

Karim Ali

ASSISTANT PROFESSOR · UNIVERSITY OF ALBERTA

3-42 Athabasca Hall, Edmonton, Alberta, T6G 2E8, Canada

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Research Areas

My primary research interest is to develop and evaluate static analysis techniques that are applicable in real-world settings by exploring three aspects: scalability, precision, and usability. My interests span programming languages and software systems.

Academic Appointments

Assistant Professor, Department of Computing Science, University of Alberta, Canada

Jul 2017–Present

Research Assistant Professor, Department of Computing Science, University of Alberta, Canada

Jul 2016–Jul 2017

Education

Ph.D., Computer Science, University of Waterloo, Canada

2014

- Advisor: Ondřej Lhoták
- Thesis: The Separate Compilation Assumption
- Committee: Jan Vitek, Frank Tip, Reid Holmes, and Werner Dietl

MMath, Computer Science, University of Waterloo, Canada

2010

- Advisor: Raouf Boutaba
- Thesis: Algorizmi - A Configurable Virtual Testbed to Generate Datasets for Offline Evaluation of Intrusion Detection Systems
- Reviewers: Ian MacKillop and Urs Hengartner

B.Sc., Computer Science, The American University in Cairo, Egypt

2007

- Advisors: Sherif G. Aly and Sherif El-Kassas
- Thesis: A Jabber Framework for Building Communication Capable Java Mobile Applications
- Minor: Mathematics

Professional Experience

Postdoctoral Researcher, Secure Software Engineering, Technische Universität Darmstadt, Germany

Oct 2014–Jul 2016

Software Engineer, Execution Team, ITWorx, Egypt

Jun 2007–Dec 2007

Researcher, Software Engineering, The American University in Cairo, Egypt

May 2007–Dec 2007

Awards and Honours

Dahl-Nygaard Junior Prize, Association Internationale pour les Technologies Objets (AITO)

2021

ACM SIGPLAN Distinguished Paper Award, ACM SIGPLAN Symposium on Principles of Programming Languages (POPL)

2019

Student's Choice Award, University of Alberta, Canada

2018

ACM SIGSOFT Distinguished Paper Award, International Symposium on Software Testing and Analysis (ISSTA)

2017

Distinguished Artifact Award, European Conference on Object-Oriented Programming (ECOOP)

2014

B.Sc. Summa Cum Laude Honors, The American University in Cairo, Egypt

2007

Research Funding

Game-Theoretic Static Bug Detection

2021–2022

- Oracle Labs
- Sole PI
- Amount: CAD\$25,000

Analysis-Driven Inlining Algorithms

2020–2023

- IBM Centre for Advanced Studies Research Fellowship
- Sole PI
- Amount: CAD\$90,000

Improving JVM Startup Performance Through Static Analysis

2020–2023

- IBM Centre for Advanced Studies Research Fellowship
- Sole PI
- Amount: CAD\$90,000

Automatic Verification of Comparators and Hash Functions

2019–2020

- Mitacs Accelerate (in collaboration with Synopsys)
- Sole PI
- Amount: CAD\$30,000

Validating the Correct Usage of Cryptography Libraries

2018–2020

- IBM Centre for Advanced Studies Research Fellowship
- Sole PI
- Amount: CAD\$60,000

Scalable and Precise Program Analysis for Modern Software Systems

2017–2022

- Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery Grant
- Sole PI
- Amount: CAD\$125,000

Improving the Inlining Algorithms in the IBM Just-in-Time (JIT) Compiler

2017–2020

- IBM Centre for Advanced Studies Research Fellowship
- Sole PI
- Amount: CAD\$90,000

Publications

Note: underlined names indicate students whom I have (co-)supervised in an official capacity. Double-underlined names indicate students whom I led to publish their course projects. Authors are ordered according to their contributions. “Hamdan” is my middle name and was used as my last name for an earlier journal publication.

