CS 330 **Microcomputer Architecture** **Winter 2006**

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Office Hours: M T W F 10:00 - 11:00 AM
M W 4:00 - 5:00 PM
Other times by Appointment

Text: Digital Computer Electronics(3rd edition), by Albert Paul Malvino

This class is an introduction to the hardware and software interaction of microcomputer operation and application. The topics have been selected so that the student will acquire the basic knowledge necessary to pursue, on her/his own, any aspect of hardware or software application later desired.

Basic principles which underlie electronic computer operation, organization and programming will be studied. These include:

- Binary numbers; arithmetic and information coding
- Boolean Algebra
- Digital logic circuits
- Machine and assembly language programming
- Interfacing including hardware and software aspects

Digital electronic circuitry and the accompanying binary arithmetic and digital logic will be introduced. Using digital logic circuits as building blocks complex register circuits and memory devices will be studied. The synchronized operation of combinations of these circuits on a bus structure forming a microcomputer architecture will be developed. The programmed operation of the microcomputer architecture will serve as a model for the study of machine language programming. The courses will conclude with an introduction to interfacing topics.

Grade Breakdown:

Fridays	Quizzes (Lowest 1 Dropped)	30%
Tuesdays	Labs	30%
Wed/Friday, Mar 1/3, 2006 12 - 12:50 PM	Midterm Exam	20%
Wednesday, May 3, 2006 12 - 1:50 PM	Final Exam	20%

NOTE: You must receive a passing grade in each part (Lecture and Lab) separately in order to pass the course as a whole. If you fail either part, regardless of your grade in the other part you will fail the course!!

All quizzes and exams are closed book and no calculators are permitted to be used during the taking of the quizzes or exams. **Quizzes are given every Friday of the semester.** The Midterm will also most likely be on a Friday as well.

Attendance at all labs is mandatory. Make ups for quizzes and labs will only be provided for at the discretion of the professor. This will occur only for reasonable excuses. Desire to go home for the weekend or to go hunting are not considered reasonable excuses. Informing the professor **BEFORE** an absence is more likely to

result in a make-up than informing the professor after the absence.

Food of any kind (including snack food) is not allowed in the lab or classroom. Please do not bring it in. Drinks will be permitted as long as care is taken not to have spills occur. If excessive spillage occurs, drinks may be restricted as well.

Lab partners will be provided with toolkits for doing lab work. These kits will be checked both before and after a lab. IF your kit is found to be missing any tools, **you and your partner will be charged for the replacement** of the missing item(s). Please be sure your tools do not walk out of lab.

The professor will make every effort to respond to all email questions received by 5 PM Monday through Friday, with a response by 10 PM Monday through Friday. The professor will also make every effort to have all handouts available on his web site for download if you should lose your copy.

Students in this class are expected to conform to a code of **academic honesty**. While it is encouraged for students to work together, there are situations where work is expected to be the student=s whose name appears on the work. Quizzes and exams are obvious examples of where cheating will not be tolerated. However, using the **same code and documentation** (even if you change your name and modify some words), is also considered cheating. Each student is expected to learn how to create their own files. In lab work, it will often be the case that both partners will have identical work. However, both partners are to turn in lab sheets, and both partners are expected to participate equally in completing the lab tasks. It is not acceptable for one partner to do all the work, while the other merely watches and writes. Both partners are expected to understand the lab exercises. If you have questions on what is considered appropriate, ask your professor.

Please be sure any cell phones or pagers or other devices do not produce sounds during lectures.

Computer Usage Policies:

- **UNLESS PERMISSION is GRANTED, All Laptops and other Electronic Communication/Entertainment devices are to be off and remain unused during class times. If Permission is granted then:**
- Computers (both room based and laptops) are to be utilized for course work and activities related to course work.
- Writing computer code whether for this class or another CS class while the professor is lecturing is not appropriate.
- Do not use computers for entertainment or communications during class meetings.
- Do not display material on screen which may be distracting or offensive to other members of the class (including the professor).
- Keep a backup of all your files. The university is not liable for any data lost due to equipment failures, damaged disks, or misuse of computer programs.
- Do not utilize software in violation of licensing agreements. Do not copy software, information, data or other work in violation of applicable copyrights. Be aware of current copyright laws regarding software, music, movies, and other digital information. Copyright information may be accessed through the NMU Library website at: http://www.nmu.edu/olsonlibrary/copyright.htm
- You may not copy, install or use any service, information, data, image, recording, or other work in violation of applicable copyrights or license agreements. You may not posses any software or resource whose purpose is to effect one of the afore mentioned violations.
- You must take full responsibility for what you publish, transmit, or possess.

- You may not steal, forge, cheat with; snoop on; tamper with; misuse, damage, harass with; hoard or monopolize; interfere with; violate the confidentiality of; or destroy any information, resource, equipment or software. This includes using your personal computer for these activities against other users or against their information resources.

If you have a need for disability-related accommodations or services, please inform the Coordinator of Disability Services in the Disability Services Office located at 2001 C. B. Hedgcock (227-1700; TDD 227-1543). Reasonable and effective accommodations and services will be provided to students if requests are made in a timely manner, with appropriate documentation, in accordance with federal, state, and University guidelines.

Northern Michigan University does not unlawfully discriminate on the basis of race, color, religion, sex, national origin, age, height, weight, marital status, familial status, handicap/disability, sexual orientation or veteran status in employment or the provision of services, and provides, upon request, reasonable accommodation including auxiliary aids and services necessary to afford individuals with disabilities an equal opportunity to participate in all programs and activities. Persons having civil rights inquiries may contact the Affirmative Action Office at 204 Cohodas (227-2420).

Course Content

I Introduction and overview

II Numbers for computers

1. Number system bases
   - decimal, binary, octal, hexadecimal
2. Binary numbers as codes
   - ASCII codes
3. Binary arithmetic
   - addition, subtraction
   - 1's compliment subtraction
   - signed number codes, 2’s compliment numbers

III Binary logic

1. Basic logic functions
   - AND, OR, EXOR, NAND, NOR
2. Introduction to Boolean algebra
   - Algebraic properties
   - DeMorgan's rules
   - Karnaugh Maps

IV Electrical devices to perform logic

1. The basic logic gates
2. The logic of arithmetic
3. The flip-flop circuit
   - construction and basic operation
   - flip-flop types and application
   - memory and counters
4. Laboratory experiments with logic devices

V Registers

1. Buffers, counters and shift registers
2. Synchronized operation
3. The tri-state concept
4. Examples of registers
5. Memory devices
   - addressing
   - memory types
6. Laboratory examples of register and memory operations in the computer.

VI Computer architecture

1. Bus organization
2. Sequential operation of registers
3. Programmed instructions
   - instruction fetch cycle
   - instruction operation cycles

VII Assembly language programming: basic instruction types

1. Data transfer
2. Addressing modes
3. Laboratory examples
4. Arithmetic and logic operation
5. Review of flags
6. Laboratory examples

VIII Branching of the program operation sequence

1. Unconditional branching
2. Conditional branching
3. Relative addressing
4. Laboratory examples
5. Subroutines and stack operation
6. Utility program examples
7. Laboratory examples

IX Interfacing topics

1. Handshaking
2. Parallel data transfer
3. Laboratory examples
4. Serial data transfer, the AY3-1015 UART
5. Optional laboratory example
6. Digital to analog and analog to digital conversion
7. Laboratory examples