COMS 4236 Introduction to Computational Complexity, Fall 2026
Time/Location: Fridays 1:10-3:40

Instructor: Toniann Pitassi
email: toni@cs.columbia.edu

Website: www.cs.columbia.edu/ $\sim$ toni/Courses/CS4236/complexity.html

Course Description.
See the detailed course outline for more information.

Grading and Assignments.
You will have 4 problem sets. They need to be turned it but they will *not* be graded but you need to turn each one in, and they will be worth 2.5 percent of your grade each (for a total of 10 percent of your final grade). Solutions to each problem set will be provided and they are intended to be closely related to the tests and quizzes. There will also be 6 quizzes roughly every other week which will be graded. Each is worth 5 percent of your grade (for a total of 30 percent). There will be an in-class midterm and an in-class final, each worth 30 percent of your final grade. They will be held during the last 75 minutes of class.

Collaboration Policy. You are encouraged to discuss the course material and the homework problems in small groups of up to 3 people, but you must **list all discussion partners on your problem set**. Discussion of homework problems may include brainstorming and verbally discussing possible solution approaches, but must not go as far as writing up solutions together; each person **MUST WRITE UP HIS/HER SOLUTIONS INDEPENDENTLY.** You may not collaborate with another student on writing up solutions or even look at another student's written solutions. If your homework writeup resembles that of another student in a way which suggests that you have violated the above policy, you may be suspected of academic dishonesty.

You may consult certain outside materials, specifically lecture notes and videos of other classes, any textbooks, and research papers. You may not

consult any other materials, including solved homework problems for this or any other class. For all outside materials used, you must provide a detailed acknowledgement of the precise materials used. Whether or not you consult outside materials, you must always write up your solutions in your own words. If your homework writeup resembles any outside source in a way which suggests that you have violated the above policy, you may be suspected of academic dishonesty.

AI Policy. You are allowed to use AI/LLMs as a resource in the class. It would be silly to disallow it. However, you should use it wisely and smartly. Seventy percent of the class grade the midterm and final exam requires you to demonstrate essential understanding of quantum information and quantum computing without any external aid. So you shouldnt become too dependent on the LLM.

Treat the quizzes and problem sets as a low-stakes way of getting practice with thinking and learning the material. We cant stop you from applying AI/LLMs to blindly solve the quizzes/problem sets, but you will likely suffer on the exams.

Here are suggestions for how to use AI/LLMs in a smart way for worksheets, quizzes, and problem sets.

1. Try to solve the problem yourself. Identify the relevant lecture material, and try to figure out an approach. Talk with a buddy.

2. If you end up using the AI, dont just copy-paste the question, and copy-paste the answer. You can enter a prompt like the following:

    - Im a student trying to learn complexity theory, and Id like you to be a helpful study partner who doesnt just give me the answer, but helps me learn and solve problems myself.
    - Explain the proof of NP-completeness of satisfiability like I'm a beginner. What's the explanation behind each step?
    - I don't understand the point of the polynomial hierachy. Why is it studied when it isn't realistic at all as a computational model.
    - Im trying to solve the following problem: [insert general description]. However dont tell me the answer. But my general approach is. Heres my derivation. Can you give me a hint as to the first line that breaks?

You must understand and verify everything you submit. A way to test whether you understand: could you explain your answers to a peer without relying on any external aid? Ultimately, youre taking this class because you want to learn complexity theory. The AI already knows the material pretty well, so dont let it rob you of the opportunity to learn.

Quizzes. To help get regular practice with the class material, and get prepared for the problem sets and exams, there will be an in-class quiz (almost) every week. The quiz problems will be based on weekly problem sheets that well release (these are ungraded). You are encouraged to go to office hours each week to work on the practice problems. The quizzes and the weekly problem sheets for the following week will be posted Monday morning. The midterm and final exam questions will also be based on the weekly problem sheets. So even though the quizzes form a small part of your grade, you should keep up with them!

You must take the quiz alone, without discussion with anyone else (although you are welcome to go over lecture material with other students). When you start the quiz, you have 1 hour to complete it. You are allowed to use your class notes/slides when taking the quiz, although the intention is that the quiz should be solvable without any materials (after you have gone over the previous lectures and digested them). No late quizzes will be accepted. The quiz is meant to be completed quickly - you will have the last 15 minutes of class to complete the quiz.

Exams. There will be a midterm and final held in class. Unlike Problem Sets, the exams must be completed individually and are meant to assess your understanding of the class material. If you are unable to attend either Exam for any reason on the designated date, you must contact the instructor ahead of time to make alternative arrangements for a makeup exam. If you are ill that day, then you must provide a valid medical note on the same day.

Regrade Policy. You may submit regrade requests for assignments or exams through Gradescope. Regrade requests must be submitted within one week of the grade being released. Include with your regrade request a clear and detailed argument for your request. When we are regrading questions, we reserve the right to regrade the entire assignment or exam, which could result in the overall score being raised, lowered, or remaining unchanged.

Academic Honesty More generally, students are expected to adhere to the

Academic Honesty policy of the Computer Science Department; this policy can be found in full here. https://www.cs.columbia.edu/academic/academic-honesty/ Please contact the instructor with any questions.