REFEREED JOURNAL ARTICLES

Abdul Ali Bangash, Hareem Sahar, Abram Hindle, and **Karim Ali**. “On the Time-Based Conclusion Stability of Software Defect Prediction Models”. *International Journal on Empirical Software Engineering*, 25(6), pp. 5047–5083, 2020. (Impact Factor: 3.156).

EMSE '20

Lisa Nguyen Quang Do, James R. Wright, and **Karim Ali**. “Why Do Software Developers Use Static Analysis Tools? A User-Centered Study of Developer Needs and Motivations”. *IEEE Transactions on Software Engineering*, (accepted to appear), 2020. (Impact Factor: 6.112).

TSE '20

Karim Ali, Xioani Lai, Zhaoyi Luo, Ondřej Lhoták, Julian Dolby, and Frank Tip. “A Study of Call Graph Construction for JVM-Hosted Languages”. *IEEE Transactions on Software Engineering*, (accepted to appear), 2019. (Impact Factor: 6.112).

TSE '19

Stefan Krüger, Johannes Späth, **Karim Ali**, Eric Bodden, and Mira Mezini. “CrySL: An Extensible Approach to Validating the Correct Usage of Cryptographic APIs”. *IEEE Transactions on Software Engineering*, (accepted to appear), 2019. (Impact Factor: 6.112).

TSE '19

Lisa Nguyen Quang Do, Stefan Krüger, Patrick Hill, **Karim Ali**, and Eric Bodden. “Debugging Static Analysis”. *IEEE Transactions on Software Engineering*, 46(7), pp. 697–709, 2020. (Impact Factor: 3.331).

TSE '18

Karim Ali, Marianna Rapoport, Ondřej Lhoták, Julian Dolby, and Frank Tip. “Type-Based Call Graph Construction Algorithms for Scala”. *ACM Transactions on Software Engineering and Methodology*, 25(1), 9:1–9:43, 2015. (Impact Factor: 2.057).


TOSEM '15

Sherif Aly, Sarah Nadi, and **Karim Hamdan**. “A Java-Based Programming Language Support of Location Management in Pervasive Systems”. *International Journal of Computer Science and Network Security*, 8(6), pp. 329–336, 2008. (Impact Factor: 1.486).

