COMP 7613/8613: Computational Complexity (Fall 2020)

Time, place: Tuesdays/Thursdays 9:40am–11:05am (when in-person classes resume)
Dunn Hall 119

Instructor: Thomas Watson
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http://www.cs.memphis.edu/~twwtson1/

Website: http://elearn.memphis.edu/

Description: In this 3-credit course we'll study the fundamental principles governing the capabilities and limitations of efficient computation. In addition to classical topics such as time and space complexity and their relationships with nondeterminism and randomness, the course will explore branches of complexity theory that are motivated by other areas of computer science:

- Computational learning theory—motivated by machine learning and AI.
- Foundations of cryptography—motivated by security.
- Interactive proofs—motivated by verification.
- Approximability—motivated by optimization.
- Query complexity—motivated by databases.
- Communication complexity—motivated by distributed computing.
- Circuit complexity—motivated by architecture and parallel computing.

Prerequisite: Any prior course on theory of computing, such as COMP 4601/6601 or COMP 7612, or permission of the instructor

Recommended textbooks: *Computational Complexity: A Modern Approach* by Arora–Barak
An Introduction to Computational Learning Theory by Kearns–Vazirani
Introduction to Modern Cryptography by Katz–Lindell

Grading: There will be five homework assignments. You may discuss homework problems with other students, but you must write up solutions entirely on your own (and in your own words). You must submit each homework as a single file in the corresponding dropbox folder in the elearn website for the course. If you choose to handwrite your homework solutions (rather than using software such as LaTeX), you may turn in a scan or photo (with all problems combined into a single file), as long as it is easy to read. Each homework is due right before the beginning of a lecture, and late homeworks cannot be accepted since model solutions will be distributed in class.

For students taking the course at the 7000-level, each homework assignment will be worth 20% of the grade. For 8000-level students, each homework will be 18%, and the remaining 10% will be for a short write-up describing what is known at the frontier of a research-level topic related to the course material.

Cheating:

Plagiarism or cheating behavior in any form is unethical and detrimental to proper education and will not be tolerated. All work submitted by a student (projects, programming assignments, lab assignments, quizzes, tests, etc.) is expected to be a student's own work. The plagiarism is incurred when any part of anybody else's work is passed as your own (no proper credit is listed to the sources in your own work) so the reader is led to believe it is therefore your own effort. Students are allowed and encouraged to discuss with each other and look up resources in the literature, but appropriate references must be included for the materials consulted, and appropriate citations made when the material is taken verbatim.

If plagiarism or cheating occurs, the student will receive a failing grade on the assignment and (at the instructors discretion) a failing grade in the course. The course instructor may also decide to forward the incident to the Office of Student Conduct for further disciplinary action. For further information on U of M code of student conduct and academic discipline procedures, please refer to: `http://www.memphis.edu/studentconduct/misconduct.htm`

Calendar:

Aug 18: lecture 1
Aug 20: lecture 2
Aug 25: lecture 3
Aug 27: lecture 4, hw 1 assigned
Sep 01: lecture 5
Sep 03: lecture 6
Sep 08: lecture 7
Sep 10: lecture 8
Sep 15: lecture 9, hw 1 due, hw 2 assigned
Sep 17: lecture 10
Sep 22: lecture 11
Sep 24: lecture 12
Sep 29: lecture 13
Oct 01: lecture 14, hw 2 due, hw 3 assigned
Oct 06: lecture 15
Oct 08: lecture 16
Oct 13: lecture 17
Oct 15: lecture 18
Oct 20: lecture 19, hw 3 due, hw 4 assigned
Oct 22: lecture 20
Oct 27: lecture 21
Oct 29: lecture 22
Nov 03: lecture 23
Nov 05: lecture 24, hw 4 due, hw 5 assigned
Nov 10: lecture 25
Nov 12: lecture 26
Nov 17: lecture 27, hw 5 due, research survey due (8613 students)