

# KAKI RYAN

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## EDUCATION

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- University of North Carolina at Chapel Hill** *Expected May 2025*  
Ph.D in Computer Science  
Thesis Topic: Using Symbolic Execution to Enable Efficient + Scalable Security Verification
- University of North Carolina at Chapel Hill** *May 2021*  
M.S. in Computer Science: A Native Symbolic Execution Engine for Hardware Designs
- University of North Carolina at Chapel Hill** *May 2020*  
B.S. in Computer Science & Mathematics

## HONORS AND RECOGNITIONS

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- 2023** Nominated for Best Paper Award at HASP
- 2022** Tanner Award for Excellence in Undergraduate Teaching by Graduate Teaching Assistants (\$5000)
- 2021** John M. Glotzer Graduate Teaching Assistant Award (\$500)
- 2021** Selected to attend GREPSEC V
- 2018** Robert E. Bryan Fellowship (\$2,500)

## TEACHING

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- UNC Chapel Hill** *Chapel Hill, NC*  
*Solo Instructor of Record*
- **COMP 520: Compilers** - Summer 2024  
Solo instructor of record for a 20-student section of a project-based compilers course taught in Java. Developed new assignments and weekly quizzes.
  - **COMP 210: Data Structures** - Summer 2024, Summer 2022  
Solo instructor of record for a 40-student section of data structures taught in Java. Developed new assignments and weekly quizzes. The course project required each student to conduct research on a notable computer scientist from a historically underrepresented background.
  - **COMP 290: Learning in the Digital Age** - Spring 2024  
Advised an undergraduate student as she led a seminar style course covering various topics on the intersection of education and technology. Provided feedback on lectures, assignments and assessments
  - **COMP 110: Intro to Programming** - Summer 2021  
Solo instructor of record for a 40-student section of CS1 course taught in Python. Daily programming assignments and weekly readings on algorithmic bias.

- UNC Chapel Hill** August 2020 - December 2022  
*Graduate Teaching Assistant* *Chapel Hill, NC*

- **COMP 435: Computer Security Principles** - Fall 2023, 2022  
Reorganized six hands-on and investigation-driven lab assignments. Each lab included programming tasks and conceptual components. Held weekly reviews going over problems and concepts from class. Held daily office hours.

- **COMP 110: Intro to Programming** - Fall 2020, Spring 2021, Fall 2021

Manage operations of introductory programming course and transition to Python. Develop online course materials, assessments and projects. Give guest lectures on selected topics. Incorporate readings about the ethics and social implications of algorithmic bias into the curriculum and lead group discussions

## UNC Chapel Hill

*Undergraduate Teaching Assistant*

August 2017 - May 2020

*Chapel Hill, NC*

- **COMP 211: Systems Fundamentals** - Spring 2020

Aided in pilot of a new core systems programming course taught in C; emphasis on representation, memory management, and software engineering tools.

- **COMP 290: Tools for Computer Science** - Spring 2020

1-hour pilot course for majors to introduce fundamental tools: shell, vim, make, git.

- **COMP 110: Intro to Programming** - Fall 2017 through Spring 2020

Covered concepts such as loops, recursion, functions and call stacks, and OOP. Taught in TypeScript and Python. Held one-on-one office hours with hundreds of students. Led grading and code review for 600+ students per semester.

## PUBLICATIONS

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### **Symbolic Execution at Scale: Exploring Large-Scale Open-Source Designs for Security Verification**

**Kaki Ryan** and Cynthia Sturton.

In Submission, 2024.

### **On the Importance of Providing Properties for Open-Source Hardware Designs**

Cade Chabra, Jayden Rogers, **Kaki Ryan** and Cynthia Sturton.

Resubmission in preparation, 2024.

Hardware Security Verification Benchmarks & Properties Database <https://github.com/HWSec-UNC/verification-benchmarks>

### **SEIF: Augmented Symbolic Execution for Information Flow in Hardware Designs**

*Nominated for Best Paper.*

**Kaki Ryan**, Matthew Gregoire, and Cynthia Sturton.

Hardware and Architectural Support for Security and Privacy (HASP), October 2023.

Open-Source Information Flow Verification Engine <https://github.com/HWSec-UNC/seif>

### **Countering the Path Explosion Problem in the Symbolic Execution of Hardware Designs**

**Kaki Ryan** and Cynthia Sturton.

Formal Methods in Computer Aided Design (FMCAD), 2023.

