Allison K. Sullivan, PhD

Assistant Professor of Computer Science at North Carolina A&T State University

504 McNair Hall, 1601 E. Market Street Greensboro, NC 27411

(+1) 281-785-8430 | allisonksullivan@gmail.com | allisonius.github.io

Research Interest

Software Engineering, in particular: Test/Oracle Generation, Automated Bug Localization and Repair, Regression Testing, Mutation Testing, and Program Synthesis.

Formal Methods and Programming Languages, in particular: Model Checking, Model Based Testing, First-Order Logic, Program Invariant Inference, Points-to Analysis and Symbolic Execution.

Academic Experience

2018-PRESENT	**Assistant Professor**, North Carolina A&T State University	*Greensboro, NC*
2012-2017	**Research Assistant**, The University of Texas at Austin	*Austin, Texas*
2011-2012	**Undergraduate Research Assistant**, The University of Texas at Dallas	*Richardson, Texas*

Education

The University of Texas at Austin — *Austin, Texas*

Ph.D. in Software Engineering — *May 2017*

- **Dissertation:** Automated Testing and Sketching of Alloy Models
- **Research Group:** Software Validation, Verification and Testing (SVVAT) | **Advisor:** Dr. Sarfraz Khurshid

The University of Texas at Austin — *Austin, Texas*

M.S. in Software Engineering — *May 2014*

- **Thesis:** AUnit - A Testing Framework for Alloy
- **Research Group:** Software Validation, Verification and Testing (SVVAT) | **Advisor:** Dr. Sarfraz Khurshid

The University of Texas at Dallas — *Richardson, Texas*

B.S. in Software Engineering — *May 2012*

- **Specialization:** Embedded Systems | **GPA:** 4.0

Industry Experience

Google, Inc. — *Mountain View, CA*

Faculty in Residence — *Jun. 2019 - July. 2019*

- **Professional Development.** FIR is an immersive professional development program that trained me to: design and implement classroom experiments related to project-based learning, conduct resume workshops, and give mock interviews. During this program, I re-designed "Comp 285: Design and Analysis of Algorithms" in conjunction with Google engineers.

Naval Research Laboratory (NRL) — *Washington, D.C.*

Research Intern in the Center for High Assurance Computer Systems — *Jun. 2015 - Jan. 2016*

- **Model Based Testing.** I Improved NRL's model based testing (MBT) infrastructure. I expanded the SCR modeling toolset to automatically generate test cases that incorporate SCR assumptions. This included updating the automated translations of SCR models into SPIN, NuSMV, and PVS with formulas that explore the assumption(s).

IBM Research — *Austin, Texas*

Software Testing Intern in the Virtual Test Suite Automation Team — *May. 2013 - Aug. 2013*

- **Test Automation Toolset.** Using RQM's REST API, I built a test automation toolset to ensue test suites automatically feed their output into IBM's project management tool. This toolset bridges existing automation scripts with the RQM toolset.

Funding

[1] **Source:** NSF Formal Methods in the Field – **Title:** Alloy Analyzer Plus: an Integrated Development Environment for Alloy – **PIs:** Allison Sullivan – **Amt:** $100k

[2] **Source:** NSF HBCU-UP ACE Implementation Project in Data Science Scholarship of Teaching and Learning Award – **Title:** Project Based Learning in the Teaching of Analysis of Algorithms – **PIs:** Allison Sullivan – **Amt:** $5k

Publications

Refereed Conference Papers

[1] Allison Sullivan, Darko Marinov, and Sarfraz Khurshid. Solution enumeration abstraction - a modeling idiom to enhance a lightweight formal method. In *International Conference on Formal Engineering Methods (ICFEM)*, 2019.

[2] Kaiyuan Wang, Allison Sullivan, and Sarfraz Khurshid. ARepair: A repair framework for Alloy. In *International Conference on Software Engineering (ICSE) Demonstration Track*, 2019.

