Computational Complexity

2025 Year in Review

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As 2025 comes to a close, the Computational Complexity blog looks back at a year that brought major transitions—both for the blog and for the broader academic community. Through 95 posts, Lance Fortnow and Bill Gasarch covered groundbreaking complexity results, navigated the ongoing AI revolution, weathered turmoil at the NSF, and marked personal milestones. Here are the highlights.

1 A Personal Transition

The biggest change for the blog came in July when Lance stepped down as founding Dean of the College of Computing at Illinois Tech, returning to the professoriate after thirteen years in administration (six as dean, seven as chair at Georgia Tech). He wrote about this in A Professor Again. Lance is teaching intro theory again this fall—his first course since 2018—and planning a sabbatical at Oxford in the spring.

The transition has given Lance time to reflect on administration, leading to posts like The Logical Argument about why logic is the wrong way to argue for resources, and A Restless Soul on the perpetual search for new challenges in academic life.

2 The Big Result: Time vs. Space

The complexity theory highlight of the year was Ryan Williams's breakthrough showing that $\mathrm{DTIME}(t(n)) \subseteq \mathrm{DSPACE}(\sqrt{t(n)\log t(n)})$. This is the first stark separation between time and space—you can reuse memory but you can't reuse time. Lance celebrated the result in You Need Much Less Memory than Time, but confessed in A Failure to Communicate that explaining it to a general audience proved remarkably difficult. Unlike P vs. NP or zero-knowledge proofs, this result resists simple explanation—perhaps because the very question itself requires technical background to appreciate.

The blog also discussed Lautemann's Beautiful Proof that $\mathrm{BPP} \subseteq \Sigma_2^p$, revisiting a classic result.

3 The Gödel Prize and Remembering Luca

The 2025 Gödel Prize went to Eshan Chattopadhyay and David Zuckerman for their work on explicit two-source extractors, as discussed in The New Godel Prize Winner Tastes Great and is

Less Filling. Bill and Lance care about this result for different reasons—Bill sees applications to constructive Ramsey theory, while Lance appreciates it as a breakthrough in pseudorandomness.

The Trevisan Prize was also announced this year, honoring Luca Trevisan who passed away in 2024. The year began with My Drunken Theorem, Lance's SIGACT Open Problems column in Luca's memory.

4 NSF Under Siege

The year brought unprecedented challenges to the National Science Foundation. Executive orders from the Trump administration effectively brought the agency to a standstill, as Lance wrote in The Situation at the NSF. Long-time program director Tracy Kimbrel was terminated along with many others, discussed in Taking a Stand.

The blog marked the NSF's 75th anniversary in A Bittersweet Anniversary—a somber occasion given the circumstances. Bill chronicled the chaos affecting his REU program in A Personal View of the NSF Hot Mess: My REU Program, and Lance wrote about the Fulbright program's board resignation in Fulbright Memories. The situation remains fluid and concerning for anyone who cares about basic research in this country.

5 AI Everywhere

AI dominated the blog's discussions this year, touching nearly every aspect of academic life. Posts ranged from the philosophical (Computers Don't Want, Big Bots Don't Cry) to the practical (AI and Intro Theory, Using AI for Reviews).

Lance used AI to navigate Germany on vacation, as described in AI and...—translating menus, interpreting tour guides in real time. In The Phone, he reflected on how the smartphone has become more transformative than any sci-fi prediction. Sam Altman's claim about "PhD-level intelligence" prompted What is "PhD-Level Intelligence"?

Bill debated whether AI helps programmers in Does ChatGPT Really Help Programmers? (the jury is still out). The question of whether to disclose AI use—brag about it or hide it?—shows how quickly norms are shifting, as explored in If You Use AI in Your Work Do You Brag About It or Hide It?

The ongoing flood of P vs. NP proof attempts seems only to have intensified, with seven arriving in two weeks at one point, as Bill wrote in P v NP Papers Galore. Eric Allender contributed Some Thoughts on Journals, Refereeing, and the P vs NP Problem after an incorrect proof was published in a Springer Nature journal.

Perhaps most interesting was AI and the Power of Nonuniform Circuits, where Lance argued that advances in AI have changed how we think about nonuniformity in computational complexity.

6 We Lost Some Giants

Tom Lehrer passed away at 97, prompting multiple posts from Bill: Tom Lehrer Passed Away at the Age of 97, My Tom L Post Inspired a Mathematical Definition of Rabbithole, and A Few More Notes About Tom L—celebrating the mathematician-songwriter who gave us "The Elements" and "New Math."

George Foreman's death inspired a classroom debate about the best invention of the last 50 years in Was the George Foreman Grill The Best Invention of the Last 50 Years?

Tom Stoppard left us at 88, remembered in Tom Stoppard 1937–2025, from "Rosencrantz and Guildenstern are Dead" to "Arcadia" and its meditation on chaos theory and determinism.

7 Fun with Numbers

Mathematical curiosities made their usual appearances. September 16, 2025 (9-16-25) marked the only Pythagorean-like Day this century—as discussed in Sept 16, 2025 was Pythagorean Day. The blog celebrated Martin Kruskal's 100th birthday with a guest post from his son Clyde in Clyde Kruskal Talks About His Father Martin on Martin's 100th Birthday.

Bill noted in People Who Live Through Two Square Years that $2025 = 45^2$ is a perfect square year, prompting reflection on who might live to see two square years. Other number theory posts included Numbers That Look Prime But Aren't, The New Lower Bound on Busy Beaver of 6, and Factoring Carmichael Numbers.

8 The New Pope Does Math

Pope Leo XIV, the first American pope, turned out to have a mathematics degree from Villanova. Bill couldn't resist multiple posts: Random Thought on the New Pope and Some are Mathematicians, Some are Carpenters' Wives, Some are Popes. Lance noted in Lance Never Thought He Would See a Pope Who Roots for the Same Team as Him that as a White Sox fan, he now shared a team with the Holy Father.

The pope's election also raised questions about satire in the AI age in Is Satire Dangerous in the AI-Age?, when fake claims spread faster than corrections.

9 Teaching in Transition

Teaching intro theory in 2025 feels different, as Lance wrote in AI and Intro Theory. The famous Garey-Johnson cartoon about NP-completeness hits differently when AI can actually solve many "hard" problems in practice. Students ask why they need to learn this material when ChatGPT can do it for them.

Bill explored whether Euclid's apocryphal response—that there is "no royal road to geometry"—remains relevant in Did Euclid Exist? Is It Okay to Quote People That Did Not Exist?

The blog also discussed The Future of Teaching Assistants (remembering Ashok Goel's "Jill Watson" experiment), Recording Lectures? Posting the Recordings? Using Slides?, and What Happened to MOOCs?

10 Defending the Field

The blog spent time defending theoretical computer science from various angles. In Defending Theory, Lance responded to skepticism about the role of theory in real-world software development. Research Then and Now compared doing research in the late 80s versus today. And The Complexity Argument for Capitalism made an unexpected case based on computational hardness.

11 Looking Ahead

The year ended with discussions of The Little Theorems—maybe AI will help researchers write up minor results that would otherwise go unpublished. Bill offered his Bad Advice for researchers—don't care if anyone else cares, follow your own interests—advice that may be shrinking in applicability but might suit Lance well in his post-administrative life.

As the blog enters 2026, Lance looks forward to his time at Oxford, returning to research and writing. The complexity of the world—computational and otherwise—continues to provide plenty of material. Thanks to all the readers for another year.