

Justin Yirka

Curriculum Vitae

B.S. in Computer Science and B.S. in Mathematics
Virginia Commonwealth University, Richmond, VA, USA

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Research Interests

Quantum computing: algorithms, complexity theory, applications

Education

Virginia Commonwealth University (VCU)

Richmond, VA

B.S. in Computer Science

May 2018

B.S. in Mathematical Sciences, GPA: 3.98 out of 4.0

Dual degrees

Specialization in Data Science

Concentration in Pure Math

Minor in Physics

University Honors

Research

Experience

Graph Theory Computational Discovery Lab, VCU

Research Assistant

Summer 2018

Supervisor: Craig Larson, Ph.D.

Topic: Automated conjecturing and graph Hamiltonicity. Implement algorithms for graph properties, improve open-source project structure for future use, and evaluate conjectures for graph Hamiltonicity.

**Joint Center for Quantum Information and Computer Science (QuICS),
University of Maryland (UMD)**

NSF REU Undergraduate Researcher

Summer 2017

Supervisor: Andrew Childs, Ph.D.

Support: NSF Research Experience for Undergraduates (REU). P.I.: William Gasarch, Ph.D.

Topic: Quantum pure-state tomography. Investigated Pauli observables using group theory (e.g. Clifford group) and bounds from study of hypergraphs.

Quantum Computing Lab, VCU

Undergraduate Research Assistant

2015–2016

Supervisor: Sevag Gharibian, Ph.D.

Topic: Quantum computational complexity. Studied quantum oracle classes characterized by local physical problems (e.g. $P^{QMA[\log]}$) and partially developed “quantum Toda’s Theorem” $QCPH \subseteq P^{PP}$.

Preprints.....

Sevag Gharibian, Stephen Piddock, and **Justin Yirka**. “Local measurements on physical Hamiltonians and oracle complexity classes”. Preprint available soon.

Sevag Gharibian, Miklos Santha, Aarthi Sundaram, and **Justin Yirka**. “Quantum generalizations of the polynomial hierarchy with applications to QMA(2)”. Available at <https://arxiv.org/abs/1805.11139>. Apr. 2018.

Sevag Gharibian and **Justin Yirka**. “The complexity of simulating local measurements on quantum systems”. Available at <https://arxiv.org/abs/1606.05626> [quant-ph]. May 2016.

Conference Presentations.....

Sevag Gharibian, Stephen Piddock, and **Justin Yirka**. “Oracle complexity classes and local measurements on physical Hamiltonians”. **Upcoming** contributed talk at 18th Asian Quantum Information Science Conference (AQIS). Nagoya, Japan, Sept. 2018.

Sevag Gharibian, Miklos Santha, Aarthi Sundaram, and **Justin Yirka**. “Quantum generalizations of the polynomial hierarchy with applications to QMA(2)”. **Upcoming** contributed talk at 18th Asian Quantum Information Science Conference (AQIS). Nagoya, Japan, Sept. 2018.

Sevag Gharibian, Miklos Santha, Aarthi Sundaram, and **Justin Yirka**. “Quantum generalizations of the polynomial hierarchy with applications to QMA(2)”. **Upcoming** contributed talk at 43rd International Symposium on Mathematical Foundations of Computer Science (MFCS). Liverpool, UK, Aug. 2018.

Sevag Gharibian and **Justin Yirka**. *The complexity of simulating local measurements on quantum systems*. Contributed talk by S. Gharibian at 12th Conference on the Theory of Quantum Computation, Communication, and Cryptography (TQC). Paris, France, 2017.

Sevag Gharibian and **Justin Yirka**. *The complexity of estimating local physical quantities*. Poster by J. Yirka at 20th Conference on Quantum Information Processing (QIP). Seattle, USA, 2017.

Justin Yirka. *Evaluation of TCP header fields for data overhead efficiency*. Poster at 30th National Conference on Undergraduate Research (NCUR). Asheville, USA, 2016.

Justin Yirka. *Evaluation of TCP header fields for data overhead efficiency*. Poster at VCU Symposium for Undergraduate Research and Creativity. Richmond, USA, 2015. — **Awarded “Launch Award for Outstanding Research Poster”**.

Department Seminars.....

Pure state tomography with Pauli observables. QuICS, University of Maryland. 2017.

Quantum complexity of estimating local physical quantities. Department of Computer Science, VCU. 2016. — **Only undergraduate invited in previous 5 years**.

Public-Audience Talks.....

Computer Science theory is fun. VCU RamDev software development club. Apr. 2018.

Quantum programming (e.g. IBM Q, LIQUi|). VCU RamDev software development club. 2017.

Independent Studies.....

Convex Optimization (CMSC 601)

VCU, Supervisor: Sevag Gharibian, Ph.D.

Fall 2017

Independently studied material for graduate optimization course as an undergraduate

Only undergraduate granted independent study approval in computer science in Fall 2017.

Scholarships (all dollar amounts in USD)

Presidential Scholarship

\$110,000, Virginia Commonwealth University

2014–May 2018

Top scholarship offered. Full cost of 4-year tuition, room, and board.

