

Assignments on Computer Organization and Architecture

CS-350: Computer Organization

© 2004 Charles Abzug

Textbooks:

- (1) NULL, LINDA; & LOBUR, JULIA (2003). *The Essentials of Computer Organization and Architecture*. Sudbury, MA: Jones & Bartlett Publishers, Inc. QA76.9.C643 N85 2003; 004.2'2—dc21; 2002040576; ISBN 0-7637-0444-X.
- (2) ANDREWS, JEAN (2003). *A+ Guide to Hardware: Managing Maintaining, and Troubleshooting. Second Edition*. Boston, MA: Course Technology. ISBN 0-619-18624-0.

NOTE on how you are to perform the assigned laboratory exercises on digital computers: Electricity can be dangerous when not handled properly. I don't want any student to get hurt while doing the assigned exercises. Therefore, I **require** you to take the following precautions:

1. Consider the monitor and the power supply both to be “black boxes”. Do **not** at any time remove their covers or attempt to access their interior circuits. Never put your hand inside either the monitor or the power supply. As Andrews states on page 93: “Both the power supply and the monitor can hold a dangerous level of electricity **even after they are turned off and disconnected from a**

power source. The power supply and monitor **[both]** have enough power inside them to kill you, **even when they are unplugged**” (emphasis added).

2. I require you **always** to unplug the power cord of the PC from the 120-volt line before you work inside the case, and to leave it unplugged until you are finished tinkering around inside. Even though your book points out that leaving the power cord plugged in with the power switch turned off helps to prevent damage to the integrated-circuit chips caused by static electric discharge due to handling, I prefer to risk damaging the chips to damaging any of my students. The chips are cheap and are easily replaced, but my students are precious to me, and I want you all to remain hale and hearty through the end of the semester and beyond. So be sure the power cord is detached from the wall socket before you touch anything inside the case.

NOTE on Your Reading Assignments: You would be well-advised, as you do your reading for the course, to make up a glossary of new and unfamiliar technical terms that you encounter. This glossary can serve as an aid to you subsequently, when you are studying or reviewing the course material. Similarly, maintain a list of acronyms, and whenever you encounter a new and unfamiliar one, add it to your list along with the definition of what it stands for. You **will** be responsible for knowing the correct meaning of all technical terms and of all acronyms that appear anywhere in your assigned readings.

Assignment 1:

Introduction, and Representation of Data in Computer Systems:

REQUIRED READINGS:

1. Null and Lobur's Chapter 1: *Introduction*.
2. Null and Lobur's Chapter 2, *Data Representation in Computer Systems*. Skip page 48 and the top of page 49, through example 2.15.
3. Abzug, Charles (2002). [Tutorial on the Representation of Numbers in Digital Computers, and on Digital Integer Arithmetic](#), pages 1-17.

RECOMMENDED READINGS:

4. Chapters 1 (*Analog versus Digital*), 2 (*Atoms, Molecules, and Crystals*), 3 (*Conductors and Insulators*), 4 (*Semiconductors: Diodes and Transistors*), 5 (*Primitive Logic Functions*), 6 (*Using Transistors to Build Primitive Logic Functions*), 7 (*Alternative Numbering Systems*), and 9 (*Boolean Algebra*) in: MAXFIELD, CLIVE RICHARD (2002). *Bebop to the Boolean Boogie. An Unconventional Guide to Electronics Fundamentals, Components, and Processes*. Boston, MA: Newnes (an imprint of Elsevier Science). TK7868.D5M323 2002; 621.381—dc21; 2002038930; ISBN 0-7506-7543-8.

REVIEW & STUDY: [Review Questions on Digital Number Representation](#), particularly questions 5, 6, 7, 8, 9, 10, and 11. Try answering each of these questions by yourself, without looking at the answers that appear later in the document. Afterwards, check in the second part of the document to see if your answers are correct.

Null & Lobur's Chapter 1: Review of Essential Terms and Concepts: #s 1-7, 13, 18, 20-22, 24-26, and 28. Exercises 2, 3, 5, 7, and 10.

Null & Lobur's Chapter 2: Review of Essential Terms and Concepts: #s 1-8, 12, 14-18, 21, 22, and 26-32.

DELIVERABLE for ASSIGNMENT 1: There is no deliverable for this assignment.

