

CS107: Computer Organization and Systems

Course Information

Stanford University - Winter 2016-17

Instructor

name: Cynthia Lee
office: Gates 190
office hours: Tuesdays & Fridays 10:00 a.m. - 12:00 p.m. (Gates 190),
see class Google calendar for updates

Course Website

Main site: <http://cs107.stanford.edu/>

Q&A forum: <https://piazza.com/class/ixp4r1nbodp5m8> (self-register)

Course Overview

CS107 is the third course in Stanford's introductory programming sequence (following CS106A and CS106B/X). Our CS106 courses provide a solid foundation in programming methodology and abstractions, and CS107 follows on to develop programming maturity and expand breadth and depth of experience. The course will work **from the C programming language down to the microprocessor** to de-mystify the machine. With a complete understanding of how computer systems execute programs and manipulate data, you will become a more effective programmer, especially in dealing with issues of debugging, performance, portability, and robustness. Topics covered include: the C programming language, data representation, machine-level code, computer arithmetic, elements of code compilation, performance optimization, and memory organization and management.

Units

Undergraduates must take the course for 5 units. Graduate and professional students may opt for 3-5 units. Course requirements and grading are the same regardless of number of units.

Who Should I Email/Contact?

- **Miscellaneous basic policy questions** (When is the midterm? How do assignment due dates work?): Re-read this course information document and the course website. Any additional questions post to **Piazza**.
- **Help with assignments or course topics:** **Piazza**, or ask TA during lab or office hours. **Private post on Piazza** if the matter should be hidden from other students but is not of a very sensitive or confidential nature (e.g., something about your code, as opposed to a confidential health issue or similar).
- **Anything very sensitive or confidential:** Email Cynthia Lee at cs107@cs.stanford.edu (also read by TAs) or cbl@stanford.edu.
- I'd be happy to talk to any student any time in office hours regarding career or course advising, questions about research and other opportunities at Stanford, concerns about performance in the class, suggestions for improving the class, good CS-related jokes, etc. Homework help is also welcome in office hours. You don't really need a "reason" to come to office hours—I like to just get to meet as many of you as possible over the 10 weeks, so stopping by to introduce yourself is most welcome! I usually have high quality chocolate of some kind in my office, so that's reason enough, right?

Prerequisites

The prerequisite is programming and problem solving at the CS106B/X level. You should be an accomplished programmer who has practical C/C++ skills in using recursion, dynamic data structures (pointers, linked lists, trees, graphs), data abstraction, classic data structures (lists, stacks, queues, sets, maps), and standard algorithms (searching, sorting, hashing). You should have an appreciation of the intrinsic value of good engineering and design and you will be expected to produce well-decomposed, readable code.

Topics

The following is a rough summary of our course topics schedule for the quarter. The terms on this list might not entirely make sense to you until we begin to cover them, but I list them here so that those who might be candidates for skipping CS107 entirely, or for whom other classes might more directly address their educational goals, can make that determination:

- Week 1: Transition to UNIX and C
- Week 2: Memory and Pointers in C
- Week 3: Void pointers and generic functions
- Weeks 4-5: Data representation (int, ASCII, two's complement, IEEE floating point)
- Weeks 6-7: AMD64 (ALU operations, control flow), compiler optimizations
- Weeks 8-9: Memory allocation details, build process
- Week 10: Quarter wrap-up

Textbook

Computer Systems: A Programmer's Perspective, Bryant & O'Hallaron **3rd edition** (required; **3rd edition actually matters** as it just changed from 32-bit to 64-bit)

The C Programming Language, Kernighan & Ritchie (optional; any C reference including web is fine)

Class Environment

In CS107, there will be significant programming assignments and you can expect to work hard and be challenged. Your effort will pay off—by mastering the machine and raising your programming skills to the next level, you will have powerful mojo to bring to any future project! To make that happen for *everyone*, I strive to create an inclusive and equitable classroom. I further depend on you to help each other obtain excellence rather than mistaking Stanford or this class for a zero-sum game. **Please do your part by seeking to promote the success of others, and by treating each other in ways that respect and celebrate the diversity of talent that is drawn to our exciting field of Computer Science.**

Here are a few specific things you should know about my policies on creating an inclusive and equitable class:

- **Preparation:** Perhaps more than many other subjects, students come to computer science with greatly varying previous exposure to programming and computer science. I want to assure students whose first real experience with programming was in CS106A+B that you are well prepared to succeed in CS107. The same was true of many of the students who are now your TAs!
- **Classroom environment:** For some reason, it seems unusually common in computer science classes that some students ask questions that are not really questions so much as opportunities to demonstrate knowledge of jargon or facts that are beyond the scope of the topic at hand. This can have a discouraging effect on other students who are not familiar with those terms and worry that this indicates that they are less prepared to do well in the class (note: this is rarely the case—knowing terms outside the scope of the course is not a good predictor of success). If you find yourself wanting to make such a question or comment in lecture, I encourage you to consider whether office hours would be a better venue for exploring that topic. I LOVE discussing things that are tangentially related to our class in office hours.
- **Office of Accessible Education accommodations:** If you have an OAE letter, please present it to me at your earliest convenience, so I can ensure that the course materials and staff support comply with your needs. I am always willing to do what it takes to support you, but I ask that you have your exam scheduling requests submitted no later than 1 week prior to the exam, because I must respect our room scheduling staff person's time to make those arrangements.