Awarded to 0.6% of students

Presidential Scholarship [unable to accept]

\$80,000, Worcester Polytechnic Institute

2014

Rensselaer Medal Merit Scholarship [unable to accept]

\$100,000, Rensselaer Polytechnic Institute

2014

Funding

Event grants for seminar series by VCU RamDev software development club

\$1,900, VCU Student Government Association

2016–May 2018

Travel grant for presentation at QIP 2017

\$500, VCU Honors College

2017

Travel grant for presentation at NCUR 2016

\$550, VCU Honors College

2016

Awards and Honors

Pure Mathematics Award

VCU College of Humanities and Sciences

May 2018

Awarded to student in pure mathematics concentration with highest graduating GPA.

Mark A. Sternheimer Capstone Design Award

VCU School of Engineering

2017

For “innovation and entrepreneurship” of senior project developing mobile app.

Included grant of \$660.

University Student Scholar Award

Virginia Commonwealth University

2015

Launch Award for Outstanding Research Poster

VCU Symposium for Undergraduate Research and Creativity

2015

For poster *Evaluation of TCP header fields for data overhead efficiency*.

Volunteer of the Year

Grade-school robotics program, Prince William County Schools, VA

2014

Teaching Experience

VCU.....

Teaching Assistant

Algebra with Applications (MATH 141)

(2 semesters) 2016–2017

Assisted with in-class work, offered tutorials, graded assignments.

Average student evaluation scores — Fall 2016: 4.78 / 5.0, Spring 2017: 4.36 / 5.0.

Mentor for 1st year student

Honors College freshman mentorship program

Fall 2016

Teaching Assistant

Honors Rhetoric (HONR 200) — first-year honors writing and research course

Fall 2015

Assisted with in-class work and critiqued student papers.

Service

University Service (VCU).....

Student Advisory Board member

Department of Computer Science

2016–May 2018

- o Invited to School of Engineering strategic planning retreat, 2017 (only C.S. undergraduate).
- o Participated in hiring interviews for new faculty, 2017 (one of two students to participate).

Senior Reader for Honors graduation dossiers

Honors College

(2 academic years) 2016–2017

Assessed papers submitted in fulfillment of University Honors. Coordinated other readers.

Panelist — Career workshop for freshman mentorship program

Department of Computer Science

2017

Panelist — Undergraduate conference preparation workshops

Honors College

2017

Judge — Launch Award for Outstanding Research Poster

VCU Symposium for Undergraduate Research and Creativity

2016

Organizer — Local Hack Day of Richmond, VA

Major League Hacking (MLH) and VCU Department of Computer Science

2016

Hosted event for 30 students including 12 high school students.

Extracurricular Service.....

Founder and President

RamDev: Software Development at VCU

2016–May 2018

- Coordinated 46 weekly seminars including 9 corporate speakers.
- Secured and managed \$2400 in funding and resources.
- Increased weekly attendance to 20 students, becoming largest C.S. organization at VCU.

Community Service.....

Volunteer for grade school FIRST & Vex robotics competitions

Prince William County Schools, VA

2011–2015

Awarded “Volunteer of the Year”, 2014.

Mentor to middle school FIRST robotics team

Wilder Middle School, Richmond, VA

2014

Programming Experience

Languages: Java, C, Python, Sage, Perl, Wolfram Language, Lua

Software: LaTeX, git and GitHub, Unix, Android, Mathematica, Weka, AutoCAD

Software Engineering coursework: Software Engineering (Agile, Android), Algorithm Analysis, Programming Languages (C, Python, Racket), Introduction to Operating Systems, Object Oriented Programming (Java)

Applications coursework: Introduction to Natural Language Processing (assignments in Perl), Introduction to Data Science (Weka), Artificial Intelligence (neural networks), Graphs and Algorithms, Visualization of Physics with Mathematica

Projects.....

Graph Brains Project — Graph Theory Computational Discovery Lab, VCU

Python

Summer 2018

Implement functions for calculating graph properties. Manage known examples and properties in Python and SQL. Improve project structure, documentation, and usability.

Campus Bluetooth tag network — Senior project

Java, Swift, Python, Android, iOS, Raspberry Pi / Unix, Google Firebase (2 semesters) 2017–May 2018

Team project developing campus item-tracking system implementing Android, iOS, and Raspberry Pi programs to locate users’ items tagged with BLE beacons.

GeoViewer Android app — Software Engineering course project

Java, Android, Amazon AWS

Fall 2016

Team project with focus on Agile development. Implemented Android app enabling users to share and discover geocached photos.

Run Planner Mathematica program — RamHacks hackathon

Wolfram Language, Mathematica

2016

Developed program utilizing opensource GPS data to take as input a starting location and a distance goal and output a jogging route of that distance along the city road network.

GroupMe Stats Android app — VTHacks hackathon

Java, Android

2016

Team project developing app to use GroupMe API to retrieve information about user’s GroupMe conversations and provide interesting statistics to the user.

Vex, FIRST, and Zero (International Space Station) robotics competitions
C++

2010–2014