

Course Information:

Location: Zoom: 957 7043 3496

Time: Tuesday, Thursday, 2-3:20 (CST)

Course Staff and Information:

Instructor: Shravas Rao, shravas@northwestern.edu

Office hours: Tuesday, Thursday, 1-1:50 (CST), Zoom: 664 905 3980

Course Description

Boolean functions are functions that take in a string of 0's and 1's, and output a 0 or 1. Thus in some sense computer science can be seen as a study of boolean functions. In recent years, analytic tools, especially Fourier analysis, have seen many applications, including to social choice theory, pseudorandomness, and learning theory. In this course, we'll both develop these analytic tools and investigate their applications.

Below is a non-exhaustive brief list of topics that will be covered in the course.

- Boolean Functions and the Fourier Expansion
- Influence and Social Choice
- Spectral Structure and Learning
- DNF Formulas and Small-Depth Circuits
- Majority and Threshold Functions
- Property Testing, Probabilistically Checkable Proofs of Proximity, and Constraint Satisfaction Problems
- Hypercontractivity

This class will be taught using a flipped classroom format. Before each class, there will be a corresponding video lecture to be watched. During class time, there will be a short discussion of the material, followed by exercises related to the topics covered in the video lecture. After class time, you will be asked to submit a write-up of the exercises you choose to work on.

Textbook

The text for this course will be Analysis of Boolean Function by Ryan O'Donnell, which can be found for free online (<http://www.contrib.andrew.cmu.edu/~ryanod/>) or purchased (<https://www.cambridge.org/us/academic/subjects/computer-science/algorithmics-complexity-computer-algebra-analysis-boolean-functions>).

Attendance

Because of the flipped classroom format, attendance is required. If you can not attend any particular meeting, you should contact the instructor to make other arrangements.

Grades

This course will be graded 100% on participation.

Accommodations

Any student requesting accommodations related to a disability or other condition is required to register with AccessibleNU (accessiblenu@northwestern.edu; 847-467-5530) and provide professors with an accommodation notification from AccessibleNU, preferably within the first two weeks of class. All information will remain confidential.

Academic Integrity

A primer on the academic integrity policy at Northwestern can be found here: <https://www.northwestern.edu/provost/policies/academic-integrity/>. Policies specific to the McCormick School of Engineering & Applied Science can be found here: <https://www.mccormick.northwestern.edu/students/academic-integrity.html>. Violations of academic integrity in this course will be punished by receiving zero credit on the affected assignments, and/or other sanctions listed in Section I.D of “Academic Integrity: A Basic Guide”, subject to the severity of the offense.

Inclusion

This classroom will be a place where you will be treated with respect, and all individuals will be welcomed, regardless of ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability –and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.