Course Syllabus
CS120: Machine Organization
Fall 2015

Instructor and Teaching Assistant
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Office: Q04, Engineering Building
Lecture hours: MWF, 9:40-10:40am (A0 section), 12-1pm(B1 section)
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Teaching assistant: Matt Reigada, Umur Ciftci
Office: TBD – check web page

Course Description
The design and implementation of digital systems. Number representation and computer arithmetic. Design of a small computing system including an ALU, control unit, RAM, registers, bus system, instruction decoder, program counter, multiplexer, channels and clocking. Programmable logic arrays. Introduction to assembly language and C. Relationship of a higher-order programming language (C) to assembly language, and assembly language to machine code. Implementation of machine code in hardware. Use of computer-aided design and simulation tools. Supervised laboratory work involves digital system design and implementation, assembly language and C programming. Prerequisite: CS 100 or CS 110, or familiarity with programming.

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CS100 or CS110, or familiarity with programming.
CS375 assumes students have mastered:

Course Objectives
This course introduces the basics of modern computing system hardware, and builds a familiarity with Boolean logic elements, basic circuits, finite state machines, and low-level computing hardware concepts. Assembly language and C will be covered. Students will develop the following skills:

• The ability to design and analyze small circuits
• Understanding of finite state machines and sequential circuits
• Simple storage structures (registers and memory)
• Binary representations of numbers (primarily integers, and 2’s complement)
• The use of logic simulators and architecture simulators
• Assembly language programming, and the relationship to the C language

Textbook
• Patt & Patel, Introduction to Computing Systems.

Main Topics
<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Cormen Textbook Chapters</th>
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<tbody>
<tr>
<td>1</td>
<td>Binary, hexadecimal, 2’s complement</td>
<td>Chapter 2</td>
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<tr>
<td>2</td>
<td>Boolean operations, addition in binary</td>
<td>Chapter 3</td>
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<td>3</td>
<td>PLAs, latches, memory systems</td>
<td>Chapter 3</td>
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<td>4</td>
<td>Finite State Machines</td>
<td>Chapter 3</td>
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<td>5</td>
<td>Von Neumann architecture</td>
<td>Chapter 4</td>
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<td>6</td>
<td>Basic processor instruction sets.</td>
<td>Chapter 5</td>
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<td>Memory access using assembly language operations</td>
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<td>7</td>
<td>Conditional branching, looping in assembly</td>
<td>Chapter 6</td>
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<td>8</td>
<td>Assembly language tools (assemblers, linkers, symbol tables)</td>
<td>Chapter 7</td>
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<td>9</td>
<td>Hardware input and output</td>
<td>Chapter 8</td>
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<td>10</td>
<td>Subroutines and function calls</td>
<td>Chapter 9</td>
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<td>11</td>
<td>Traps and interface to the BIOS</td>
<td>Chapter 9</td>
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<td>12</td>
<td>The stack</td>
<td>Chapter 10</td>
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</tbody>
</table>

**Lecture Notes**

Students are expected to take notes during class. Note taking is an important skill to develop. Meetings with others will be a part of any computer science related career – and no one else will provide notes from these meetings. The textbook resources (available through the course web page) have lecture slides provided from offerings of similar courses at other universities. These may be useful, but are not a substitute for attending class, asking questions, and taking notes.

**Grading**

1. Your grade will be based on
   - Three exams 75% (25% each)
   - In-class quizzes 10% (roughly 1% each)
   - Lab participation and attendance 15% (roughly 1.5% per lab)

You may miss two quizzes; after this, the quiz portion of the grade will be reduced by 1% per quiz. You may miss one lab session. After this, the lab portion of the grade will be reduced by 1.5% per lab. Note that active participation in lab is required – this is beyond simply being physically present. If the TAs feel that you are not actively engaged in the work, you will not receive credit.
2. **Exams.** Exams will be in class, closed notes, and closed book, unless otherwise specified (unlikely). Two exams will occur during the semester, and the final will be during finals week. Check the course web page for exact dates.

3. **Quizzes.** Quizzes will be completed during class, and handed in at the end of class. We will use these to check class attendance, but the details of the individual quizzes will not be graded. During class, each of the quiz questions will be solved on the board – the goal is to ensure that every student has a chance to see how the various problems are solved, and have a chance to ask questions. Quizzes and quiz solutions will be posted on the web page – use these to check that you have done your work correctly, and understand the material thoroughly.

**Reading Assignments and Review Questions**

The lectures will follow the outline of the textbook. Please read the relevant chapters before class, and be ready to ask questions on topics that are unclear.

The in-class quizzes will have questions that may reappear as part of the exams.

**Academic Honesty Expectations**

Please review the academic honesty document and make sure that you understand it! The link is at: [http://www.binghamton.edu/watson/about/honesty-policy.pdf](http://www.binghamton.edu/watson/about/honesty-policy.pdf). Cheating and copying will NOT be tolerated.

- Each exam will have a first page with the following statement:

  “I understand that if I am caught copying or talking during the exam/quiz I will have to sign an official form that I have cheated and that this form will be stored in my official university record. I also understand that I will receive a grade of 0 for the involved exam.”

  Your exam will not be graded unless the statement above is followed by your signature.

**Collaboration**

Students are encouraged to help one another and to form study groups. In Computer Science, you can learn more from your peers than from your instructors and teaching assistants. As long as the help is appropriate, please be generous with your time and expertise when helping fellow students. Doing so is good for you and good for them.

But keep in mind – the ultimate goal of the coursework over your time at Binghamton is to prepare you for a career in computer science. After graduation, there will be interviews – where seasoned experts will pepper you with questions, and test the limits of your knowledge. There will be no way to succeed, other than having a firm grasp of all the material. There will be no opportunities to get help from a friend, and interviewers will not be willing to cut you any slack, or give you a second chance. There will be heavy competition for the most interesting opportunities; your best bet is to work hard to develop your skills to their fullest potential. While letter grades on a transcript might seem like the most obvious goal, it will in fact be your skills that ultimately determine your career trajectory.

**Computers and Other Electronic Devices**

If you take notes with a computer during class, please use it for only taking notes. During lectures, you should focus on the technical material, rather than texting your friends. University education is expensive; use your money (and your time) wisely.