Teaching Statement

Ziv Scully

1 Teaching Experience

I have been a TA for two computer science theory courses, undergraduate complexity (CMU 15-455) and graduate performance modeling (CMU 15-857), and I have been the primary instructor for a half-semester discussion-based course on Diversity, Equity, and Inclusion (DEI) topics in computer science academia (CMU 15-920). I also have informal teaching experience from middle- and high-school outreach. Finally, though it differs from teaching courses, I apply a teaching mindset to my research communication, for which I have received several recognitions. I highlight below some important aspects of my teaching experience.

Taking Responsibility for Students' Success One of the courses I was a TA for, CMU 15-455, experienced two major disruptions. A few weeks into the course, the instructor had an unexpected surgery, after which he had to transition to remote lecturing. About a month later, CMU closed down due to COVID-19, at which point all the students became remote as well.

I saw it as my responsibility to help the course through these disruptions. I took on much of the course administration. I increased my availability, holding additional office hours and review sessions. This extra time with students helped me track how they were doing. For example, before the first exam, I noticed that many students were still struggling with several core concepts. I made the decision to postpone the exam and hold extra review sessions. The instructor recognized my efforts in my end-of-semester review:

> *For a major part of the course, Ziv functioned effectively as a co-instructor. Without his unfailing support and generous investment of time and energy the course would likely have collapsed, given my medical emergency and the subsequent coronavirus adjustments. I cannot praise his efforts enough and would like to express my deepest appreciation.*
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> —Prof. Klaus Sutner, instructor of CMU 15-455 in Spring 2020

Outstanding Research Communication I value clear communication not just when teaching courses, but also when communicating research. I prioritize writing clear papers and giving high-quality presentations. I have been recognized for this by several awards, including the SIGMETRICS 2020 Best Video Award, invitations to give tutorials at SIGMETRICS 2019 and SIGMETRICS 2021, and multiple best paper awards.

Remote Teaching and Video Production I recognize the increasing importance of fully remote and hybrid remote/in-person classrooms. As a TA for CMU 15-455, I managed a classroom with a remote lecturer and an in-person audience, which became a fully remote classroom with the onset of COVID-19. I also held many office hours and review sessions fully remotely. I produce high-quality videos for remote conference presentations, and I would apply the same effort and expertise to producing videos for course lectures.

Outreach to Middle- and High-School Students As an undergraduate at MIT, I accumulated over 150 hours of experience in middle- and high-school outreach programs, including MIT Splash [2]. These ranged from hour-long one-shot lessons with titles like "Calculate π…with Trains!" to a weekly AP Physics C course that lasted the entire academic year. My many successes and failures during this period helped me hone my teaching and presentation skills, particularly ways to engage all students in the classroom.

2 Teaching Interests

Undergraduate and Graduate Curricula I am comfortable teaching a variety of courses. I could teach undergraduate theory, e.g. algorithms and data structures, probability and statistics, optimization, signals and systems, complexity, and information theory. I could teach most graduate theory, too, given time to prepare. Outside of theory, I could teach introductory courses in many subjects, e.g. programming,

data science, circuits, software engineering, and computer architecture. I also have some background in programming languages and could teach in that area, e.g. compilers, type systems, and program analysis.

I am a committed teacher and a curious learner, so with adequate support, I will teach in areas or using techniques that are new to me, e.g. case-based learning. For example, this year I taught a discussion-based course on DEI topics, a field entirely new to me, using a curriculum designed by a team of CMU students.

Proposals for New Courses

Scripting and Software Engineering for Scientists (intro undergrad) Computer science majors pick up a menagerie of computing skills over the course of their degrees, e.g. working with the command line, using version control, writing build scripts, deploying web sites, and basic software engineering practices. But these skills are useful to anyone who uses programming in their work, regardless of their major. This course would teach these computing skills with a non-computer-science major audience in mind.

How to Deal with Queues: Scheduling and Performance Modeling (advanced undergrad or intro grad) Queues are ubiquitous in a variety of systems, ranging from computing to manufacturing. This course would introduce queueing theory as a tool for understanding how queues form and several tools, including scheduling, for reducing time wasted in queues. One of the course's goals would be to expose students building systems to theoretical ideas that can help guide their designs.

Optimization under Uncertainty via Three Flavors of Bandits (advanced grad) The world is full of uncertainty, so algorithms must be designed with such uncertainty in mind. But there are many types of uncertainty, and different algorithmic ideas have been proposed for dealing with each one. This course would explore these different techniques for dealing with uncertainty by using three variants of the multi-armed bandit problem (stochastic, adversarial, and Markovian) as case studies.

3 Teaching Philosophy

Active Engagement Students learn material best when they actively engage with it. One strategy I use to give all students a chance to engage is a variation on "think-pair-share": I ask a question; give students time to consider it individually or, if they prefer, in small groups; then invite students to share answers. This lets everyone engage with the question at their own pace, mitigating the pattern where only the few quickest or bravest students participate. Another strategy I use is handing out note-taking templates with prompts like "draw a picture of X" or "list two causes of Y". Filling in a template gives students a low-activation-energy way to engage with a lecture, and the prompts highlight the most important takeaways. In the future, I would be curious to try alternative classroom structures that are designed with active learning in mind [4].

Tight Feedback Loops For students to build an accurate idea of which concepts they understand well and which they do not, they need feedback. The more quickly such feedback arrives, the more quickly students can patch holes in their understanding, and the less likely they are to fall behind. A tight feedback loop requires high instructor availability in some form, such as many TAs helping in a lab session, many office hours options, fast grading turnaround, or a frequently checked online forum. One feedback strategy I am curious to try in the future is having students give brief, ungraded oral presentations on homework problems to an instructor or TA, who asks questions and provides feedback.

Psychological Safety Research shows that psychological safety, namely the belief that one can safely take risks like asking a question or sharing an unfinished idea, leads to better team performance in the workplace [3, 6], and benefits have also been observed in group projects in courses like software engineering [5]. I believe creating psychological safety in the classroom should be a priority, and I am eager to incorporate strategies that ensure all students feel comfortable actively participating. One idea that has been used in online classrooms is having students interact with TAs over text chat [1], with interactions being private by default. As I discuss further in my DEI Statement, promoting psychological safety also helps create a more inclusive environment for students from underrepresented identity groups.

References

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[4] Qiang Hao, Bradley Barnes, Ewan Wright, and Eunjung Kim. 2018. Effects of Active Learning Environments and Instructional Methods in Computer Science Education. In *Proceedings of the 49th ACM Technical Symposium on Computer Science Education (SIGCSE 2018)*. ACM, Baltimore, MD, 934–939.

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