[3] Kaiyuan Wang, Allison Sullivan, and Sarfraz Khurshid. Automated model repair for Alloy. In *International Conference on Automated Software Engineering (ASE)*, 2018.

[4] Kaiyuan Wang, Allison Sullivan, Darko Marinov, and Sarfraz Khurshid. Asketch: a sketching framework for Alloy. In *The ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (FSE)*, 2018.

[5] Allison Sullivan, Kaiyuan Wang, and Sarfraz Khurshid. AUnit: A test automation tool for Alloy. In *International Conference on Software Testing, Verification and Validation (ICST)*, 2018.

[6] Kaiyuan Wang, Allison Sullivan, Darko Marinov, and Sarfraz Khurshid. Solver-based sketching of Alloy models using test valuations. In *International ABZ Conference ASM, Alloy, B, TLA, VDM, Z*, 2018. **Invited for journal submission.**

[7] Kaiyuan Wang, Allison Sullivan, Manos Koukoutos, Darko Marinov, and Sarfraz Khurshid. Systematic generation of non-equivalent expressions for relational algebra. In *International ABZ Conference ASM, Alloy, B, TLA, VDM, Z*, 2018.

[8] Kaiyuan Wang, Allison Sullivan, and Sarfraz Khurshid. MuAlloy: A mutation testing framework for Alloy. In *International Conference on Software Engineering (ICSE)*, 2018.

[9] Allison Sullivan, Kaiyuan Wang, Razieh Nokhbeh Zaeem, and Sarfraz Khurshid. Automated test generation and mutation testing for Alloy. In *IEEE Conference on Software Testing, Validation and Verification (ICST)*, 2017.

[10] Nima Dini, Allison Sullivan, Milos Gligoric, and Gregg Rothermel. The effect of test suite type on regression test selection. In *International Symposium on Software Reliability Engineering (ISSRE)*, 2016.

[11] Allison Sullivan, Razieh Nokhbeh Zaeem, Sarfraz Khurshid, and Darko Marinov. Towards a test automation framework for Alloy. In *International Symposium on Model Checking of Software (SPIN)*, 2014.

Refereed Workshop Papers

[12] Allison Sullivan, Kaiyuan Wang, Sarfraz Khurshid, and Darko Marinov. Evaluating state modeling techniques in Alloy. In *Workshop on Software Quality Analysis, Monitoring, Improvement, and Applications (SQAMIA)*, 2017.

Thesis and Dissertation

[13] Allison Sullivan. Automated testing and sketching of Alloy models. In *Texas ScholarWorks - UT Electronic Theses and Dissertations*, 2017.

[14] Allison Sullivan. AUnit: A testing framework for Alloy. In *Texas ScholarWorks - UT Electronic Theses and Dissertations*, 2014.

University Service

Club Advisor

- I am the faculty advisor for the **Girls Who Code Loops** branch at NC A&T.

Faculty Mentor for SAE International and General Motors co-sponsored AutoDrive Challenge

- **Functional Safety Group.** Mentors 4 graduate students, 1 undergraduate student.
- **Mapping Challenge Group.** Mentors 4 graduate students. *Placed 2nd overall in the Year 2 competition.*

Member of NC A&T's Center of Excellence in Cybersecurity Research, Education and Outreach (CREO)

- I work with an interdisciplinary group to apply formal methods to the cybersecurity field.

Intel's HBCU Consortium CS Representative

- I helped brainstorm for, and will help draft, NC A&T's submission to Intel's HBCU Beyond 2020 Program grant that will span 2 years and 2 million dollars.

Co-organized the Triad Programming Contest

- I wrote half the problems for the contest and helped judge the contest.

Faculty Advisor for 2nd Annual Advancing Minorities' Interest in Engineering (AMIE) Design Challenge

- Advised a team of 5 undergraduate students competing in an IBM "Design Thinking" challenge.

NC A&T Representative to Facebook T3 Summit on Data Structures and Algorithms

- Worked with Facebook engineers to design and share course material for Data Structures and Algorithms.

