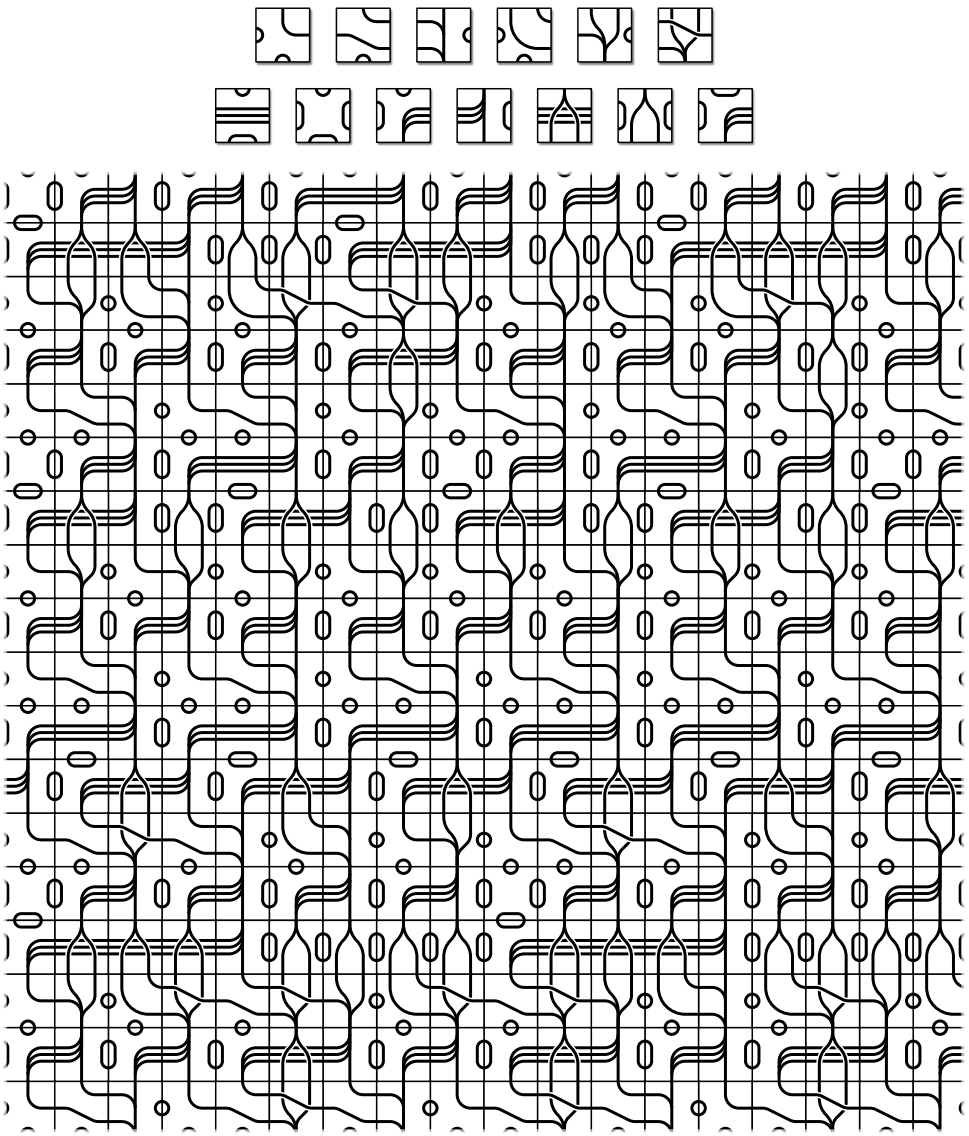
Models of Computation

Jeff Erickson



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I'm writing a book.
I've got the page numbers done,
so now I just have to fill in the rest.

— Stephen Wright

About These Notes

These are lecture notes that I wrote for a new course "Algorithms and Models of Computation" at the University of Illinois, Urbana-Champaign in Fall 2014 and revised again in Fall 2016. This course is a broad introduction to theoretical computer science, aimed at third-year computer science and computer engineering majors, that covers both fundamental topics in algorithms, for which I already have copious notes, and fundamental topics on formal languages and automata, for which I wrote the notes you are reading now.

The most recent revision of these notes (or nearly so) is available online at http://jeffe.cs.illinois.edu/teaching/algorithms/, along with my algorithms notes and a near-complete archive of past homeworks and exams from all my theoretical computer science classes. I plan to revise and reorganize these whenever I teach this material, so you may find more recent versions on the web page of whatever course I am currently teaching.

About the Exercises

Each note ends with several exercises, many of which I used in homeworks, discussion sections, or exams. *Stars indicate more challenging problems (which I have *not* used in homeworks, discussion sections, or exams). Many of these exercises were contributed by my amazing teaching assistants:

> Alex Steiger, Chao Xu, Charlie Carlson, Connor Clark, Gail Steitz, Grant Czajkowski, Hsien-Chih Chang, Jacob Laurel, Junqing Deng, Konstantinos Koiliaris, Mark Idleman, Nick Bachmair, Patrick Lin, Phillip Shih, Sahand Mozaffari, Shalan Naqvi, Spencer Gordon, Srihita Vatsavaya, Tana Wattanawaroon Umang Mathur, Vipul Goyal, and Yipu Wang.

Please do not ask me for solutions to the exercises. If you are a student, seeing the solution will rob you of the experience of solving the problem yourself, which is the only way to learn the material. If you are an instructor, you shouldn't ask your students to solve problems that you can't solve yourself. (I don't always follow my own advice, so I'm sure some of the problems are buggy.)

Caveat Lector!

These notes are best viewed as an unfinished first draft. You should assume the notes contain several major errors, in addition to the usual unending supply of typos, fencepost errors, off-by-one errors, and brain farts. Before Fall 2014, I had not taught this material in more than two decades. Moreover, the course itself is still relatively new, so even the choice of which material to emphasize, sketch, or exclude is still in flux.

I would sincerely appreciate feedback of any kind, especially bug reports.

Thanks, and enjoy!

— *Jeff*