IJCSNS '08

REFEREED CONFERENCE PUBLICATIONS

- Erick Ochoa, Cijie Xia, **Karim Ali**, Andrew Craik, and José Nelson Amaral. “U Can’t Inline This!” *International Conference on Computer Science and Software Engineering*, pp. 1–10, 2021. (Acceptance Rate: 18/70 = 25%). CASCON '21
- Kristen Newbury, **Karim Ali**, and Andrew Craik. “Hotfixing Misuses of Crypto APIs in Java Programs”. *International Conference on Computer Science and Software Engineering*, pp. 1–10, 2021. (Acceptance Rate: 18/70 = 25%). CASCON '21
- Abdul Ali Bangash, Daniil Tiganov, **Karim Ali**, and Abram Hindle. “Energy Efficient Guidelines for iOS Core Location Framework”. *International Conference on Software Maintenance and Evolution*, pp. 1–12, 2021. (Acceptance Rate: 43/179 = 24%). ICSME '21
- Daniil Tiganov, Jeff Cho, **Karim Ali**, and Julian Dolby. “SWAN: A Static Analysis Framework for Swift”. *ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering*, pp. 1640–1644, 2020. (Acceptance Rate: 26/44 = 59%). ESEC/FSE '20
Tool Paper
- Stefan Krüger, **Karim Ali**, and Eric Bodden. “COGNICRYPT_{GEN} - Generating Code for the Secure Usage of Crypto APIs”. *International Symposium on Code Generation and Optimization*, pp. 185–198, 2020. (Acceptance Rate: 26/95 = 27%). CGO '20
- Abdul Ali Bangash, Hareem Sahar, Shaiful Alam Chowdhury, Alexander William Wong, Abram Hindle, and **Karim Ali**. “What do developers know about machine learning: a study of ML discussions on StackOverflow”. *International Conference on Mining Software Repositories*, pp. 260–264, 2019. (Acceptance Rate: 14/27 = 52%). MSR '19
Mining Challenge
- Artem Chikin, José Nelson Amaral, **Karim Ali**, and Ettore Tiotto. “Toward an Analytical Performance Model to Select between GPU and CPU Execution”. *IEEE International Workshop on High-Level Parallel Programming Models and Supportive Environments*, pp. 353–362, 2019. HIPS '19
- Johannes Späth, **Karim Ali**, and Eric Bodden. “Context-, Flow-, and Field-Sensitive Data-Flow Analysis Using Synchronized Pushdown Systems”. *ACM SIGPLAN Symposium on Principles of Programming Languages*, 48:1–48:29, 2019. (Acceptance Rate: 77/267 = 29%). POPL '19
Distinguished Paper
- Stefan Krüger, Johannes Späth, **Karim Ali**, Eric Bodden, and Mira Mezini. “CrySL: An Extensible Approach to Validating the Correct Usage of Cryptographic APIs”. *European Conference on Object-Oriented Programming*, 10:1–10:27, 2018. (Acceptance Rate: 26/66 = 39%). ECOOP '18
- Lisa Nguyen Quang Do, Stefan Krüger, Patrick Hill, **Karim Ali**, and Eric Bodden. “VISUFLOW: A Debugging Environment for Static Analyses”. *International Conference on Software Engineering (Companion Volume)*, pp. 89–92, 2018. (Acceptance Rate: 30/72 = 42%). ICSE '18
Tool Paper
- Stefan Krüger, Sarah Nadi, Michael Reif, **Karim Ali**, Mira Mezini, Eric Bodden, Florian Göpfert, Felix Günther, Christian Weinert, Daniel Demmler, and Ram Kamath. “CogniCrypt: Supporting Developers in using Cryptography”. *International Conference on Automated Software Engineering*, pp. 931–936, 2017. ASE '17
Tool Paper
- Johannes Späth, **Karim Ali**, and Eric Bodden. “IDE^{al}: Efficient and Precise Alias-Aware Dataflow Analysis”. *ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages and Applications*, 99:1–99:27, 2017. (Acceptance Rate: 66/223 = 30%). OOPSLA '17
- Mona Nashaat, **Karim Ali**, and James Miller. “Detecting Security Vulnerabilities in Object-Oriented PHP Programs”. *IEEE International Working Conference on Source Code Analysis and Manipulation*, pp. 159–164, 2017. SCAM '17
- Taylor Lloyd, Artem Chikin, Erick Ochoa, **Karim Ali**, and José Nelson Amaral. “A Case for Better Integration of Host and Target Compilation When Using OpenCL for FPGAs”. *International Workshop on FPGAs for Software Programmers*, pp. 1–9, 2017. FSP '17
- Lisa Nguyen Quang Do, **Karim Ali**, Ben Livshits, Eric Bodden, Justin Smith, and Emerson Murphy-Hill. “Just-in-Time Static Analysis”. *International Symposium on Software Testing and Analysis*, pp. 307–317, 2017. (Acceptance Rate: 31/118 = 26%). ISSTA '17
Distinguished Paper
- Lisa Nguyen Quang Do, **Karim Ali**, Ben Livshits, Eric Bodden, Justin Smith, and Emerson Murphy-Hill. “Cheetah: Just-in-Time Taint Analysis for Android Apps”. *International Conference on Software Engineering - Companion Volume*, pp. 39–42, 2017. (Acceptance Rate: 18/57 = 32%). ICSE '17
Tool Paper
- Johannes Späth, Lisa Nguyen Quang Do, **Karim Ali**, and Eric Bodden. “Boomerang: Demand-Driven Flow-Sensitive, Field-Sensitive, and Context-Sensitive Pointer Analysis”. *European Conference on Object-Oriented Programming*, 22:1–22:26, 2016. (Acceptance Rate: 25/79 = 32%). ECOOP '16