Faculty Supervisor

Current Students

- **Fikirte Ayalke** – **Level:** Doctoral, **Focus:** Formal Methods and Cyber Security, **Projected grad date:** Spring 2022
- **Jasmine Mabrey** – **Level:** Masters, **Focus:** Program and Data structure Repair, **Projected grad date:** Spring 2020
- **Jeffrey Moore, II** – **Level:** Masters, **Focus:** Extending SCR to model CPS, **Projected grad date:** Spring 2020
- **Angel Patterson** – **Level:** Masters, **Focus:** Autonomous Vehicle Verification, **Projected grad date:** Spring 2020
- **George Thompson** – **Level:** Masters, **Focus:** Prolog Fault Localization, **Projected grad date:** Spring 2020
- **Joelle Banks** – **Level:** Undergraduate, **Focus:** Semantic-Based Program Repair, **Projected grad date:** Spring 2020

Graduated Students

- **Regina Bunch** – **Level:** Masters | **Project:** AMail: Email for Austim | **Graduation date:** Fall 2018

Open Source Contributions

Solution Enumeration for Alloy

- **Seabs.** Toolset to guide solution enumeration for Alloy models using abstract functions, which specify how the solutions must differ: *https://github.com/Allisonius/Seabs*.

AUnit: Unit Testing Tools for Alloy

- **AUnit Analyzer.** Extension to the Alloy Analyzer that provides support for AUnit, namely: test creation and execution, coverage reporting, and automated test generation: *https://sites.google.com/view/aunitanalyzer*.
- **MuAlloy.** A command line tool built on top of Alloy 4.2 that provides mutation testing and mutation-based test generation for Alloy models: *https://github.com/kaiyuanw/MuAlloy*.

Alloy Repair and Sketching Tools

- **ARepair.** A command line tool built on top of Alloy 4.2 that automatically repairs faulty Alloy models, including models with multiple faults: (*https://github.com/kaiyuanw/ARepair*).
- **ASketch.** A command line tool built on top of Alloy 5.0 that can synthesis partial Alloy models, producing complete models which are correct w.r.t. a test suite: (*https://github.com/kaiyuanw/ASketch*).

Honors & Awards

Oct 2019	**Grace Hopper Celebration 2019 Faculty Scholarship**, from AnitaB.org
2012 - 2016	**Virginia and Ernest Cockrell Jr. Fellowship in Engineering Recipient**, University of Texas at Austin.
Spring 2012	**ECS Departmental Honors**, University of Texas at Dallas.
2008 - 2012	**Academic Excellence Scholarship Recipient**, University of Texas at Dallas.

Teaching Experience

Fall 2019	**Instructor**, COMP 285: Analysis of Algorithms, North Carolina A&T State.	*Undergrad*
Fall 2019	**Instructor**, COMP 611: System Testing and Evaluation, North Carolina A&T State.	*Graduate*
Spring 2019	**Instructor**, COMP 496: Senior Design, North Carolina A&T State.	*Undergrad*
Spring 2019	**Instructor**, COMP 681: Formal Methods, North Carolina A&T State.	*Graduate*
Fall 2018	**Instructor**, COMP 285: Analysis of Algorithms, North Carolina A&T State.	*Undergrad*
Spring 2016	**Teaching Assistant**, EE 382C: Verification and Validation, University of Texas at Austin.	*Graduate*
Spring 2014	**Teaching Assistant**, EE 382C: Requirements Engineering, University of Texas at Austin.	*Graduate*
Fall 2011	**Teaching Assistant**, CS 3345: Data Structures & Algorithms, University of Texas at Dallas.	*Undergrad*

Skills

Systems	Windows, Linux
Languages	Java, C++, Alloy, SCR, Promela, SMT, Prolog, JavaScript, SQL, HTML
Tools	Eclipse, Visual Studio, JUnit, Alloy Analyzer, SPIN, NuSMV, Java PathFinder, Z3 SMT Solver, Rosette, Selenium, MySQL, IBM DB2, jQuery, Hadoop, Subversion, Git,