Assignment 2:

Overview of the Wintel PC:

REQUIRED READINGS:

1. Andrews' Chapter 1: *How Computers Work*.
2. Andrews' Chapter 2: *How Hardware and Software Work Together*.

RECOMMENDED READING:

3. Chapters 10 (*Karnaugh Maps*) and 11 (*Using Primitive Logic Functions*) in: MAXFIELD, CLIVE RICHARD (2002). *Bebop to the Boolean Boogie. An Unconventional Guide to Electronics Fundamentals, Components, and Processes*. Boston, MA: Newnes (an imprint of Elsevier Science). TK7868.D5M323 2002; 621.381—dc21; 2002038930; ISBN 0-7506-7543-8.

REVIEW & STUDY: My personally-authored [Review Questions on Digital Number Representation](#) (access the document from the course web page), particularly questions 5, 10, and 11. Try answering each of these questions by yourself, without looking at the answers that appear later in the document. Afterwards, check in the second part of the document to see if your answers are correct.

Andrews' Chapter 1: Review Questions #s 3, 7, 9-17, and 20.

Andrews' Chapter 2: Review Questions #s 1-3, 5, 10, 14-20, 23, 25, and 27.

DELIVERABLE for ASSIGNMENT 2, PART 1: Null & Lobur's Chapter 2: Exercises 6-10, 16, 17, 41, 42, and 43. Hand in your answers to these questions in hardcopy form on the due date for Assignment 2. A good-faith effort to solve each of these problems is required for you to receive full credit for this assignment, regardless of whether your answers are right or wrong.

DELIVERABLE for ASSIGNMENT 2, PART 2: Do the Hands-On Project on Andrews' page 47: "Identifying Motherboard Components", and on page 48: "Examining Your Computer". Hand in a labeled copy of Figure 1-47, and also a printout of **just** the tab that shows the CPU information and the amount of memory on the computer.

Assignment 3:

Basics of the WIntel PC:

REQUIRED READINGS:

1. Andrews' Chapter 3: *Electricity and Power Supplies*.
2. Andrews' Chapter 4: *The Motherboard*.
3. Abzug, Charles (2002). [Tutorial on the Representation of Numbers in Digital Computers, and on Digital Integer Arithmetic](#), pages 18-end.

RECOMMENDED READING:

4. Chapter 14 (*Integrated Circuits*) in: MAXFIELD, CLIVE RICHARD (2002). *Bebop to the Boolean Boogie. An Unconventional Guide to Electronics Fundamentals, Components, and Processes*. Boston, MA: Newnes (an imprint of Elsevier Science). TK7868.D5M323 2002; 621.381—dc21; 2002038930; ISBN 0-7506-7543-8.

REVIEW & STUDY: My personally-authored [Review Questions on Binary Integer Arithmetic](#) and [Review Questions on Power Supplies](#) (access both documents from the course web page). Try answering each of these questions by yourself, without looking at the answers that appear later in the document. Afterwards, check in the second part of the document to see if your answers are correct.

Andrews' Chapter 3: Review Questions #s 3-11, 13, 14, 16-18, 24, 25, and 29.

Andrews' Chapter 4: Review Questions #s 3, 5-7, 9, 12, 14, 15, 27, 28 and 30.

DELIVERABLE for ASSIGNMENT 3, PART 1: Andrews' Chapter 3: Hands-On Projects on pages 133-141: (1) "Energy Star Features on a PC", (2) "PC Power Supply Facts", (3) "Research the Market for a UPS for Your Computer System", (4) "Wattage Used by Your Drives", and (5) "Taking Apart a Computer and Putting It Back Together". You may do these projects either on your computer at home or on one of our Computer Science Department computers in the lab, but it is strongly suggested that you do exercise 5 in the lab, so as not to risk putting your personal computer out of commission.

DELIVERABLE for ASSIGNMENT 3, PART 2: Andrews' Chapter 4: Do all of the Hands-On Projects on pages 203-205:

Assignment 4:

Digital Logic Circuits:

REQUIRED READINGS:

1. Null and Lobur's Chapter 3: *Boolean Algebra and Digital Logic*.

REVIEW & STUDY: My personally-authored [Review Questions on Design and Construction of Digital Computers](#) (access the document from the course web page). Try answering each of these questions by yourself, without looking at the answers that appear later in the document. Afterwards, check in the second part of the document to see if your answers are correct.