Open-Source Hardware Symbolic Execution Engine: <https://github.com/HWSec-UNC/Sylvia>

### **Special Session: CAD for Hardware Security - Promising Directions for Automation of Security Assurance**

Sohrab Aftabjahani, Mark Tehranipoor, Farimah Farahmandi, Bulbul Ahmed, Ryan Kastner, Francesco Restuccia, Andres Meza, **K. Ryan**, Nicole Fern, Jasper Van Woudenberg, Rajesh Velegalati, Cees-Bart Breunesse, Cynthia Sturton, Calvin Deutschbein

VLSI Test Symposium (VTS), 2023

**Symbolic Execution for Hardware Verification & Security Properties of Open-Source Designs**

Kaki Ryan, Cade Chabra, Jayden Rogers and Cynthia Sturton. Intel Scalable Assurance Workshop, 2024.

**Symbolic Execution + the Security Verification of Hardware Designs**

Kaki Ryan and Cynthia Sturton. CRA-WP Grad Cohort for Women, 2023.

**Countering the Path Explosion Problem in the Symbolic Execution of Hardware Designs**

Kaki Ryan and Cynthia Sturton. Design Automation Conference (DAC), 2023.

INVITED TALKS AND PRESENTATIONS

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1. "Position and Layout," Guest lecture in Practical Web Design Course. February 2024.
2. "Bringing Symbolic Execution to the Security Verification of Hardware Designs," Systems Seminar at UNC. October 2023.
3. "SEIF: Augmented Symbolic Execution for Information Flow in Hardware Designs," Workshop Presentation at HASP. October 2023.
4. "Sylvia: Countering the Path Explosion Problem in the Symbolic Execution of Hardware Designs," Conference Talk at FMCAD. October 2023.
5. "User Authentication," Guest lecture in Computer Security Concepts Course. September 2023
6. "Sylvia: Countering the Path Explosion Problem in the Symbolic Execution of Hardware Designs," Research presentation at Intel Scalable Assurance Cluster Fall Workshop. September 2023.
7. "Bringing Symbolic Execution to the Security Verification of Hardware Designs," Invited talk at Workshop on Computer Architecture Research with RISC-V (CARRV). June 2023.
8. "Understanding Information Flow through Static and Symbolic Analysis," Research presentation at Semi-Conductor Corporation (SRC) Hardware Security Annual Review. June 2023.
9. "Three Strategies for Falsifying Information Flow Paths Using Static and Symbolic Analysis," Lightning talk at Women in Security and Cryptography Workshop (WISC). June 2023.
10. "Understanding Information Flow through Static and Symbolic Analysis," Research presentation at Intel Scalable Assurance Cluster Spring Workshop. May 2023.
11. "Formal Verification + Operating Systems," Guest lecture in Advanced Operating Systems. March 2023.
12. "Piecewise Composition: A new strategy for tackling path explosion," Systems Seminar at UNC. January 2023.
13. "Modes of Operation and Encryption," Guest lecture in Computer Security Concepts course. September 2022.
14. "Hardware Security at UNC," invited talk at UNC Black in Tech Research Fair. March 2022.
15. "Intro to Recursion," Guest lecture in CS1 course at UNC. December 2021.
16. "Intro to git!," Invited talk at HACK110 Hackathon at UNC. December 2021.
17. "Peer Teaching Summit," Student panelist at SIGCSE. March 2019.
18. "University discussion of using Undergraduate Learning Assistants (ULAs)," invited panelist. March 2019.

## UNDERGRADUATE STUDENTS MENTORED

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<b>Martim Gaspar</b> <i>UNC Chapel Hill</i>	August 2024 - Present
<b>Samantha Espinosa</b> <i>UNC Chapel Hill</i>	August 2024 - Present
<b>Niyaz Shakeel</b> <i>UNC Chapel Hill</i>	August 2024 - Present
<b>Divya Mankani</b> <i>UNC Chapel Hill</i>	August 2024 - Present
<b>Trisha Samavedam</b> <i>UNC Chapel Hill</i>	January 2024 - Present <i>UNC-Intel REU Summer 2024</i>
<b>Jayden Rogers</b> <i>NC A&amp;T</i>	June 2023 - Present <i>UNC-Intel REU Summer 2023</i>
<b>Karen Gonzalez-Palomo</b> <i>UNC Chapel Hill</i>	B.S. May 2024
<b>Cade Chabra</b> <i>UNC Chapel Hill</i>	B.S. May 2024
<b>Jesse Wei</b> <i>UNC Chapel Hill</i>	November 2022 - May 2023
<b>Maurille Beheton</b> <i>Shaw University</i>	Summer 2022 <i>UNC-Intel REU Summer 2022</i>
<b>Moshe Ikechukwu</b> <i>UNC Chapel Hill</i>	B.S. December 2022

