

# Justin Yirka

B.S. in Computer Science and B.S. in Mathematics

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## 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

Supported by VCU Presidential Scholarship

## 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 repository structure for future research, 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 18<sup>th</sup> 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 “long”/plenary talk at 18<sup>th</sup> 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 43<sup>rd</sup> 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<sup>th</sup> 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<sup>th</sup> Conference on Quantum Information Processing (QIP). Seattle, USA, 2017.

## Programming Experience

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**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), Intro. to Operating Systems, Object Oriented Programming (Java)

**Applications coursework:** Convex Optimization (graduate course), 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 for sharing 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 provide interesting statistics to a user.

## Extracurricular Experience

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### Founder and President

*RamDev: Software Development at VCU* 2016–May 2018

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

## Awards and Honors

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### Presidential Scholarship

*\$110,000, Virginia Commonwealth University* 2014–May 2018  
Full cost of 4-year tuition, room, and board.  
Awarded to 0.6% of students.

### 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.

### Launch Award for Outstanding Research Poster

*VCU Symposium for Undergraduate Research and Creativity* 2015