Null & Lobur's Chapter 3: Review of Essential Terms and Concepts: #s 2-6, 8, 9, 11-16, 18, and 19.

DELIVERABLE for ASSIGNMENT 4: Null & Lobur's Chapter 3: Exercises 1-5, 7, 8a, 9a, 14, 15 using truth tables, 16 using truth tables, and 17 using truth tables.

Assignment 5:

Input and Output:

REQUIRED READINGS:

1. Andrews' Chapter 5: *Supporting I/O Devices*.

REVIEW & STUDY: Andrews' Chapter 5: Review Questions #s 1, 2, 7, 9, 11, 21, 24, 25, 31, and 32.

DELIVERABLE for ASSIGNMENT 5, PART 1: Null & Lobur's Chapter 3: Exercises 18, 19, 23, 24, 26-30, 33, 36, and 38-41.

DELIVERABLE for ASSIGNMENT 5, PART 2: Do the Hands-On Projects on Andrews' pages 271-273: "Installing a Device", "Searching the Internet for an Older Video Driver", "Exploring Parallel Port Modes", and "Working with a Monitor", items 1 through 4. Hand in a brief report indicating what adjustments you have made, and describing the visual results of the changes that you made in the display parameters.

Assignment 6:

Basic Computer Organization and Architecture:

REQUIRED READINGS:

1. Null and Lobur's Chapter 4: *MARIE: An Introduction to a Simple Computer*.

REVIEW & STUDY: Null & Lobur's Chapter 4: Review of Essential Terms and Concepts: #s 1, 3-8, 10-13, 15, 18-23, 25-26, 28, 30-34, 37-38, and 40-41.

DELIVERABLE for ASSIGNMENT 6: Null & Lobur's Chapter 4: Exercises 2-12, 14, 16-19, 22, and 26.

Assignment 7:

Primary and Secondary Storage:

REQUIRED READINGS:

1. Andrews' Chapter 6: *Memory and Floppy Drives*.
2. Andrews' Chapter 7: *Understanding and Supporting Hard Drives*.

REVIEW & STUDY: Andrews' Chapter 6: Review Questions #s 1, 4-5, 15, 18, 19, and 23-26.

Andrews' Chapter 7: Review Questions #s 1, 3-4, 6, 13, 16, 19, 23, 27, and 30.

DELIVERABLE for ASSIGNMENT 7: Do the Hands-On Projects on Andrews' pages 319-320: "Upgrading Memory", "Troubleshooting Memory", and "Troubleshooting and Installing Floppy Drives", items 2 through 4. Also do the Hands-On Projects on Andrews' pages 373-375, "Examining a Hard Drive's BIOS Settings", "Preparing for Hard Drive Hardware Problems", and "Install a Hard Drive". Hand in a brief report indicating what you did, and describing what results you obtained.

Assignment 8:

Instruction-Set Architecture:

REQUIRED READINGS:

1. Null and Lobur's Chapter 5: *A Closer Look at Instruction Set Architectures*

REVIEW & STUDY: Null & Lobur's Chapter 5: Review of Essential Terms and Concepts: #s 1-2, 4-9, 11-16, 18, and 20.

DELIVERABLE for ASSIGNMENT 8: Null & Lobur's Chapter 5: Exercises 1-3, 5, 7, 11, 12, 18, and 19.

Assignment 9:

The Memory Hierarchy:

REQUIRED READINGS:

1. Null and Lobur's Chapter 6: *Memory*

REVIEW & STUDY: Null & Lobur's Chapter 6: Review of Essential Terms and Concepts: #s 1-2, 4-6, 8-16, 19-27, 30-31, and 33.

DELIVERABLE 1 for ASSIGNMENT 9: Null & Lobur's Chapter 6: Exercises 1-4 and 9.

DELIVERABLE 2 for ASSIGNMENT 9: A PC with an Intel 486 processor has been placed in the Organization and Architecture Lab (ISAT/CS Room 150). Using this computer, redo the exercise, "Examining Your Computer" that appears in Andrews' page 48, and also "Examining the Motherboard in Detail" that appears on page 203. Is there a Floating-Point Co-Processor on this machine? If your answer is "yes", then indicate where it is, and if "No", then indicate how do you know that.