## INDUSTRY AND WORK EXPERIENCE

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<b>Cisco Systems, Inc.</b> <i>Summer Software Engineering Intern</i>	Summer 2019 <i>Research Triangle Park, NC</i>
Developed MEAN stack application to automate Google Lighthouse audits, measure performance of Cisco.com and its microsites. Project deployed into production.	
<b>Voting Rights Data Institute Summer Fellowship</b> <i>Metric Geometry and Gerrymandering Group</i>	May 2018 - August 2018
Used census data and GIS shapefiles to compile data-rich population graphs. Developed R Shiny application to calculate and interpret ecological inference. Generate districting plans with a Markov chain Monte Carlo algorithm.	
<b>Viyb Health</b> <i>Front-End Development Intern</i>	Summer 2018 <i>Chapel Hill, NC</i>
Created user-friendly web platform for a mental health start-up using HTML and CSS. Collaborate with back-end developers to improve usability.	

**National Alliance on Mental Illness (NAMI)***Education Intern*

Summer 2017

Arlington, VA

Wrote selections on diversity and inclusion for program manual to be distributed to trainers at NAMI affiliates nationwide.

**UNIVERSITY AND DEPARTMENT SERVICE**

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**UNC Computer Science Graduate Curriculum Committee***Graduate Student Member*

August 2023 - Present

Serve as graduate student representative to provide feedback on program changes and current offerings.

**UNC Intel REU Program***Graduate Student Research Mentor and Co-Organizer*

May 2022 - Present

During summer 2022 I served as a research mentor for one student, leading them in a project that involved building a testing framework onto one of our group's existing tool chains. Collaborating with UNC staff and Intel partners to create an engaging and inclusive program for students.

**University Post-Baccalaureate Teaching Awards Committee***Graduate Student Member*

July 2022 - May 2023

Review the portfolios and select the recipients of the University Distinguished Teaching Awards for Post-Baccalaureate Instruction.

**UNC Computer Science Diversity and Inclusion Committee** January 2022 - December 2023*Graduate Student Member*

Create, develop, and assess DEI practices with the department. Member of community engagement subcommittee focused on outreach to K-12 students and surrounding schools.

**UNC Undergrad Curriculum Committee***Student Member*

April 2019 - January 2023

Serve as a liaison between students and faculty in the computer science department. Provide input and feedback on current course offerings and topics covered.

**UNC Computer Science Undergraduate Admissions Committee** May 2022 - December 2022*Graduate Student Member*

Provide student insight and experiences during the development of new departmental admission processes and procedures. Read applications and provide input during the decision making process.

**UNC 3C Fellows***Cohort 2*

January 2022 - December 2022

Develop new curriculum for UNC's undergraduate computer science program focused on the intersection of computing and racism, identity, discrimination, equity, and bias. Study texts with goal of implementing new departmental policies to foster a more inclusive and equitable culture.

**STUDENT LEADERSHIP POSITIONS**

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**UNC Systems Reading Group**

Founded the group as a way to build community and relationships across the systems research groups in the department.

Spring 2024 - Present

**UNC Graduate Women in Computer Science**

August 2022 - Present

*President*

Revitalized the organization post-covid to serve as a space for women in the department to connect and find community. Additional activities include community outreach, mentorship, networking with alumni, and a semesterly speaker series.

**TOPICS Club**

September 2021 - Present

*Graduate Student Mentor*

“Talking Over Papers in Computer Science.” Graduate mentor for undergraduate women’s reading group. Help select papers to read and provide advice, encouragement, and a place to talk.

**UNC Computer Science Students Association**

August 2022 - May 2024

*Student Officer*

Collaborate with other officers to represent the interests of UNC Computer Science graduate students to the faculty. Advocate for curriculum and cultural changes. Plan social events.

**UNC Student Safety and Security Committee**

August 2022 - December 2022

*Graduate Student Member*

Represent the safety and security interests of UNC Chapel Hill graduate students. Responsible for maintaining and appropriating the Student Safety and Security Fee to campus organizations and university departments to promote student safety at UNC.

**Mental Health Ambassadors**

September 2018

*Carolina Center for Public Service*

Prepare and deliver presentations to various organizations and audiences on campus about different aspects of mental health to fight stigma. Mental health first aid certified. Bryan Fellowship project.