory, Performance issues. (3 hours)

8. Interfacing Processors and Peripherals; PCI Chipset. (2 hours)

9. Overview of multiprocessors, GPU computing (2 hours)

10. Tests. (3 hours)

Grading Policy:

1. micro-Quiz: 5%

2. Quiz 1: 15%

3. Quiz 2a: 10%

4. Quiz 2b: 10%

5. Quiz 3: 10%

6. Final Quiz: 25%

7. Home Assignments:

   Programming, Exercises 25%

The Programming assignments and exercises provide essential material for the quizzes. The assignments will be primarily graded on an effort basis and proper presentation. Each report should contain the following sections: Objective, Source code, Explanations and Screen shots, Conclusions.