- Steven Arzt, Sarah Nadi, **Karim Ali**, Eric Bodden, Sebastian Erdweg, and Mira Mezini. “Towards Secure Integration of Cryptographic Software”. *ACM SIGPLAN Symposium on New Ideas in Programming and Reflections on Software at SPLASH*, pp. 1–13, 2015. (Acceptance Rate: 17/37 = 46%). Onward! '15
- Karim Ali**, Marianna Rapoport, Ondřej Lhoták, Julian Dolby, and Frank Tip. “Constructing Call Graphs of Scala Programs”. *European Conference on Object-Oriented Programming*, pp. 54–79, 2014. (Acceptance Rate: 27/101 = 27%). ECOOP '14  Distinguished Artifact
- Karim Ali** and Ondřej Lhoták. “Averroes: Whole-Program Analysis without the Whole Program”. *European Conference on Object-Oriented Programming*, pp. 378–400, 2013. (Acceptance Rate: 29/116 = 25%). ECOOP '13
- Karim Ali** and Ondřej Lhoták. “Application-Only Call Graph Construction”. *European Conference on Object-Oriented Programming*, pp. 688–712, 2012. (Acceptance Rate: 30/140 = 21%). ECOOP '12

OTHER REFEREED PUBLICATIONS

- Karim Ali**, Issam Aib, and Raouf Boutaba. “P2P-AIS: A P2P Artificial Immune Systems architecture for detecting DDoS flooding attacks”. *Global Information Infrastructure Symposium*, 2009. GIIS '09
- Karim Ali** and Raouf Boutaba. “Applying Kernel Methods to Anomaly-based Intrusion Detection Systems”. *Global Information Infrastructure Symposium*, 2009. GIIS '09

Selected Invited Talks

- “Scalable and Precise Static Analysis. For Real!” Dahl-Nygaard Junior Prize Keynote, 2021. ECOOP '21
- “Hotfixing Misuses of Crypto APIs in Java Programs”. IFIP Working Group 2.4 on Software Implementation Technology, 2021. IFIP '21
- “Is Program Analysis The Silver Bullet Against Software Bugs?” Java Pathfinder Workshop, 2020. JPF '20
- “U Can’t Inline This”. IFIP Working Group 2.4 on Software Implementation Technology, 2020. IFIP '20
- “Scalable and Precise Detection of Security Vulnerabilities”. Amazon, Palo Alto, CA, USA, 2019. Amazon '19
- “Scalable and Precise Detection of Security Vulnerabilities”. Google, Mountain View, CA, USA, 2019. Google '19
- “Is Program Analysis The Silver Bullet Against Software Bugs?” Papers We Love Conference, St. Louis, MI, USA, 2019. PWLConf '19
- “U Can’t Inline This”. TURBO Workshop at SPLASH, 2018. TURBO '18
- “SWAN: A Program Analysis Framework for Swift”. NJR Workshop at SPLASH, 2018. NJR '18
- “Designing Tomorrow’s Static Analyses - Addressing Scalability, Precision, and Usability”. University of Colorado Boulder, 2016. Boulder '16
- “Designing Tomorrow’s Static Analyses - Addressing Scalability, Precision, and Usability”. Rochester Institute of Technology, 2016. RIT '16
- “Designing Tomorrow’s Static Analyses - Addressing Scalability, Precision, and Usability”. Iowa State University, 2016. ISU '16
- “Evaluating Call Graph Construction for JVM-hosted Language Implementations”. IFIP Working Group 2.4 on Software Implementation Technology, 2015. IFIP '15
- “Averroes - Letting go of the library!” Samsung Research America, Mountain View, CA, USA, 2015. SRA '15
- “Whole-Program Analysis Without the Whole Program”. McGill University, 2015. McGill '15

Patents

“Assessment of the Benefit of Post-Inlining Program Transformation in Inlining Decisions”. Andrew James Craik, Erick Ochoa, José Nelson Amaral, and Karim Ali, U.S. Patent P201803683US01, Jun 2019.

