

15-251: Great Theoretical Ideas In Computer Science

Spring 2006 Course Document

<http://www.cs.cmu.edu/~15251>

This course will take a philosophical and historical perspective on the development of theoretical computer science. The technical material will be self contained, assuming no specific knowledge beyond high school algebra and high school programming.

From a pile of stones to represent and manipulate numbers, humans have progressively developed an abstract vocabulary with which to mathematically represent their world. The ancients, especially the Greeks, realized that they could consistently reason about their representations in a step by step manner. In other words, by computing in abstract models, they could describe and predict patterns in the world around them.

Starting with ancient algorithms for arithmetic, we will revisit the development of mathematics from a computational point of view. Conversely, we will mathematically study the nature of computation itself. What is computation? What is computable, in principle? What is especially easy, or especially hard to compute? To what extent does the inherent nature of computation shape how we learn and think about the world?

Weekly Schedule

LECTURE:	TR 3:00-4:20p	DH 2315
RECITATION SECTION A:	M 10:30-11:20a	PH A18A
RECITATION SECTION B:	M 11:30-12:20p	SH 220
RECITATION SECTION C:	M 12:30-1:20p	SH 220
RECITATION SECTION D:	M 1:30-2:20p	SH 220
RECITATION SECTION E:	M 2:30-3:20p	SH 220
RECITATION SECTION F:	M 3:30-4:20p	PH A18A

Course Staff

Name	Office and Phone	Email	Office hours
Professors:			
Luis von Ahn	Wean 7115, 268-3620	biglou@cs.cmu.edu	Thu 4:30-6:30p
Victor Adamchik	Wean 5121, 268-8121	adamchik@cs.cmu.edu	Thu 4:30-6:30p
TAs:			
Brendan Meeder	Wean 8th floor couches	bmeeder@andrew.cmu.edu	M 7-9p
Matt Wright	Wean 8th floor couches	mrwright@andrew.cmu.edu	Tu 4:30-6:30p
Rob Bayer	Wean 8th floor couches	rbayer@andrew.cmu.edu	M 5-7p
Brian Thompson	Wean 8th floor couches	bthompso@andrew.cmu.edu	Su 7-9p
Matt Streeter	Wean 8116	matts@cs.cmu.edu	M 7-9p
Anton Bachin	Wean 8th floor couches	abachin@andrew.cmu.edu	Th 6:30-8:30p

Text

There is no required text for the course. The material is fairly diverse, and no standard text contains it. Copies of the slides used in the lectures will be handed out or made available on the web. Note that these are not a substitute for coming to lecture — former students of 251 have said that learning the material just from the slides is extremely difficult.

You can check the website for related texts to this course.

Web Page and Bboards

The class Web page will provide a wealth of up-to-date information about the course. The URL is

<http://www.cs.cmu.edu/~15251>

The web page will have all assignments and on-line handouts, as well as facilities to check how you are doing in the course. **You should visit it frequently.** Additionally, the bulletin board for the class is: `academic.cs.15-251`.

Mailing lists: the list `cs-251@cs` mails to the entire class and teaching staff; `cs-251-A@cs`, `cs-251-B@cs`, etc. mail only to the specified recitation sections (and their TAs). `cs-251-staff@cs` mails only to the teaching staff.

Grading

Over the course of the semester, there will be:

- Twelve **problem sets**, which will include some programming assignments. These will constitute **40%** of your final grade.
- Three **exams**, which will be 50 minutes long, and given in recitation. These total to **25%** of your final grade.
- Six short **quizzes**, each 10 minutes long and given at the beginning of lecture. These sum to **5%** of your final grade.
- One **final exam**, which will be 3 hours long. It will be worth the remaining **30%** of your grade.

The dates of all of the above (except the final exam) appear on the website.

In determining your grade, we will drop your lowest homework grade and heavily discount your lowest exam grade. While we may curve upwards if needed, we expect the formula to determine your grade exactly. Your midterm grade will reflect your anticipated final grade.

Note that if you put in little effort on the homework and come through on the exams, your grade will suffer a bit. This is deliberate; we think the homework is important.

Submitting Homework

As mentioned previously, homework is a large and integral part of this course. Assignments will be due every Tuesday at 11:59 PM via *electronic* submission. We will accept files in postscript (ps) or acrobat (pdf) format. To submit your homework `#N`, copy your homework file to the directory:

- `/afs/andrew/scs/cs/15251/student/assignmentN/handin/userid`

Please see the web page for more information on converting files to postscript or pdf.

Typesetting Homeworks

You must typeset your solutions to the problem sets. This makes the graders' job much easier. Many former students have told us how helpful it was to learn L^AT_EX. While we recommend that you learn and use L^AT_EX, anything typed is fine as long as it is easily understandable. Both Microsoft Word and FrameMaker can typeset equations.

