Eric P. Astor

Remote (timezone flexible) – based in Jersey City, NJ

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I work to understand the root of the problem, and produce clean, reusable, documented solutions.

Software engineer, former research mathematician. Software work includes optimizing compilers, caching systems, developer infrastructure, client-side applications, machine learning, and open-source leadership. Mathematical research published in 3 top journals, presented by invitation at 5 leading int'l conferences. Interdisciplinary communicator; respected coach/mentor/team player; dedicated & proactive problem-solver.

Experience

Google LLC (XLS) **Remote**

Senior Software Engineer *May 2023 – current*

"LLVM for the End of Moore's Law"; open-source optimizing hardware compiler, written in C++.

Achievements:

- Led optimization subteam guided by customer needs/results, including AI-accelerator and video-accelerator hardware; team improved XLS cell area for an AI-accelerator component by $> 15\%$ while helping to close timing.
- Improved XLS cell area for another customer by $\sim$2x, enabling them to cut production cell area by $>5\%$.
- Designed & developed "dynamic state feedback" feature — automatic fast paths for hardware recurrences. Motivating example: simpler code saw 33% better throughput, 10% smaller area.
- Designed & developed support for "II>1" (less-than-full throughput) circuits, trading throughput for area.
- Sped up optimizer with various profiling-guided improvements, including deferred computation & believed-novel "re-validating" cache; now >4x faster on worst cases, enabling more optimizations within time budget.
- Designed experiments & data analysis to verify performance of hardware synthesis engines.

Google LLC (Drive desktop clients) **Remote**

Senior Software Engineer *(Remote) Nov 2020 – May 2023*

Software Engineer III *(New York, NY) July 2018 – Nov 2020*

First-party streaming file system backed by Google Drive, written in C++.

Achievements:

- Designed & implemented cache efficiency upgrade, saving terabytes/day of outgoing bandwidth.
- Proposed & led transition of product to modern build system (Bazel), improving team satisfaction by 33 points, build & test speed by $\sim$3x+ (while improving consistency), and saving ~ 8 eng-hours/wk in maintenance alone.
- Developed & maintained standard system for cross-platform Windows builds, mentoring tens of engineers to use it; made the case for full organizational commitment, then successfully handed off to new team.
- Proposed & developed new compatible assembler for a proprietary language in the LLVM project (LLVM-ML).
- Optimized binary size for a space-sensitive platform, reducing required space by $\sim 25\%$.
- Led multiple successful cross-team cross-organization projects, advocating for optimized & unified approaches.
- 20% project: launched open-source FHE transpiler based on XLS hardware/HDL compiler infrastructure, enabling experimentation with fully-homomorphic encryption.

Open Source

The Reverse-Mathematics Zoo **rmzoo.math.uconn.edu**

Lead Developer & Maintainer *2016 – 2018*

Expert system and authoritative bibliography for reverse mathematics, written in Python.

Reverse mathematics works to minimize & characterize the assumptions of formal proofs.

Achievements:

- Re-architected the Zoo for improved maintainability, portability, and performance.
- Implemented a new inference engine, increasing capability, extensibility, and performance (8x speed).
- Expanded & cleaned underlying bibliography for the field (4x previous size, verified and detailed referencing).

Mathematics

University of Connecticut **Storrs, CT**
Assistant Research Professor *Aug 2015 – Aug 2018*
50% research in reverse mathematics, analyzing which assumptions are required to prove a given theorem;
50% teaching and educational work.
Detailed achievements:

- Developed new line of inquiry in international collaboration, involving bounds on the strength of large families of assumptions — first application found limits on the power of computation with access to random numbers.
- Refined analysis of strengths of closely-related systems, applying tools from another field with new methods.
- Presented at major conferences, both national (e.g., North American Annual Meeting of the ASL) & international (e.g., Symposia on the Foundations of Mathematics [interdisciplinary]).
- Published in leading journals (including: Annals of Pure and Applied Logic, the Journal of Symbolic Logic).
- Designed & taught assorted undergraduate and graduate courses, receiving consistently strong student evaluations for accessibility, clarity, and general recommendation, as well as a University commendation for merit in teaching.

University of Chicago **Chicago, IL**
Ph.D. candidate & Lecturer *June 2011 – June 2015*
75% research and training in mathematical logic (specifically computability theory); 25% teaching.
Detailed achievements:

- Designed & taught assorted undergraduate courses, receiving consistently strong student evaluations for accessibility, clarity, and general recommendation.
- Strengthened & refined analyses of asymptotic computation, algorithms that work for "almost all" inputs.
- Recovered desired & standard results not present in prior work, permitting the generalization of classic results.
- Presented in invited talks at major international conferences, including the Workshop on Computability Theory in Bucharest and the Annual Meeting of the Canadian Mathematical Society.
- Published in leading journals (including the Journal of Symbolic Logic).

AMALTHEA (University of Central Florida and Florida Tech) **Orlando, FL**
Machine Learning REU Participant *June 2008 – July 2008*
Studied numerical optimization algorithms, esp. simplex variants, for support vector machine (SVM) training.
Integrated a conjugate residual solver into Rusin's revised simplex method for quadratic programming, producing a hybrid algorithm with promising applications to SVM training.

Computer skills

Languages: C++ (modern), Python, DSLX, Go, Java, C#/.NET, C

Other: Bazel, SQL, Mathematica, ANTLR, MATLAB, compiler design, data analysis & reporting

Education

University of Chicago **Chicago, IL**
Ph.D., Mathematical Logic *2009–2015*

M.S., Mathematics *2009–2011*

Swarthmore College **Swarthmore, PA**
B.A., Mathematics and Physics, with High Honors *2005–2009*
GPA 3.86/4.00

Doctoral thesis

title: *Asymptotic density and effective negligibility*

supervisors: Denis R. Hirschfeldt and Robert I. Soare

description: Introduced new analyses for asymptotic computation, a framework for algorithms that work for "almost all" inputs; proved the halting problem not asymptotically computable.