16.317: Microprocessor Systems Design I

Summer 2012

Syllabus

Course Meetings

MW 2:00-5:00 PM, Olsen 405
F *(7/20 & 8/3 only)*, Olsen 407

Lab: Open lab hours in Ball Hall 407; instructor lab hours TBD

Course Website

http://mgeiger.eng.uml.edu/16317/sum12/index.htm

Course Discussion Group

All course announcements will be posted on the discussion group—you are responsible for checking the board regularly or enabling direct e-mail updates from Piazza.

Sign up link: http://piazza.com/uml/summer2012/16317

Instructor

Dr. Michael Geiger
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Phone: 978-934-3618 (x3618 on campus)
Office hours: MTTh 10-12 *(tentatively)*

Once finalized, my office hours are the minimum that I will be available—I will (usually) be on campus five days a week. Feel free to stop by my office, e-mail me questions, or schedule a one-on-one appointment. Office hours are subject to change.

Textbook

Walter Triebel, *The 80386, 80486, and Pentium Processors: Hardware, Software, and Interfacing*, 1998, Prentice Hall.
ISBN: 0-13-533225-7

Course Overview

Description: This course provides an introduction to microprocessors. It uses assembly language to develop a foundation on the hardware, which executes a program. Memory and I/O interface design and programming. Study of microprocessor and its basic support components, including CPU architecture, memory interfaces and management, coprocessor interfaces, bus concepts, serial I/O devices, and interrupt control devices. Laboratories directly related to microprocessor functions and its interfaces.

Credits: 3

Prerequisites: 16.265 (Logic Design) and 16.365 (Electronics I)

Course Overview (cont.)

Course Objectives: By the end of this course, you should be able to perform all of the following tasks:

1. Microprocessors and Microcomputers (Chapter 1)
   - Describe evolution of reprogrammable computer systems.
   - Describe general architecture of a microcomputer system
2. Real-Mode Software Architecture of the 80386DX Microprocessors (Chapter 2)
   - Describe the internal architecture of 80386DX.
   - Describe real-mode software architecture.
   - Describe real-mode memory space and data organization.
   - Draw data alignment in memory.
   - Convert 2's complement integer format among hexadecimal, decimal and binary.
   - State the generation of a real-mode memory address.
   - State the operation of stack.
   - Describe real-mode I/O address space.
3. Real-Mode Assembly Language Programming Methodology (Chapter 3)
   - Describe the concept of software.
   - Describe the steps of assembly language program development.
   - Describe the evolution of 8086 family instruction set.
   - Describe the addressing modes of 80386DX.
4. Assembly Language Coding and Debugging (Chapter 4)
   - Convert assembly language instructions to machine code.
   - Use "DEBUG" program to debug.
5. Real-mode 80386DX Programming I (Chapter 5)
   - Use data transfer instructions.
   - Use arithmetic instructions.
   - Use logic instructions.
   - Use shift instructions.
   - Use rotate instructions.
   - Use bit test and bit scan instructions.
6. Real-mode 80386DX Programming II (Chapter 6)
   - Use flag-control instructions.
   - Use compare and set instructions.
   - Use jump instructions.
   - Use subroutine instructions.
   - Use loop instructions.
7. Program Development with MS-MASM (Chapter 7; covered only in lab, not lecture)
   - Describe statement syntax.
   - State pseudo operations.

Course Overview (cont.)

Course Objectives (cont.): By the end of this course, you should be able to perform all of the following tasks:

8. Protected-mode Software Architecture of 80386DX (Chapter 8)
    - Describe protected-mode register model.
    - Describe protected-mode memory management and address translation.
    - State descriptor and page table entries.
    - State multitasking and protection.
9. Memory and I/O Interfaces of the 80386DX Microprocessors (Chapter 9)
    - Describe system clock and bus cycles.
    - Construct hardware organization of memory address space.
    - Describe memory interface circuitry
    - State types of I/O.
10. Memory Devices, Circuits and Subsystem Design (Chapter 10)
    - Describe program and data-storage memory.
    - Explain read only memory (ROM).
    - State random access memory (RAM).
    - Describe parity checking and related circuit.
11. PIC Microcontroller
    - Understand the differences between microcontroller and microprocessor
    - State the instruction and data memory organization
    - Know the instruction set of PIC
    - Be able to program the PIC to complete a specific task
    - Know how to interface PIC to peripheral circuits
    - Design and debug microcontroller based circuits

Grading: Grades will be computed on an A to F scale; no A+ grades will be assigned, in accordance with UMass Lowell policy. The weights assigned to the various items are:

Lab assignments	35%
Homework	20%
Exam 1	15%
Exam 2	15%
Final	15%

Incomplete grades will only be given in exceptional situations, and the student must be passing the class at the time the grade is requested.

