

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.

Awards

(selected)

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)

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.

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.

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.

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*.

Experience

Encrypted Systems Lab

Fall 2020 – Present

Cryptographic Systems Researcher

- Engineered novel crypto protocol and Java / Node.js prototype for Massachusetts's *Dept. of Public Health* to securely conduct epidemic research over databases of 22 distributed MA institutions, *eliminating costly, vulnerable manual anonymization process*.

Cryptography, Anonymity, Privacy, Security (CAPS) Group

Fall 2020 – Present

Encrypted Databases Researcher

- Designed 7 novel, $O(1)$ -time, provably secure schemes for computing aggregates over encrypted DBs, *lowering state-of-the-art runtime and storage overhead by up to 83%*.
- Devised novel data structure and mathematical algorithms in Python to *reduce experiment and database setup times by 99%* and include 100x larger benchmarks in final publication.
- Exploited geometric patterns in the index structure of multidimensional encrypted databases to develop 2 novel attacks that *fully reconstruct plaintext* of queried attributes.

Google

Summer 2020

Software Engineering Intern, Google Cloud KMS and HSM

- Created [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.
- Devised hierarchical architecture and a system of Bash and Bazel linking scripts to eliminate OpenSSL symbol conflicts with various Google C++ APIs (Abseil, testing, etc.).

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/CSS, 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 6 CS courses, including **Computer Systems Security** (2021, 2020, 2019), a course on web application security, cryptography, Unix / Linux security, networks, etc. in Bash, C, JavaScript, Python, PHP, Ruby, and Go (Golang).
- Automated grading and project setup via shell scripts spawning Linux Docker containers in Google Compute Engine, saving 250 staff hours in total and \$4k/year in dept. budget.
- Taught in 2021 as main lecturer for 9 of 22 lectures and designer for 80% of assignments.

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.
- Released *GrblGrader*, a modular feedback delivery and grading management system in JavaScript. Generates 1000 student impressions across 8 CS courses each year.