“Hybrid Computing Device Selection Analysis”. Artem Chikin, José Nelson Amaral, and Karim Ali, U.S. Patent P201803063, Aug 2018.

Professional Service

PROGRAM COMMITTEE ORGANIZATION

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| ECOOP PC Co-Chair , European Conference on Object-Oriented Programming | 2022 |
| SPLASH-I Co-Chair , ACM SIGPLAN Conference on Systems, Programming, Languages and Applications: Software for Humanity | 2018 |
| SPLASH-I Co-Chair , ACM SIGPLAN Conference on Systems, Programming, Languages and Applications: Software for Humanity | 2017 |
| ESSoS Artifact Evaluation Co-Chair , International Symposium on Engineering Secure Software and Systems | 2017 |
| FSE Demonstration Track Co-Chair , ACM SIGSOFT Symposium on the Foundations of Software Engineering | 2017 |
| SOAP Program Committee Co-Chair , ACM SIGPLAN International Workshop on the State Of the Art in Program Analysis @ PLDI | 2017 |

PROGRAM COMMITTEE MEMBER

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| ICSE , International Conference on Software Engineering | 2022 |
| ICQ , International Conference on Code Quality | 2022 |
| OOPSLA , ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages and Applications | 2021 |
| ICSE NIER , International Conference on Software Engineering | 2021 |
| OOPSLA , ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages and Applications | 2020 |
| ECOOP , European Conference on Object-Oriented Programming | 2020 |
| MSR Mining Challenge , International Conference on Mining Software Repositories | 2020 |
| ISSTA , International Symposium on Software Testing and Analysis | 2019 |
| SOAP , ACM SIGPLAN International Workshop on the State Of the Art in Program Analysis @ PLDI | 2019 |
| SEAD , International Workshop on Software Security from Design to Deployment @ ASE | 2019 |
| ECOOP , European Conference on Object-Oriented Programming | 2018 |
| ISSTA , International Symposium on Software Testing and Analysis | 2018 |
| CASCON , International Conference on Computer Science and Software Engineering | 2017 |
| Onward! , ACM International Symposium on New Ideas, New Paradigms, and Reflections on Programming and Software @SPLASH | 2017 |

ARTIFACT EVALUATION COMMITTEE MEMBER

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| ISSTA , International Symposium on Software Testing and Analysis | 2016 |
| PLDI , ACM SIGPLAN Conference on Programming Language Design and Implementation | 2015 |
| ECOOP , European Conference on Object-Oriented Programming | 2015 |
| ECOOP , European Conference on Object-Oriented Programming | 2014 |

WORKSHOP ORGANIZATION

| | |
|--|------------|
| PLMW Co-Chair , Programming Languages Mentorship Workshop @ OOPSLA | 2019, 2020 |
| Panathon Co-Organizer , Program Analysis Hackathon @ ECOOP | 2018, 2019 |
| BenchWork Co-Organizer , Workshop on Benchmarking @ ECOOP/ISSTA | 2018 |
| CDP Co-Organizer , Compiler-Driven Performance Workshop @ CASCON | 2017 |
| SOAP Co-Organizer , ACM SIGPLAN International Workshop on the State Of the Art in Program Analysis @ PLDI | 2017 |
| WALA Hackathon Co-Organizer , Program Analysis Hackathon @ PLDI | 2017 |
| DECAF Co-Organizer , Workshop on Designing Code Analysis Frameworks @ ISSTA | 2016 |
| Co-Organizer , Workshop on WALA @ PLDI | 2015 |

