Syllabus for CPSC 468/568

Spring 2017

Instructor: James Aspnes

Description

Introduction to the theory of computational complexity. Basic complexity classes, including polynomial time, nondeterministic polynomial time, probabilistic polynomial time, polynomial space, logarithmic space, and nondeterministic logarithmic space. The roles of reductions, completeness, randomness, and interaction in the formal study of computation. After Computer Science 365 or with permission of the instructor.

Meeting times

Lectures will be held Tuesday and Thursday 14:30–15:45 as a Zoom meeting at https://yale.zoom.us/j/220040380.

On-line course information

The lecture schedule, course notes, and all assignments can be found in a single gigantic PDF file at http://www.cs.yale.edu/homes/aspnes/classes/468/notes.pdf. You should probably bookmark this file, as it will be updated frequently.

For office hours, see http://www.cs.yale.edu/homes/aspnes#calendar.

Staff

The instructor for the course is James Aspnes. Office: AKW 401. Email: james.aspnes@gmail.com. URL: http://www.cs.yale.edu/homes/aspnes/.

The is Lucas Paul. Office: AKW 313. Email: lucas.paul@yale.edu.

Textbook

The textbook for the class is:

Sanjeev Arora and Boaz Barak. *Computational Complexity: A Modern Approach.* Cambridge University Press, 2009. ISBN 0521424267. QA267.7.A76X 2009 (LC).

This book is available on-line in an inconvenient format from Yale campus IP addresses at http://proquest.safaribooksonline.com/9780511530753. A draft version in PDF format is also available at http://theory.cs.princeton.edu/complexity/book.pdf, but this is not identical to the final published

version. Where it makes a difference, in the notes we will cite the PDF draft as [AB07] and the print version as [AB09].

Reserved books at Bass library

In addition to the textbook, the following books are on reserve at Bass Library:

- Oded Goldreich. *Computational Complexity: A Conceptual Perspective.* Cambridge University Press, 2008.
- Christos H. Papadimitriou. *Computational Complexity.* Addison-Wesley, 1994.
- Michael R. Garey and Davis S. Johnson. *Computers and Intractability: A Guide to the Theory of NP-completeness.* W. H. Freeman, 1981.

The first two are other widely-used computational complexity theory textbooks, which may offer perspectives on various topics that complement Arora-Barak and the course notes. The last is a classic collection of known **NP**-hard problems, and can be helpful as a starting point for checking if some problem you are interested is also **NP**-hard.

Other useful resources

- https://complexityzoo.uwaterloo.ca/Complexity_Zoo. On-line catalog of complexity classes.
- http://www.scottaaronson.com/papers/pnp.pdf. Survey of current state of the **P** vs. **NP**problem.

Course requirements

Six homework assignments (100% of the semester grade).

Use of outside help

Students are free to discuss homework problems and course material with each other, and to consult with the instructor or a TA. Solutions handed in, however, should be the student's own work. If a student benefits substantially from hints or solutions received from fellow students or from outside sources, then the student should hand in their solution but acknowledge the outside sources, and we will apportion credit accordingly. Using outside resources in solving a problem is acceptable but plagiarism is not.

Clarifications for homework assignments

From time to time, ambiguities and errors may creep into homework assignments. Questions about the interpretation of homework assignments should be sent to the instructor at james.aspnes@gmail.com. Clarifications will appear in an updated version of the assignment.

In some circumstances, you may be able to get a faster response using Piazza, at https://piazza.com/yale/spring2020/cpsc468. Note that questions you ask there are visible to other students if not specifically marked private, so be careful about broadcasting your draft solutions.

Late assignments

Late assignments will not be accepted without a Dean's Excuse.

References

[AB07] Sanjeev Arora and Boaz Barak. Computational complexity: A modern approach. Unpublished draft available at http://theory.cs.princeton.edu/complexity/book.pdf, 2007.

[AB09] Sanjeev Arora and Boaz Barak. *Computational Complexity: A Modern Approach*. Cambridge University Press, 2009.