



Introduction

ICS312 Machine-Level and Systems Programming

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Course Goal

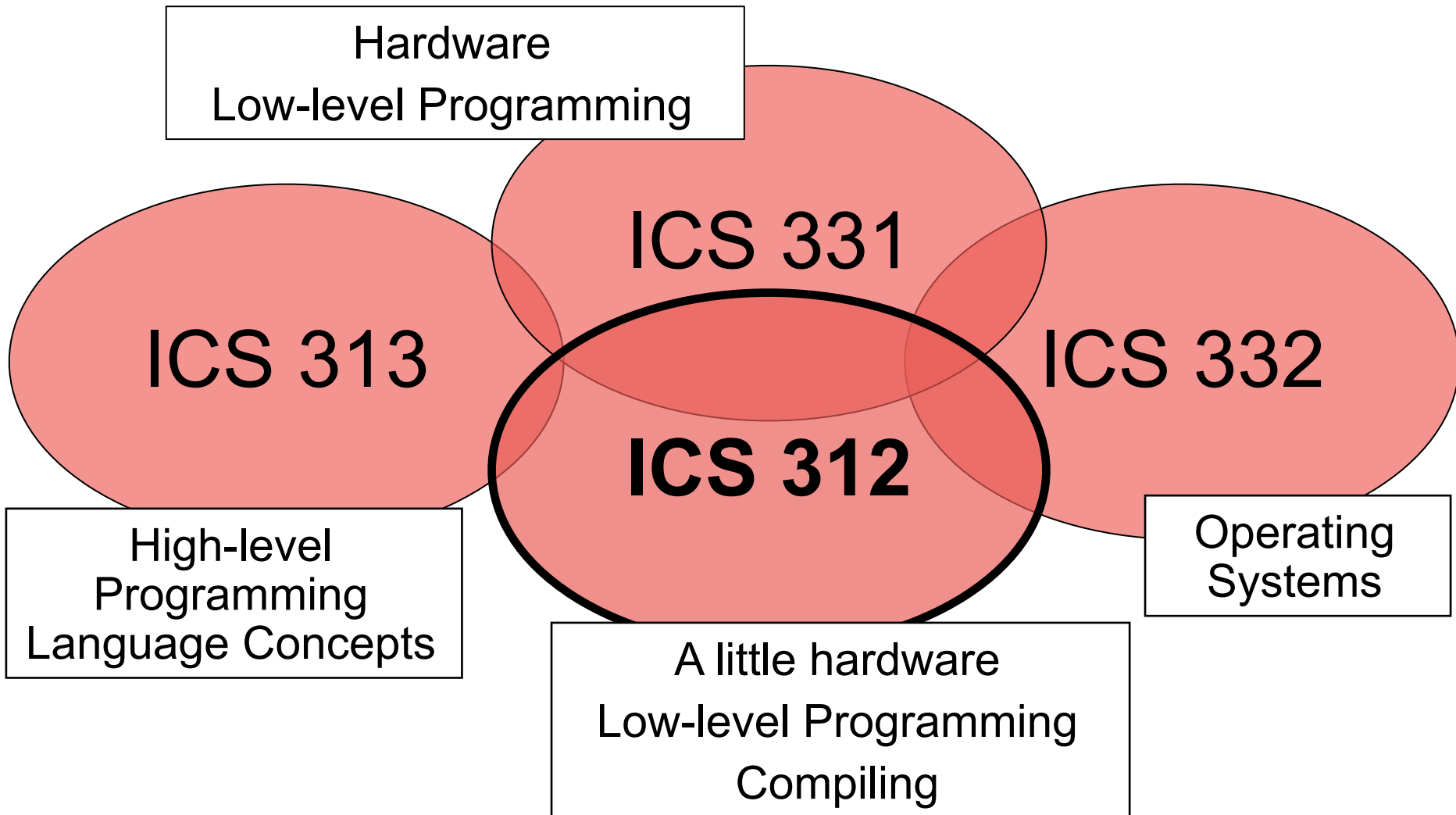
- At this point in your computer science education, most of you have only a very high-level understanding of how a computers run programs
- Your experience so far: you write code in some language (say a compiled language), you build it, and then you run it
 - Each of these steps involve hitting buttons in IDEs or typing some Shell commands
- You all know how to do this, but (most of) you have only very superficial understanding beyond “this magically creates an executable”, “this magically runs an executable that my CPU magically knows how to do”
- A big part of being an effective (and employable) computer scientist is knowing what the magic is, which is the goal of this course



What we will learn

- What is inside a computer?
 - Elements of computer organization
 - Elements of computer architecture
- Assembly programming
 - Intel x86 Assembly
- What is compiling, linking, loading, and debugging?
- How does one build a compiler?
 - We'll build a small one
- **This is a hands-on course**
 - Writing (pieces of) programs in x86 assembly
 - Tiny bits of C (to be read) and Java (to be written)