JOURNAL REVIEWER

TSE, IEEE Transactions on Software Engineering

2013, 2019

TOPLAS, ACM Transactions on Programming Languages and Systems

2018, 2019

SCP, Science of Computer Programming

2015

OTHER

CANOSP Co-Founder, Canada Open-Source Projects

2019–Present

Reverse EXPO Co-Organizer, Annual Computing Science Industry/Academia Conference at the University of Alberta

2018–2019

Associate Editor, IEEE Software Blog

2017–2020

Steering Committee Member, Undergraduate Capstone Open Source Projects (UCOSP)

2018

Faculty Mentor, Undergraduate Capstone Open Source Projects (UCOSP)

2018

Web Chair, European Conference on Object-Oriented Programming (ECOOP)

2018

Web Chair, International Symposium on Software Testing and Analysis (ISSTA)

2018

Subreviewer, International Conference on Compiler Construction (CC)

2017

Students

GRADUATE STUDENTS, UNIVERSITY OF ALBERTA

Ph.D. **Jiaqi He**, Formal Verification of Neural Networks

2020–Present

Ph.D. **Ifaz Kabir**, Designing Programming Languages for Non-Volatile Memory

2018–Present

Ph.D. **Abdul Ali Bangash**, Detecting Energy-Inefficient Code via Program Analysis
(Main supervisor; Co-supervised with Abram Hindle)

2018–Present

Master's **Jeff Cho**, Static Analysis for Games

2020–Present

Master's **David Seekatz**, Constructing Precise Library Summaries

2019–Present

Master's **Ahmed Elkhair**, Proving Program Equivalence via Symbolic Execution

2018–2021

Master's **Kristen Newbury**, Automatic Hot-Fixing of Crypto APIs Misuses

2018–2020

CodeQL Analysis Engineer at Github

Master's **Erick Ochoa**, Guiding Inlining Decisions Using Post-Inlining Transformations
(Main supervisor; Co-supervised with José Nelson Amaral)

2017–2019

Compiler Engineer at Theobroma Systems

GRADUATE STUDENTS, PADERBORN UNIVERSITY (CO-SUPERVISED WITH ERIC BODDEN)

Ph.D. **Stefan Krüger**, Designing Language Support for Detecting Crypto APIs Misuses

2015–2020

Software Consultant at CQSE GmbH

Ph.D. **Lisa Nguyen Quang Do**, User-Centered Tool Design for Data-Flow Analysis

2015–2019

Software Engineer at Google

Ph.D. **Johannes Späth**, Synchronized Pushdown Systems for Pointer and Data-Flow Analysis

2015–2019

Research Associate at Fraunhofer IEM

GRADUATE STUDENTS, TU DARMSTADT

Master's **Manuel Benz**, Interprocedural Data Dependency Graphs

2016

Ph.D. at the University of Paderborn, Germany

Master's **Michael Appel**, Call Graph Summaries for the Android SDK

2016

UNDERGRADUATE STUDENTS

UAlberta **Daniil Tiganov**, Program Analysis for Swift

2019–Present

UAlberta **Cijie Xia**, Just-in-Time Compiler Optimizations

2020

Ph.D. at the University of Toronto

UAlberta **Revan MacQueen**, Symbolic Verification of Neural Networks

2018–2019

Master's at the University of Alberta

UAlberta **Jeff Cho**, Program Analysis for Swift

2017–2019

Master's at the University of Alberta

UAlberta **Supakorn 'Jamie' Rassameemasuang**, Formal Verification of String Equations

2019

Undergraduate at the University of Alberta

UAlberta **Spencer Killen**, Inlining Optimization in JIT Compilers

2019

Master's at the University of Alberta

UAlberta **Alexander MacKenzie**, Automated Benchmark Creation for Program Analysis Tools

