

Ammar Ratnani

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Education

Georgia Institute of Technology, B.S. in Computer Science

May 2023 (Expected)

- *Concentrations:* Systems & Architecture and Theory
- *Coursework:* Computer Architecture, Operating Systems, Processor Design, Algorithms
- *GPA:* 4.0

Academic Experience

Student Researcher | Embedded System Cyber Security VIP

Aug. 2021 - Present

- Won first place in CSAW's Embedded System Cybersecurity competition on voltage glitching and power side-channel analysis
- Analyzed `malloc` implementations, fuzzing them for vulnerabilities and using those found to gain shell access on the target system
- Investigated modifying AFL++'s compiler runtime to circumvent infinite recursion when instrumenting standard library functions

Student Researcher | AOS-RISC-V

Apr. 2022 - May 2022

- Worked on a project to provide pointer bounds-checking in hardware
- Implemented the QARMA block cipher in Scala to verify an existing Chisel codebase
- Created a pipelined functional unit to sign pointers using QARMA, and integrated that into the BOOM's pipeline

Teaching Assistant | Intro. Computer Architecture

Aug. 2020 - May 2022

- Instructed students in this challenging major-specific course, guiding them through circuit building, Assembly, C, and some C++
- Interacted with students in both one-on-one office hours and group recitations
- Created instructional material for recitations, as well as student assignments: homeworks, quizzes, and the final exam
- Attained a deeper understanding of how computer systems work

Freelance Tutor | Intro. Information Security

Jan. 2020 - Apr. 2020

- Instructed a student in this graduate-level computer security course covering common vulnerabilities and their mitigation
- Moved from low- to high-level exploits, going from buffer overflows in C to cryptography in Python to web-based exploitation in JavaScript and PHP

Industry Experience

Software Engineering Intern | L3Harris

May 2021 - Aug. 2021

- Administered three platforms running C++ applications on embedded Linux
- Refactored firewall setup scripts to reduce duplicate code while ensuring no regressions were introduced in the process
- Initiated a move to multi-user systems, configuring authentication to integrate with both open-source and hand-written PAM modules

Software Engineering Intern | Fraudmarc

May 2020 - Jul. 2020

- Used Test-Driven Development to work heavily on maturing the codebase
- Cut backend test boilerplate by a factor of twelve and reduced average Cypress runtimes three-fold
- Introduced frontend visual testing with Percy to flag uncaught regressions with little to no overhead and few false positives
- Gained familiarity in email protocols by reading IETF RFCs

Simulation Team Member | Institute of Electrical and Electronics Engineers

Aug. 2019 - Dec. 2019

- Created Georgia Tech's submission to Southeastcon 2020: a small robot that moves to collect blocks then stacks as many as it can in a particular order
- Collaborated with subteam members to test the design and guidance of the robot
- Integrated custom electronics code in Python with PyBullet to ensure fidelity when simulating rigid- and soft-body interactions

Publications

AOS-RISC-V: Towards Always-On Heap Memory Safety

May 2022

Yonghae Kim, Anurag Kar, Siddant Singh, [Ammar Ratnani](#), Jaekyu Lee, Hyesoon Kim
Computer Architecture Research with RISC-V (CARRV)

Honors and Awards

First Place in NYU's CSAW Embedded Systems Cybersecurity Competition

Dec. 2021

- Attacked an ARM microcontroller using power analysis and voltage glitching
- Solved nine binaries, as well as one timed challenge

Third Place in NYU's CSAW CTF Competition

Nov. 2020

- Performed well in the qualifying round and was accepted to the Mad H@tters' team
- Swept the cryptography challenges in the final round, placing us third overall

Perfect Score on the AP Computer Science A Exam

May 2017

- One of only 112 to receive this honor

Projects

Sudo in UserSpace

Oct. 2021 - Dec. 2021

- Experimented with running most of `sudo`'s logic as an unprivileged user
- Configured Linux permissions to ensure isolation between the user and root access
- Achieved feature-completeness, utilizing Rust and its build tools

Gameboy Advance Cross-Compilation

Apr. 2020 - May 2021

- Compiled a GCC-based toolchain to target the GBA with Assembly, C, and some C++
- Packaged the toolchain into Docker containers for end-users and for testing in CI/CD
- Became familiar with program initialization on bare-metal targets and used that knowledge to write a C runtime from scratch

Languages and Frameworks

Proficient: C, Linux

Intermediate: C++, Rust, Verilog, Java, Python, Git

Beginner: Go, CUDA, Chisel, Kotlin, Scala, NumPy, SQL

Open Source Contributions

hangover | github.com/emeryberger/hangover/pull/2

Mar. 2022

Fixed many spurious segmentation faults and aborts in this C++ framework for fuzzing `malloc` implementations

cmocka | gitlab.com/cmocka/cmocka/-/merge_requests/36

Mar. 2021

Propagated failure messages to test output instead of dumping them to standard-out

IEEE SoutheastCon 2020 | github.com/ngadgetry/southeastcon2020/issues/1

Oct. 2019

Corrected an off-by-one error in the score calculation logic for the Student Hardware Competition at this annual event

Gentoo Linux | forums.gentoo.org/viewtopic-p-8341586.html

Jun. 2019

Wrote a patch resolving compiler errors that prevented some users from installing Blender