

J. Stanley Warford

Computer Systems

FIFTH EDITION

CS-334 Computer Architecture Fundamentals

25 Aug. – 15 Dec. 2018

On-line course, web conferencing 8:30-9:45AM Fridays

Instructor: Dr. Cartledge

<http://www.cs.odu.edu/~ccartled/Teaching>

• Topics

- Number Representation and Boolean Algebra
- Combinational Circuits
- Arithmetic Units and Memory System
- Microprogrammed Control Units
- Architecture of Microcomputers
- Component-based System Development
- Performance Evaluation of Competing Architectures

• Academic prerequisites:

- MATH-163
- CS-150 and a final grade of C or better

• Text

- J. Stanley Warford, "Computer Systems," 5th Edition

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1 Course description

Topics include: number representation, base conversion, Boolean algebra, combinatorial circuits, arithmetic units, registers, memory, hardwired and microprogrammed control units, architecture of typical microcomputers, and the development of systems from basic components. The performance of competing architectures will be a major concern. This course satisfies the requirements of both CS 170 and CS 270. This web-based course requires considerable maturity and independent responsibility on the part of the student. Prerequisites: MATH 163 and a grade of C or better in CS 150 (or an equivalent course in a high level language).

Students will need to have prior programming experience as well as being prepared in mathematics at least through pre-calculus. The background requirement is firm as many of our explanations will be in terms that will only make sense to those with programming experience and we will also assume the students are proficient in algebra. Students must be comfortable using the Internet, e-mail and software, including a word processor. Students must be highly disciplined and motivated in the art of self-learning. This includes being able to efficiently read, absorb, and retain new information, as well as being fully capable of studying and understanding new concepts and technical ideas in a timely and independent manner.

2 Course outline

The goal of this course is to give students a clear understanding of the architecture and organization of modern computers, and the cost and performance tradeoffs involved in their design.

Topics :

- Number Representation
- Boolean Algebra
- Combinational Circuits
- Arithmetic Units
- Memory System
- Microprogrammed Control Units

- Architecture of Microcomputers
- Component-based System Development
- Performance Evaluation of Competing Architectures

Textbook :

- Required: J. Stanley Warford, "Computer Systems," Jones and Bartlett Publishers, 5th Edition
- Reference: David A. Patterson and John L. Hennessey, "Computer Organization and Design: The Hardware/Software Interface," Morgan Kaufman Publisher

3 Assignments

Homework assignments are to be submitted as instructed - typically via Blackboard, on or before the due date. Any assignment submitted after its deadline is considered late. Assignments that are submitted late by one day - 30% off penalty, 2 days - 50% off, 3 days and beyond - not graded and no credit be awarded. Quizzes are administered via Blackboard. Quizzes expire on the due date, and cannot be taken after they have expired and become unavailable. (See section Revisions for additional information.)

4 Grading

Homework, quizzes, and exams will have different weights. (See section Revisions for additional information.)

Area	Percentage
Homework Assignments	20
Online Blackboard Quizzes	20
Exams	60

The overall grading scale is:

Table 1: Grading scale

Range	Grade	Grade points
94 - 100	A	4.00
90 - 93	A-	3.70
87 - 89	B+	3.30
82 - 86	B	3.00
80 - 81	B-	2.70
77 - 79	C+	2.30
73 - 76	C	2.00
70 - 72	C-	1.70

(Continued on the next page.)

Table 1. (Continued from the previous page.)

Range	Grade	Grade points
67 - 69	D+	1.30
63 - 66	D	1.00
60 - 62	D-	0.70
0 - 59	F	0.00
N/A	WF	0.00

5 Course Policies

You are responsible for the contents of all lectures and presentations. If you know that you are going to miss a lecture, have a reliable friend take notes for you although slides will be available. Of course, there is no excuse for missing assignment due dates or exam days.

6 Academic Integrity / Honor Code

By attending Old Dominion University you have accepted the responsibility to abide by the honor code. If you are uncertain about how the honor code applies to any course activity, you should request clarification from the instructor. The honor pledge is as follows:

“I pledge to support the honor system of Old Dominion University. I will refrain from any form of academic dishonesty or deception, such as cheating or plagiarism. I am aware that as a member of the academic community, it is my responsibility to turn in all suspected violators of the honor system. I will report to Honor Council hearings if I am summoned.”

In particular, submitting anything that is not your own work without proper attribution (giving credit to the original author) is plagiarism and is considered to be an honor code violation. It is not acceptable to copy source code or written work from any other source (including other students), unless explicitly allowed in the assignment statement. In cases where using resources such as the Internet is allowed, proper attribution must be given.