2017–2018

| | | |
|----------------------|--|---|
| UofT | Bryan Tam , Program Analysis for Swift | Undergraduate at the University of Alberta 2018 |
| SFU | Leo Li , Program Analysis for Swift | Undergraduate at the University of Toronto 2017–2018 |
| UofT | Swapnil Shah , Automated Benchmark Creation for Program Analysis Tools | Master's at the University of Toronto 2018 |
| UNB | Tyler Pavlovic , Automated Benchmark Creation for Program Analysis Tools | Software Engineer at Okeru 2018 |
| Western Dalhousie | Alex Li , Automated Benchmark Creation for Program Analysis Tools Yaser Alkayale , Program Analysis for Swift | Application Developer at ACOA 2018 2017 |
| SFU | Lydia Wu , Program Analysis for Swift | Software Engineer at Microsoft 2017 |
| SFU | Chen Song , Program Analysis for Swift | Master's at UC Berkley 2017 |
| UAlberta | Stuart Hoye , Developing GitHub Classroom Management Tools | Ph.D. at UT Austin 2017 |
| UAlberta | Noah Weninger , Program Analysis for Swift | Application Consultant at Ontracks 2017 Master's at UBC |

Teaching

INSTRUCTOR

| | | |
|-----------|---|---------------------|
| CMPUT 664 | Secure Software Engineering , University of Alberta, Canada | Winter 2020–Present |
| CMPUT 416 | Foundations of Program Analysis , University of Alberta, Canada | Winter 2019–Present |
| CMPUT 229 | Computer Organization and Architecture I , University of Alberta, Canada | Winter 2017–Present |
| CMPUT 620 | Static Program Analysis , University of Alberta, Canada | Fall 2016–Fall 2017 |
| SAS | Static Analysis Seminar , Technische Universität Darmstadt, Germany | Winter 2015 |

CO-INSTRUCTOR

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|------|--|-------------|
| APSA | Applied Static Analysis , Technische Universität Darmstadt, Germany | Spring 2016 |
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SUBSTITUTE LECTURER

| | | |
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| DECA | Designing Code Analyses , Technische Universität Darmstadt, Germany | Fall 2014 |
| CS 241 | Foundations of Sequential Programs , University of Waterloo, Canada | Spring 2013 |

GRADUATE TEACHING ASSISTANT

| | | |
|------------|--|-------------|
| CS 241 | Foundations of Sequential Programs , University of Waterloo, Canada | 2011–2013 |
| CS 444/644 | Compiler Construction , University of Waterloo, Canada | 2011–2013 |
| CS 446/646 | Software Design and Architectures , University of Waterloo, Canada | Spring 2011 |
| CS 456/656 | Computer Networks , University of Waterloo, Canada | 2008–2010 |
| CS 125 | Introduction to Programming Principles , University of Waterloo, Canada | Winter 2008 |
| CS 448 | Security Engineering , The American University in Cairo, Egypt | Fall 2007 |

UNDERGRADUATE TEACHING ASSISTANT

| | | |
|--------|---|-----------|
| CS 448 | Security Engineering , The American University in Cairo, Egypt | Fall 2007 |
| CS 330 | Computer Architecture , The American University in Cairo, Egypt | 2005–2006 |
| CS 106 | Fundamentals of Computer Science , The American University in Cairo, Egypt | 2004–2005 |

Volunteer Work

| | |
|---|-------------|
| CyberPatriot Technical Mentor , Strathcona High School, Edmonton, Alberta, Canada | 2016–2018 |
| Graduate Student Ambassador , University of Waterloo, Canada | Fall 2013 |
| Tour Guide, Computer Science Open House , University of Waterloo, Canada | Winter 2012 |
| President, Egyptian Students Association , University of Waterloo, Canada | 2010–2011 |
| Ushers Committee Leader, Honors Assembly , The American University in Cairo, Egypt | Spring 2007 |
| Academic Committee Head, ACM Chapter , The American University in Cairo, Egypt | Spring 2007 |