**CS 153 Current Topics in Theoretical Computer Science** **Fall 2024**

# Course Summary and Syllabus

*Lecturer: Chris Umans* *Date: October 1*

**Course summary:**

We'll study pseudorandomness, a central topic in Theoretical Computer Science. Broadly, this is the study of efficiently computable objects that appear random to efficient "observers". We'll follow a recent survey by Hatami and Hoza, which is largely self-contained. This survey covers some striking recent results, and highlights many ingenious mathematical ideas and proof techniques.

**Course Information:**

- Instructor: Chris Umans (`umans@cs.caltech.edu`)
- Lectures: Tuesdays and Thursdays 1:00 – 2:25 in Annenberg 213
- Office hours: TBD
- Our primary resource will be this survey on pseudorandomness

  "Theory of Unconditional Pseudorandom Generators." Pooya Hatami and William Hoza. 2023. Available at `https://eccc.weizmann.ac.il/report/2023/019/`

**Format:** We are going to experiment with something resembling a "flipped" course format. In this small class, everyone will be responsible for reading and understanding the portion of the survey we plan to cover in the upcoming class, before that class. One student will be responsible for leading each class (with the instructor's help and guidance), in which we will all work through the material together, answering questions, working examples, discussing implications and open questions that come up, and filling in background details as necessary.

**Prerequisite:** This course is pitched at a beginning graduate level, but both undergrads and grad students are encouraged to attend. Prerequisites are mathematical maturity and curiosity. The course is intended to be largely self-contained, but exposure to elementary probability and algebra, as well as material covered in CS21, CS38 and CS151, is helpful.

**Course requirements:** Course participants should attend and participate in classes (30%), lead approximately 3-4 classes during the term as discussed above (40%) and read and present a relevant research paper at the end of the term (30%). Depending on how the term unfolds, we make decide to roll these last two parts into one part worth 70%.

I may also assign a small number of short written excercises as they suggest themselves, to solidify understanding, and these should be completed and turned in to receive full credit for the participation part of the course.

**Honor code:** For any written parts, you may consult *only* the course material (i.e., don't hunt around online for solutions). Collaboration with others in the class is encouraged, although you should produce your own writeup and note with whom you worked. Please feel free to ask me for clarification if any of these guidelines are unclear.

**Collaboration policy:** Collaboration on all aspects of the course is encouraged. However, you are individually responsible for learning and understanding the course material and this is not likely to happen if you rely too heavily on your collaborators.