Late Work

The good news is that you can hand in any assignment up to one week late (seven days). The bad news is that you will lose seven points (out of 100) per day for the privilege. To be unambiguous, we define a "day" to start at midnight. You will lose seven points for each extra midnight that it takes you to do the assignment. *Late work makes a class much harder to administer. It also hurts you. Please try to avoid it.* If your assignment is more than seven days late, you will get a grade of zero (0) for that assignment.

Written assignments may be submitted multiple times. *If you resubmit any version more than one day late you must tell your TA to ensure we grade the most recent version.*

Programming assignments may be resubmitted any number of times throughout the 7-day grading period. Each night at midnight, starting on the night the assignment is due, our scripts will automatically collect all the new handins and grade them, taking into account the 7-point-per-day lateness penalty. Your best current grade for the assignment will be posted to the Web page by the following morning.

If you have a good excuse (such as being very sick), you should contact the instructors. For compelling reasons (that extend beyond the fact that you have a lot of work lately and didn't plan ahead), we will excuse you from the lateness penalty.

The Homework Guru

Each homework assignment will have a specific *guru*: (s)he will be expert on all the details of that particular assignment. Though any staff member might be able to answer your questions, the guru knows all.

Extra Credit

A few of you will find the assignments too easy. Hence, we will include more challenging extra credit problems, which will be substantially more sophisticated. Extra credit problems will not have a high point value and will not be a source of much partial credit. These are intended for the student who wants an increased challenge, despite the lack of point incentive.

Policy on Collaboration and Cheating

- You *may* verbally collaborate on homework problems and the programming assignments. On each problem and program that you hand-in, you *must* include the names of the students with whom you have had discussions concerning your solution. Indicate whether you gave help, received help, or worked something out together.
- You may not *share written work or programs with anyone else*.
- You *may not* receive help from students who have taken the course in previous years.
- You *may not* review any course materials (or software) from previous years.
- You *may not* read the current solution (handed out) if you will be handing in the current assignment late.
- You *may not* look up the answer to a homework assignment which happens to appear in the published literature, or on the web.
- You *may not* attempt to violate the security of the electronic grading system.
- However, you *may* get help from anyone concerning programming issues which are clearly more general than the specific assignment (e.g., what does a particular error message mean?).

Thus, clear examples of *cheating* include:

- Showing your code to another student.
- Copying a program from someone else.
- Getting help from someone whom you do not acknowledge on your solution.
- Showing a draft of a written solution to another student.
- Copying from another student during an exam.
- Receiving exam related information from a student who has already taken the exam.
- Submitting a program that attempts to alter or erase grading information.
- Looking at someone else's files containing draft solutions, even if the file permissions allow it.
- Lying to the course staff.
- Looking up answers to homework problems on the web

Penalty for Cheating

Our reaction to your cheating will vary according to the situation.

- **Unsolicited Confession:** If you seek us out and admit that you have cheated, we will probably let it go with minor penalty on your grade.
- **Solicited Confession:** If we come to you and ask if you have cheated and you freely admit it, we will take that into consideration. We will either give you a zero on the assignment, ask you to drop the class, or fail you in the course.
- **Denial:** If you do not admit that you have cheated, we will provide our evidence that you have done so. We will at the very least fail you in the class; furthermore, we will take our evidence to the dean and seek more substantial penalties.

Pedagogical Rationale and Advice

Collaboration not only helps get the job done, it teaches you how to explain your (inchoate) ideas to others. This is why we permit discussion of the problems between students. Be careful not to let other people do all the work. If you misuse the opportunity for collaboration in this manner, you will fail the exams and do poorly in the course. The best is usually to find a single partner with whom you have a relatively balanced collaboration. A group of four is usually too big for everyone to be following the joint problem solving process.

Some course material will be the same as in previous years. This is not because we are lazy. It takes years to develop good problems. The only reason to change them is to make cheating more difficult. It is far better for you to work on the most excellent problems that we have been able to find in over a decade of teaching. We appeal to your sense of honor because this is what is optimal from a pedagogical point of view.

Signing the Statement on the Back Page

We understand that most of you would never consider cheating in any form. There is, however, a small minority of students for whom this is not the case. In the past, when we have caught students cheating they have often insisted that they did not understand the rules and penalties. For this reason we require that each student read, sign and return the back page of this document.

Commitment to Honor the Course Policy

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I, _____, have read and understood the above statement
(PRINT YOUR NAME)
of the CS 15-251 policy on collaboration and cheating which was distributed on the first day of class. I agree to honor the rules which the policy statement describes.

(SIGN AND DATE)