Any evidence of an honor code violation (cheating) will result in a 0 grade for the assignment/exam, and the incident will be submitted to the Department of Computer Science for further review. Note that honor code violations can result in a permanent notation being placed on the student’s transcript. Evidence of cheating may include a student being unable to satisfactorily answer questions asked by the instructor about a submitted solution. Cheating includes not only receiving unauthorized assistance, but also giving unauthorized assistance. For class files kept in Unix space, students are expected to use Unix file permission protections (chmod) to keep other students from accessing the files. Failure to adequately protect files may result in a student being held responsible for giving unauthorized assistance, even if not directly aware of it.

Students may still provide legitimate assistance to one another. Students should avoid discussions of solutions to ongoing assignments and should not, under any circumstances, show or share code solutions for

an ongoing assignment. All students are responsible for knowing the rules. If you are unclear about whether a certain activity is allowed or not, please contact the instructor.

7 Revisions

Changes/additions to the original syllabus:

1. **Extra credit:** Extra credit is available in the form of a paper approximately 10 pages in length dealing with computer hardware to the level of detail in the text.

Weighting:

The extra credit work will be worth an additional 5% of the course grade, if you choose to undertake it. To be clear, your initial grade will be based on the percentages for quizzes, homework, and exams as per the syllabus. That grade may be increased by as much as 5%, depending on how well you do on the extra credit. You do not have to do any extra credit work. Extra credit is recognition of work over and beyond what is normally expected.

Topic:

CS-334 is an introductory hardware course, so the paper should focus on hardware to about the same depth as in the text. Take a piece of computing hardware that you have (that could be your laptop, desktop, phone, trying to get information about wearables, TVs, and things like Alexa maybe too hard), and deconstruct it. For instance, if you are looking at a phone, what kind of CPU does it have (is it based on ARM technology, or not), does it use von Neumann or Harvard architecture, what is its instruction width (the Pep/9 is 8 bits not including operand), what kind of disk drive does it have (SSD, mechanical, others), what type of bus is used between the CPU and the various peripherals, how much of what type of RAM does it have, is the RAM expandable or not and if so what restrictions are there. Again, this is a hardware course, so the paper needs to be about hardware.

Format:

PDF. About 10 double spaced pages of text. The page count does not include the frontmatter (title page, table of contents, list of figures, list of tables, etc.), does not include the backmatter (references, appendices, supplemental data sheets, etc.), does not include page matter like headers and page numbers in footers, and does not include figures or tables. You can use whatever font size you desire, but the page count will be based on the number of words extracted from the report using the Linux `pdftotext` program. A double spaced page will have about 2,000 characters, or about 400 hundred words. While things like increasing font size will increase the page count, it will not increase the number of words. If you use figures (and I encourage you to do so), then the figures must be referenced in the text. The same goes for tables. Tables and figures that are not referenced in the text are just so much eye clutter and add nothing to the paper's topic. A similar requirement applies to the references. It is extremely unlikely that you will be able to write a paper about computer hardware, and not have references. I am indifferent to the reference citation style, and format. Whichever word, or text processing program you use to create the report will have a plethora of different styles, choose one.

The paper should reflect the computer system you are interested in, whether that is a "traditional" computer system, or one of the more ubiquitous and smaller ones from the Internet of Things. Dissect the device and write coherently about it.

Due date:

12 Dec. 2018 (earlier is better)

2. **Grade forgiveness:** Some people have expressed a desire to have their some of their lowest grades forgiven. I cannot do that on an individual-by-individual basis, but I can do that on a class basis. I will drop the lowest homework, and the lowest quiz grade. I will not drop the final exam. The final exam will have one part focused on chapter 12, and the rest will be comprehensive.

Supplemental URLs:

- **Link to the text via Safari:**
<http://proquest.safaribooksonline.com.proxy.lib.odu.edu/book/information-technology-and-software-9781284079647>
- **Errata page for the text:**
<http://computersystemsbook.com/editions/fifth-edition-errata/>
- **Warford's [our author] home page for his CsSc 330 class, including chapter lecture slides first six chapters**
<https://www.cslab.pepperdine.edu/warford/cosc330/>
- **Video recordings of his lectures for the class**
<https://www.cslab.pepperdine.edu/warford/cosc330-5e-videos/>
- **Warford's [our author] home page for his CsSc 425 class, including chapter lecture slides second six chapters**
<https://www.cslab.pepperdine.edu/warford/cosc425/>
- **Video recordings of his lectures for the class**
<https://www.cslab.pepperdine.edu/warford/cosc425-videos/>