SYLLABUS

Computer Science 170

Computer Operations & Architecture, I
Lectures: 3 Hours, 3 Credits
Tuesday & Thursday 4:20 to 5:35 PM
Kaufman Hall 224
Instructor: C. E. Grosch

Text:
Computer Organization & Design; The Hardware/Software Interface, 2nd Ed.
David A. Patterson and John L. Hennessy

General Description of the Course
This course is designed to present the fundamentals of the operation and architecture of modern digital (really binary) computers. It is the first course in a two semester sequence; CS 170/270. In this first course, CS 170, I assume that you have no background in and know nothing of programming, computer architecture, organization and operation. CS 170 is an entirely self contained course with no prerequisites. CS 170 is a prerequisite for CS 270. Throughout both 170 and 270 I will be emphasizing:

• The importance of performance.
• The strong connection between the hardware and software.

What is this course about and why is it important?
Computer Architecture is Instruction Set Architecture plus Computer Organization and Operations. Instruction Set Architecture is an abstract interface between the hardware and the lowest level software of a machine. It encompasses all of the information necessary to write a correct machine language program and includes specifying the instructions, number, size and functions of the registers, the memory size and how it is accessed and so on. Computer Organization defines the capabilities and performance characteristics of the principal functional units, the ways in which these are interconnected, how information flows between components and the logic and ways in which the information flow is controlled. Computer Operations are the ways in which the functional units act.

Why is the material in this course and in CS 270 important? I can do no better than quote the author’s comments in the Preface to the Text. “We believe that learning in computer science and engineering should reflect the current state of the field, as
well as introduce the principles that are shaping computing.” “Modern computer
technology requires professionals of every computing specialty to understand both hardwire and software. The interaction between hardwire and software at a variety of levels also offers a framework for understanding the fundamentals of computing.”

“Thus, our emphasis in this book is to show the relationship between hardwire and software and to focus on the concepts that are the basis for current computers.”

Textbook and Outline of the Course Material
The same textbook will be used in both CS 170 and CS 270. It is important that you read and study the text. Generally, it will be helpful to you if you “skim” the chapter before I begin discussing the material in it; this will give you an overview. After my lectures you should read the relevant chapter in depth. You are responsible for all of the material in each of the chapters listed above unless I specifically state otherwise. In addition to the text I will use handout material which will be given to you in class throughout the semester.

The material to be covered in this course and the corresponding chapters of the text are:

1. Overview of the Course, some terminology and basics of binary numbers including One’s and Two’s Complement representation.

2. Basics of Computer Logic: Appendix B, Sections B.1 through B.5. Topics include the basics of Boolean Algebra, truth tables and logic equations; AND, OR, NOT, NAND and NOR gates; combinatorial logic including decoders and multiplexors, PLAs and ROMs; clocks and timing; memory elements including Flip-Flops, Latches, register files, SRAMs and DRAMs.

3. Abstractions and Technology: Chapter 1. System hierarchy, overview of a computer; integrated circuit technology and the cost of integrated circuits.


5. Instruction Sets and Operations: Chapter 3. An overview of computer organization and operation; operations and operands; basics of the MIPS assembly language; arithmetic, load/store and control instructions; instruction representation in machine language; examples of other (PowerPC and I80X86) instruction sets.

The text contains terms which may be unfamiliar to you. At the end of each chapter there is a list of the key terms introduced in that chapter; these are completely defined in the Glossary, Appendix G. I urge you to list each of these new terms in your notes and append the definitions of them to them.
**Classroom Behavior**

I strongly encourage you to ask questions in class. Do not be afraid to ask questions. If you have a question about the material being discussed it is likely that others in the class have the same or similar questions. I will either answer your question at once (assuming that I can) or, if the answer will come later on in the lecture, I will say so. If you don’t ask questions I can only assume that you understand all of the material completely.

All cell phones and pagers are to be turned off when you are in the classroom, not just while class is in session. If you are waiting for an urgent call, wait outside of the classroom.

Do not carry on conversations with others while class is in session. If you think that you are speaking quietly and not disturbing others, including me, you will be wrong. If I become aware of any disruptive behavior occurring in class I will ask that it stop. If it does not stop I will ask those participating in the disruptive behavior to leave immediately.

**Homework Assignments**

There will be 7 homework assignments. These are:

1. Convert the binary numbers (a) 1000 1001, (b) 0101 1101, (c) 1111 1111 1111, (d) 1111 1101 to decimal numbers. Convert the decimal numbers (e) 27, (f) 129, (g) 71, (h) 170 to binary numbers. In base 12 the symbols are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, P, Q. (i) Convert the base 12 number \((Q237P)_{12}\) to a decimal number. Express the decimal numbers, (j) 23 and (k) 137 in One's and Two's complement binary form.


4. Problems 1.1 to 1.45; 1.49 and 1.50.

5. Problems 2.13, 2.16, 2.18, 2.20, 2.21, 2.26, 2.27, 2.31, 2.32, 2.41 and 2.43.

6. Problems 3.1, 3.2, 3.3, 3.4, 3.5, 3.7 and 3.10.


Each of these homework assignments will be collected and graded on a range of 0 to 10.

I will announce, in class, when each assignment is due. In general, homework problems assigned in week \(N\) will be due in class on the same day of week \(N + 1\) or \(N + 2\). You should keep copies of the homework which you hand in. Solutions for the homework will be handed out when the homework is returned.
I strongly urge you to read the homework problems as soon as I make the assignment; do not wait until the day before they are due. If you have trouble understanding what is being asked for in a homework assignment you should ask me in class, during my office hours or by making an appointment to see me.

Late Homework Assignments
Unless you have an excellent excuse, such as illness, an accident, etc., you will lose 1 point for each day for which the homework is late. In order to receive any credit for late homework you must write an explanation as to why the homework is late, sign it and attach it to the homework when you hand it in. Do NOT send me homework via email; I must have paper copies to give to the homework grader.

Grades, Tests and the Final Examination
Your grade will be based on a total of 100 points. The homework will count for 20 points. There will be two tests and each will count for 20 points for a total of 40 points. The final examination will be comprehensive and will count for 40 points. The Tests and Final Examination will be open book and notes.

The tests will be given on (1) Thursday, 25 September and (2) Thursday, 6 November. A solution for each test will handed out when the test is returned. If you are absent from class when the test is handed out you may pick up your test and the solution at the next class.

Thursday, 4 December is the last day of class for CS 170. The Final Examination will be held on Tuesday, 9 December from 3:45 to 6:45 PM in Kaufman Hall 224.

There will be no class on Tuesday, 14 October (Fall Holiday) and Thursday, 27 November (Thanksgiving Holiday).

Office hours, appointments, email, messages and phone calls
My office hours are: Monday, 10:00AM to 2:00PM in Room 207 Crittenton Hall and Tuesday, 3:00PM to 4:00PM in Room 252-6 Education Building. Crittenton Hall is on West 52nd Street off Colley Avenue. The Gray Campus Bus stops in the parking lot of Crittenton Hall. You may also see me by appointment. You may call me at 683-4931 or 683-4585. You may send me email at enright@cpo.odu.edu or at grosch@cs.odu.edu. You may also leave messages, papers, etc. for me at the CS Department Office. The Department staff will send me email and/or put material in my mailbox.

DO NOT PUT MESSAGES OR PAPERS UNDER MY OFFICE DOOR!