1 Course Content and Prerequisites

This course provides a challenging introduction to some of the central ideas of theoretical computer science. Beginning in antiquity, the course will progress through circuits and decision trees, finite automata, Turing machines and computability, efficient algorithms and reducibility, the P versus NP problem, NP-completeness, the power of randomness, cryptography and one-way functions, computational learning theory, and quantum computing. It examines the classes of problems that can and cannot be solved by various kinds of machines. It tries to explain the key differences between computational models that affect their power.

We assume that you have taken 6.042 Mathematics for Computer Science, or have equivalent mathematical preparation. In particular, we will assume you have basic “mathematical maturity”: i.e., that you’re comfortable both reading and writing rigorous mathematical proofs.

2 People, Places, and Times

The course staff members are:

- Lecturer: Prof. Scott Aaronson, 32-G638, 617-833-2349, aaronson@csail.mit.edu
- Lecturer: Prof. Nancy Lynch, 32-G668, x3-7225, lynch@theory.csail.mit.edu
- Teaching assistant: Bob Altshuler, 32-G538, x3-6870, raltshul@mit.edu
- Course Secretary: Joanne Talbot Hanley, 32-G672A, x3-6054, joanne@theory.csail.mit.edu

Lectures are held Tuesdays and Thursdays, 2:30-4:00pm, in 32-124.
Recitations are held on Fridays at 11:00am in 34-304, and 2:00pm in 34-303.
Teaching assistant office hours are (tentatively) on Tuesdays from 4-5pm and on Wednesdays from 2-3pm in or near 32-G538.
Prof. Aaronson is available during office hours on Mondays from 1-3pm, and usually right after class.
Prof. Lynch is available by appointment, and usually right after class.

The course web site can be found at:

http://stellar.mit.edu/S/course/6/sp09/6.045J/

Electronic copies of handouts will be available on the site.
There are two course mailing lists.

- 6.045-staff@mit.edu, reaches only the course staff.
- 6.045-students@mit.edu, reaches all staff and students.

Please feel free to contact the staff via the first list, and your fellow students via the second. We especially encourage you to use the list to find other students to collaborate with.
3 Course materials

The book for this class is *Introduction to the Theory of Computation* by Michael Sipser. This term, we will use the *Second Edition* of the textbook, which is available at the MIT Coop. The textbook, as well as the following supplementary book, will be placed on reserve at Barker Library.


4 Course Requirements

4.1 Grading

There will be six homework assignments, an in-class midterm, and a final exam. The final grade will be computed using the following weights:

- Homework: 42%
- Midterm: 16%
- Final Exam: 32%
- Participation in class and recitation sections: 10%.

4.2 Homeworks

Homework will be due approximately every other week, on Thursday at the beginning of class. You may hand in a hard copy of your homework in class or you may hand in electronically by submitting a PDF through the course website (do not submit your homework by email). We think it is very important that you turn in the homework assignments on time and we are unable to accept late homeworks; if you cannot complete an assignment on time, please just hand in what you have managed to do.

When we grade homeworks, we will give full credit for correct answers and proofs. We will give partial credit for partial solutions and solutions with small flaws. We will also give a small amount of partial credit for answers which read in full, “I don’t know”. Likewise, proofs with gaps will receive partial credit, and the partial credit granted will increase if the gaps are explicitly noted. We will give no credit for wildly incorrect answers which are obviously there only in the hope of getting partial credit. Making yourself believe a false proof is bad for your brain!

We ask that all homework solutions be typed. We will provide LaTeX shells for you to flesh out with your solutions, but you do not need to use them. Hand-drawn diagrams are permitted (though that may preclude submitting electronically). If you are unfamiliar with LaTeX there are links on the course website to useful LaTeX resources.

4.3 Collaboration Policy

We strongly encourage collaboration. We do, however, expect you to write up your own solution to every problem, even if the solution is the result of a collaborative effort. To repeat: each person must write up his/her solutions separately. Also, in your write-up please credit the people with whom you worked. If you consult any reference material other than the textbook, please note on your homework which sources you used for each problem.

4.4 Quizzes and Exams

There will be one midterm and one final exam. The midterm will be held during class time on Thursday, March 19. Note that that is the class meeting just before spring break, so please take this into account when you plan any travel. The final exam will be during finals week, and has yet to be scheduled. It will cover all the course material.