- **Preferred name and correct gender pronouns:** I want you to be you in our class. You are always welcome to write your preferred name on all class assignments and exams. If you have a name and/or pronoun that doesn't match what our class roster gets from the registrar's office, please let me know and I will ensure we use that in our class.
- **Class expenses (textbook, device for class participation, etc.):** If obtaining any material for use in our class presents a financial hardship for you, please let me know and I will be happy to provide gift or loan items for you as needed.
- **Feedback:** Please do not hesitate to reach out to me, anonymously if you prefer, if any aspect of our course or class community can be improved.

Grades

Your overall course grade will be determined by the following percentage breakdown:

15%	lab participation
35%	homework assignments
12.5%	midterm exam #1
12.5%	midterm exam #2
25%	final exam

See the web pages for more detail on homework/lab breakdown. To receive a passing course grade, you must have passing work on both the coursework and exams. Restated, if you fail the exams, then you will fail the class in spite of any astounding performances on the assignments or vice versa.

You may replace (at most) **one** of your midterm scores with your score on the final exam. If you need to miss a midterm exam for any reason (illness, emergency, conflict with another activity, etc.), or you simply do not score as well on a midterm as you do on the final, this policy will apply. You are not required to formally notify me of your desire to apply the policy; my spreadsheet that calculates final grades will simply apply the formula most favorable to you. It is my goal that the class averages for the three exams be fairly similar, but the final exam average is typically a bit lower. That said, for students who performed very poorly on a midterm, it is not at all uncommon for their final exam score to be significantly higher, hence the score replacement policy.

Grades will be assigned *no stricter than* the usual scale of 90% = A- or better, 80% = B- or better, etc. A more generous curve may be adopted at the instructor's discretion, depending on exam difficulty or other factors.

Lab Participation

The hands-on lab component is one of the most valuable parts of CS107! All students participate in a weekly 2-hour lab section, working in pairs on guided exercises. We will post the lab schedule on the course web site, and you will be able to sign up for a lab from the available options. Lab signup is **first-come first-served**; best to move quickly once signups open if you don't have much schedule flexibility. Signups open Wednesday of 1st Week, 10am.

Lecture

There will be frequent opportunities for participation during lecture: solving problems, responding with mobile app, and group discussion. In short, this class operates more like a conversation than other college classes you may be used to. **Lecture attendance is not required, but everyone present on a given day is expected to sit in groups of about three students and contribute to their group's discussions.** Discussion questions with mobile app votes are used to help me gauge class understanding in real time (rather than waiting until the midterm) and tailor the class to your needs.

Unfortunately, we are not on SCPD this quarter, so there will not be lecture videos.

Exams

Midterm #1 and Midterm #2 will be held outside of lecture time (on Thursdays in the evening). If you must miss Midterm #1 or Midterm #2 due to an exam in another class at the same time or similarly unavoidable and equally high-priority conflict, **you must notify the instructor immediately by filling out this web form:**

<https://goo.gl/forms/bcOvk27IVxJ0aUMr1>

There are no discretionary alternate exams. Family vacations, internships, job interviews, etc., are not allowable reasons to miss an exam.

The final exam will be held during the University-scheduled final exam slot. Please note that University policy prohibits students from enrolling in courses with conflicting lecture times or conflicting final exams, so we do **not give alternate exam times for conflicting Final exam** (except OAE extended time). Stanford athletes only may take the exam on the road under coach supervision, but at the same time as the rest of the class.

The 107 midterms are closed-book (one page of notes, two sides) and the final is open-book (two pages of notes, two sides). No electronic resources may be used in the exam. I know textbooks are expensive and that some students choose not to purchase one, so a very few copies will be available for quick reference during the exam (they stay at the front and do not go back to your seat). A reference page will be included in the exam itself, containing commonly needed information. The purpose of my book/notes policy is to reduce the need for rote memorization of anything (this is a problem-solving course, not a memorization course), but still standardize the playing field in terms of precisely what information students have with them.

Homework Assignments Grading and Working in Pairs

Homework consists of programming assignments done on an individual basis, except for perhaps the very last assignment (to be announced). Pair programming is optional though encouraged on the assignment (if any) where it is allowed. If you submit as a pair, each of you are expected to make a significant contribution toward solving that assignment. You should not claim to be part of a pair submission if you did not contribute significantly to help solve that program. Regardless of pairs, every student is still responsible for learning all course material. Of course, all exams are completed individually. If you work on an assignment as a pair, you must submit as a pair, and you will be given the same grade.

There is extensive, detailed information about assignment grading attached to each assignment specification, as well as information on deadlines and lateness, etc, on our course website. Please refer there if you have further questions.

Honor Code

The Stanford Honor Code is an undertaking of the students and faculty to individually and collectively participate in upholding the highest standards for academic integrity. **Please review the full collaboration policy on our site (<http://cs107.stanford.edu/collaboration.html>) for a thorough explanation of how it applies in this course.** As an instructor, one of the most difficult things that happens in my job is dealing with Honor Code cases where student say they did not realize they were violating the code. For this reason, you must carefully review—and be responsible for all the details contained in—the Honor Code document at the link above.