Instructor and Teaching Assistant
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Course Description
Introduction to the C programming language, including local and global variables, basic control structures, function calls, pointers and the stack; use of command-line C development environments and development tools such as gdb and make; assembly language connection to higher-level C; building blocks of the Von Neumann machine (ALU, registers, control unit, RAM, decoders, program counters) and the underlying basic logic elements; simple non-pipelined processor architectures. Supervised laboratory work involves programming in C and low-level languages, interfacing with hardware, and the design and simulation of small circuits and simplified microprocessors.

Prerequisites: CS100 or CS110, or familiarity with programming.

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:

- Assembly language programming, and the relationship to the C language
- 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

Textbook: Harris & Harris, Digital Design and Computer Architecture, MIPS Edition. We will cover the majority of the book, beginning with the back (on C programming), and then moving to the front, and then following the chapter order.

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.
**Lecture Schedule:** The precise schedule will be available on the web page. A rough plan is as follows.

- **Late August:** Appendix C, C programming. Unix development environments, C language development tools. Basic Unix command line environments, text editors. Arduino programming, sensors, LEDs, speakers.
- **Early September:** Chapter 1, Binary number systems, basic Boolean logic elements.
- **Mid September:** Chapter 2, 3, Combinational and Sequential Logic. Finite State Machines. Memory elements.
- **Late September:** Chapter 4, hardware description languages.
- **Late September:** Exam 1.
- **October:** Chapter 5, Arithmetic Circuits, Memory Arrays, extremely simple processors (using the Logisim logic simulator).
- **Late October:** Chapter 6, assembly language (in ARM). Connection of memory systems to the use of pointers in C, and translation of basic C constructs into assembly language.
- **Early November:** Exam 2.
- **November:** Microarchitecture, single and multi-cycle processors, pipelining.
- **Early December:** Memory systems, I/O, interrupt handling. Very high level introduction to interfaces between user programs and the BIOS; we will touch on high level operating system concepts.
- **Finals Week:** Exam 3. This exam will be comprehensive, repeating a few topics from earlier exams, with emphasis on material covered after the second exam.

**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)

Letter grades will be (roughly) A/A- in the 100-90 range, B+/B/B- in the 90-80 range, C+/C/C- in the 80-70 range. Below 65 is almost certainly an F. Grade break points are usually found from “gaps” in the numerical averages; the goal is avoid giving students different letter grades when the numerical averages are nearly identical.

**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 dates.

**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. You may miss two quizzes; after this, the quiz portion of the grade will be reduced by 1% per quiz.

**Labs:** 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.

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.