ICS312 and the ICS Curriculum

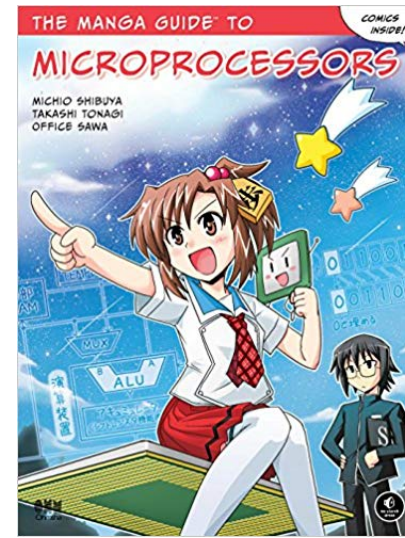


Course Website

- Located at:
 - http://courses.ics.hawaii.edu/ics312_spring2025/
 - Linked from my personal homepage
 - Google for “Henri Casanova”
- Organized as Modules
 - All lecture notes as PDF files
 - Pointers to useful on-line material
 - All assignments
 - Announcements
 - A link to the Syllabus
 - Which we’re going over now in these slides
- Let’s look at the Web site...

Textbook(s)

- The main text is a **free** book:
 - *PC Assembly Language*, Paul A. Carter
 - Available for download on the course's Web site
- The user's manual for our assembler, NASM, is also available on the course's Web site, and other manuals will be made available throughout the semester
- Other interesting free resource available for download:
 - *The art of assembly programming*, John W. Lockwood
 - *Assembly Language for x86 Processors*, Kip Irvine
- See links from the Syllabus on the Course Web site
- A former ICS 312 student highly recommended this textbook: *The Manga Guide to Microprocessors*
 - I am not affiliated with the author/publisher in any way and I have not read it



Lectures and Office Hours

- Lectures in KUY 301, Tue/Thu 3PM-4:15PM
- Lecture notes are posted on the course's Web site regularly
 - You can read them before or after the lecture, up to you really
 - I am notorious for spacing out on putting the notes up on the site, so just drop me a one-line e-mail
- Office hours, teaching assistant, etc.
 - All information on the Web site

Inverted Lectures

- A *few* lectures will be “**inverted**”
 - You watch a screencast at your own pace
 - The lecture period is for questions and practice exercises
- I do this for a few topics in the course that are more “mechanical” or “difficult”
- **You must watch the screencast ahead of time!**
 - E-mails reminders will be sent out
- Scheduling may be imperfect
 - Out-of-order and/or overlapping modules
 - We might end a few lecture periods early

Screencast Lectures

- A few lectures might be **screencast**
 - This is because I am often required to travel to conferences or to the National Science Foundation during the semester
- More information later if necessary...

Course Content

- In spite of my best efforts it happens that the course Web site could have small problems (typos, missing link, etc.)
- Anytime you see anything strange/broken on the Web site, please let me know right away!
 - A one-line e-mail, a DM on Discord, etc.

Grading on 1000 points

- Two exams
 - One midterm exam (250 points)
 - One final exam (280 points)
- Quizzes (70 points)
 - 8 10-point quizzes, worst grade is discarded
- Nine homework assignments (400 points)
 - Homework #1: 16 points
 - Homework #2: 50 points
 - Homework #3: 50 points
 - Homework #4: 50 points
 - Homework #5: 50 points
 - Homework #6: 50 points
 - Homework #7: 50 points
 - Homework #8: 50 points
 - Homework #9: 34 points

CES Evaluation

- Extra credit given to all students:
 - 0 points if CES completion rate is $< 90\%$
 - 5 points if CES completion rate is $\geq 90\%$
 - 10 points if CES completion rate is 100%
- Why?
 - I do look at the evaluation every semester and evolve the course accordingly
 - Even if you love the course, it's important for me to hear what things didn't work
 - These evaluations have more impact than you may think and are taken seriously
 - Impact for individual faculty, for the whole department, for future students, etc.

