Zachary Espiritu

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Education

Brown University

Sc.M. in Computer Science • GPA: 4.0
Sc.B. in Computer Science • GPA: 4.0
Completing both degrees in Dec 2021.

Publications

Z. Espiritu, E. A. Markatou, R. Tamassia. "Time- and Space-Efficient Aggregate Range Queries on Encrypted Databases". 2021. *Under review.*

F. Falzon, E. A. Markatou, Z. Espiritu, R. Tamassia. "Encrypted Range Search in Multiple Dimensions". 2021. *Under review.*

Awards

CrowdStrike NextGen Scholarship for Cybersecurity and AI
(6 selected nationwide)

(ISC)² Cybersecurity Scholarship
(20 selected nationwide)

1st Place at Hack@Home Security CTF
(1 out of ~100 participants)

Projects *(selected)*

Dropbox (Secure File Store)

As Head TA, authored new project for security course on using untrusted servers for secure, efficient file storage and sharing. Project scored average student evals of 4.61 / 5.00 in first year.

CS Concentration Validator

Developed Racket web script using formal provers to synthesize degree completion plans for 300+ CS majors at Brown; currently being integrated into official University advising system.

Vehicle Routing Solver

Designed top-performing local search solver out of 21 teams for NP-hard vehicle routing problem in graduate-level competition. In Python and Java.

Weenix

Wrote full operating system kernel in C.

Experience

Encrypted Systems Lab Fall 2020 – Present
Researcher

- Wrote novel crypto protocol and Java / Node.js prototype for Massachusetts's *Dept. of Public Health* to securely conduct opioid epidemic research over databases of 22 distributed MA hospitals, community mental health organizations, etc, *eliminating costly and vulnerable manual anonymization* process.

Cryptography, Anonymity, Privacy, Security (CAPS) Group Fall 2020 – Present
Researcher

- Designed 7 novel, O(1)-time, provably secure aggregate range query schemes for encrypted DBs, *lowering state-of-the-art runtime and storage overhead by up to 83%* in practice.
- Devised dynamic programming algorithm to *reduce experiment setup times by 99%*, allowing inclusion of larger Python benchmarks (3 orders of magnitude) in final publication.

Google Summer 2020
Software Engineering Intern, Google Cloud HSM

- Architected open-source OpenSSL engine to enable web servers to use HSM-backed keys for crypto signatures *without any source code changes*. C++ with gRPC and Bazel.

Brown PLT (Programming Languages Team) Summer 2018
Research Intern

- Created machine learning package, *used yearly in 90-student introductory CS course*, for Pyret, a functional programming language. Built using TensorFlow.js.

Negotiatus Summer 2016 and Summer 2017
Software Engineering Intern

- Led full-stack development in HTML, JavaScript, and Ruby on Rails of still-existing, core value propositions such as Scheduled Orders, *converting ~20% of non-recurring revenue into monthly recurring revenue* by 2017.
- Optimized internal-facing SQL queries via PostgreSQL materialized view caching layers and cron jobs for *up to 100x faster product searches*.

Teaching Service *(@ Brown Computer Science)*

Head Teaching Assistant (for 6 Computer Science Courses) Fall 2018 – Present

- Hired, trained, and managed 54 TAs for **Software Exploitation** (2021), **Systems Security** (2021, 2020, 2019), **Programming Languages** (2020), and **Accelerated CS Intro** (2018).
- Automated grading and project setup via Bash scripts spawning Linux Docker containers in Google Compute Engine, saving 250 staff hours in total and $4k/year in dept. budget.
- Modernized security course written assignments by writing +30 new problems covering cryptography, web security, networks, data compression, protocol vulnerability analysis.

Meta Teaching Assistant (TA Program Coordinator) Fall 2019 – Present

- Led hiring / training of 781 TAs over 56 courses by managing 112 HTAs over 14 time zones.
- Authored Bash and Python scripts and new organizational processes to reduce management workload by 300 hours, yielding department savings of $5k/year.
- Advocated for TA population by directly negotiating with department and University administrators to yield 20% raise in base pay for *all TAs* from 2019–2021.
- Released *GrblGrader*, a modular feedback delivery and grading management system in JavaScript. Generates 1000 student impressions across 8 CS courses each year.