Homework: All homework should be completed individually. Late homework assignments will be penalized at the rate of 10% per day.

Exams: Make-up exams will only be offered in exceptional circumstances. You must notify Dr. Geiger as early as possible in order to determine an appropriate make-up date.

Course Overview (cont.)

Lab policies: The course contains five lab assignments that involve both assembly language programming and hardware interfacing. Please check the course web page for detailed lab specifications.

Lab policies include the following:

- All experiments should be done in groups of one or two people.
  - Once a group is formed, member change is NOT allowed without the approval of the instructor.
- Each group member must complete his or her own lab report. **No copying is allowed unless explicitly specified**. (For example, you will often generate screenshots to show completion of a given part of the lab. Group members can use the same screenshot, but must each write his or her own description).
- Each report should be typed, not handwritten, and must follow a specific format, which will be described in a separate document.
- Reports are due in class on the due date. Late reports will be penalized at a rate of 20% per weekday.
- All labs must be checked off by Dr. Geiger unless noted otherwise.

Class participation: You are responsible for all material discussed or announced in class. You are expected to attend class regularly and participate in any in-class discussions, as such exercises are essential to your learning. Although lecture attendance is not explicitly required, regular attendance will improve your understanding of the course concepts.

Academic Honesty

All assignments and exams must be completed individually unless otherwise specified. You may discuss concepts or material covered in class, but may not share any details of your solutions to assigned problems, including algorithms and code. Plagiarism is also unacceptable and will be treated as an instance of cheating.

Students are allowed to discuss lab assignments in general terms and to help one another fix specific errors. In this case, students are required to note that they received assistance from a classmate by listing that person's name and the nature of their assistance as part of their lab report.

Any assignment or portion of an assignment that violates this policy will receive a grade of zero for all parties concerned. Depending on the severity of the infraction, or in cases of repeat violations, additional penalties may be given at the instructor’s discretion, up to and including a failing grade in the course.

Further information on the UMass Lowell Academic Integrity Policy can be found at: http://www.uml.edu/catalog/undergraduate/policies/academic_dishonesty.htm

Course Schedule

This schedule contains a tentative schedule of topics we will cover throughout the term; the course website will contain the most up-to-date version. The web page will also describe which section(s) of the textbook are associated with each lecture.

Please note that the exam dates are fixed—the first exam will be held on **Friday, July 20 in class**, the second exam will be held on **Wednesday, August 1 in class**, and the third exam will be held on **Wednesday, August 15 in class**.

Lecture	Date	Lecture Topics
1	M, 7/9	Course introduction/overview General microprocessor overview 80386DX introduction
2	W, 7/11	Address generation, stack, I/O address space Assembly language program development Addressing modes
3	M, 7/16	Instruction formatting Data transfer and arithmetic instructions
4	W, 7/18	Logical and shift instructions Rotate and bitwise instructions
5	F, 7/20	**Exam 1**
6	M, 7/23	Bit test/scan, flag, compare instructions Jump, loop, and subroutine instructions
7	W, 7/25	Protected mode intro IDTR, task switching, virtual addresses, segmented virtual space Virtual memory intro
8	M, 7/30	More on virtual memory 80386DX interfaces System clock and bus cycles
9	W, 8/1	**Exam 2**
10	F, 8/3	Memory organization/interfacing PIC microcontroller overview, data memory organization *NOTE: Saturday, 8/4 is last day to withdraw*
11	M, 8/6	PIC instruction set
12	W, 8/8	PIC programming examples
13	M, 8/13	Topics TBD
	W, 8/15	**Final Exam, 2:00-5:00, Olsen 405**