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. $\mathrm{P}^{\mathrm{QMA[log]}}$) and partially developed "quantum Toda's Theorem" $\mathrm{QCPH} \subseteq \mathrm{P}^{\mathrm{PP}}$.

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 hiearchy 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, Miklos Santha, Aarthi Sundaram, and **Justin Yirka**. "Quantum generalizations of the polynomial hiearchy 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 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, LIQ$Ui|\rangle$*)*. 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*
- Invited to School of Engineering strategic planning retreat, 2017 (only C.S. undergraduate).
- 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, Unix, Android & mobile apps, 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 (Interational Space Station) robotics competitions
C++ *2010–2014*