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, Stephen Piddock, and **Justin Yirka**. "Oracle complexity classes and local measurements on physical Hamiltonians". **Upcoming** contributed talk at 18$^{\text{th}}$ Asian Quantum Information Science Conference (AQIS). Nagoya, Japan, Sept. 2018.

Sevag Gharibian, Miklos Santha, Aarthi Sundaram, and **Justin Yirka**. "Quantum generalizations of the polynomial hiearchy with applications to QMA(2)". **Upcoming** contributed **"long"/plenary talk** at 18$^{\text{th}}$ Asian Quantum Information Science Conference (AQIS). Nagoya, Japan, Sept. 2018.

Sevag Gharibian, Miklos Santha, Aarthi Sundaram, and **Justin Yirka**. "Quantum generalizations of the polynomial hiearchy with applications to QMA(2)". **Upcoming** contributed talk at 43$^{\text{rd}}$ 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 12$^{\text{th}}$ 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 20$^{\text{th}}$ Conference on Quantum Information Processing (QIP). Seattle, USA, 2017.

Justin Yirka. *Evaluation of TCP header fields for data overhead efficiency*. Poster at 30$^{\text{th}}$ 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 *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 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.