Quizzes

- 8 Quizzes in the semester
- Taken on the first lecture day of the week
 - Always on a Tuesday, unless that Tuesday is a holiday, in which case it will be on a Thursday
- Always **announced the previous week**
- Taken at the **beginning of the lecture period, in the first 10 minutes**
 - You cannot take the quiz if you show up more than 5 minutes late to lectures
- No make-up quizzes (but worst quiz grade discarded)

Homework Assignments (1)

- All assignments must be turned in electronically using Laulima by 11:55PM on the day the assignment is due
 - Scanned hand-written assignments not allowed
- **Late Assignments**
 - 10% penalty for up to 24 hours of lateness
 - A grade of zero for more than 24 hours of lateness
 - e.g., if the due date is 3/10, an assignment turned in at 1AM on 3/11 will be penalized by 10%, and given a zero if turned in at 5PM on 3/12
- **Solutions will always be discussed in class and available**
- Each semester 1 or 2 students, somehow, assume that the late penalties do not apply to them (not sure what's that's about)
 - For fairness sake, no exceptions will be made (unless there are well-justified, documented reasons)
- Assignments are posted well-ahead of the due date, so that everybody has plenty of time to complete assignments regardless of the wide range of “life” constraints we all face

Homework Assignments (2)

- If Laulima is down, just e-mail us (me and the TA) your submission immediately (don't send an e-mail that says "Laulima is down what should I do?" Which we'll only see the day after)
- **After submitting double-check what you submitted!**
 - "Oops, I submitted an empty file... here is what I really meant to submit yesterday" will not be accepted
- **Solutions will always be discussed in class and available upon request**

Homework Assignments (3)

- All assignments are individual (no group assignments in this course)
- Some assignments will be “pencil-and-paper” and require no programming
- Some assignments will be programming assignments
- Pencil-and-paper and programming assignments can overlap in time



Homework Assignments (4)

- Instructor/TA will not answer assignment-related e-mails on the day the assignment is due!

How to not do well in this course?

- **Don't come to class (“the slides are nice”)**
 - We do a LOT of stuff in class, including live coding, and I give a lot of explanations, examples
- **Start assignments late (“I work better under pressure”)**
 - Assembly programming and compilers are difficult topic
 - Starting late seems to be a growing trend, and it's a problem
 - Read the assignment early to subconsciously start thinking about it
- **Don't turn in assignments**
 - Every semester some students do not turn in assignments and then seem surprised to fail (not sure what that's about)
 - Just count your points to know where you're at!
- **Don't come to office hours (“The instructor is scary because he shows ‘how to no do well in this course?’ slides”)**
 - After you struggle for a while on something, drop by
 - But don't expect to “camp” in the office hours for the solutions to be given out
 - Instructor and TA office hours are an amazing service provided to you, and yet, they go mostly unused

How to not do well in this course?

■ Cheat

- Almost every semester students are caught cheating
 - Cheating is bad for many reasons, including hurting the reputation of ICS graduates!
 - This is part of the reason for 50% of the course's points being exams
- **If you are caught cheating or enabling cheating:**
 - **zero on the assignment/exam**
 - **overall grade lowered by a step (i.e., a "B" becomes a "C")**
 - **reported to UH's Office of Judicial Affairs (as required)**

■ Expect that "what can I do for extra credit?" will be met with a positive response... it won't

■ Don't study for the quizzes

- "It's only 7% of the grade"
- But studying for quizzes is a HUGE help to prepare for exams
- When I don't do quizzes, the average grade drops!

Show of hands

- To get an idea of your backgrounds here are a few “show-of-hands” questions
 - It’s totally OK if all the answers are “No”, don’t panic
- Have you taken / are taking ICS331?
- Have you taken / are taking ICS313?
- Have you written assembly code before as part of a course?
- Have you written assembly code before not as part of a course?
- If yes to above was it x86, MIPS, other?
- How often are you using the (UNIX/Linux/MacOS) Shell (not implying you are a Shell wizard)?
 - We don’t need much in this course
 - Note that this is something that you will have to do way more than you think beyond graduation
 - The “Getting Started” module has some pointers (let’s look at them quickly)

Software/Hardware for ICS312

- You'll have to use an Intel-based machine that speaks the x86 32-bit Instruction Set Architecture (IA-32)
 - Luckily, we all have that (or can emulate that)
 - In fact we have 64-bit machines!
 - But in this course I use 32-bit assembly because:
 - It has less “stuff” and is better for a first experience
 - We learn exactly the same set of things
 - Our free textbook is about 32-bit assembly
 - When you'll need to go to 64-bit assembly, the transition will be easy
- We'll use the NASM software package, which is also free
- Let's look at **Homework Assignment #0**, which is ungraded but which you should do as soon as possible in the semester
 - Don't show up the day the first programming assignment is due with a “I can't run NASM” problem!



More Questions

- Any questions on the syllabus?
- Any questions on the course in general?
- Do the “participation verification” thing on Laulima!

What's Next?

- There is already an announcement on the course Web site regarding **two short screencasts to watch BEFORE THE NEXT LECTURE**
- These screencasts are about “numbers and computers”
 - Many of you will find them easy and can fast forward a lot of the material
 - Make sure you watch them before this coming Wednesday as we'll do in-class practice exercises to make sure we're all up to speed
- This is all in the Integers and Computers module...
 - let's look at it now...
- And don't forget to get started on **Homework #0...**