

**Justin Yirka**  
*Curriculum Vitae*  
B.S. in Computer Science and B.S. in Mathematics  
Virginia Commonwealth University, Richmond, VA, USA

YirkaJk@vcu.edu  
(703) 229-7956  
[www.linkedin.com/in/yirkajk](http://www.linkedin.com/in/yirkajk)

## Research Interests

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Quantum computing: algorithms, complexity theory, applications

## Education

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**Virginia Commonwealth University (VCU)**

*B.S. in Computer Science*

**Richmond, VA**

*(Dual degree program) 2018*

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

Concentration in Pure Math  
Specialization in Data Science  
Minor in Physics  
University Honors

## Research

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Experience.....

**Graph Theory Computational Discovery Lab, VCU**

*Research Assistant*

*Summer 2018*

Supervisor: Craig Larson, Ph.D.

Topic: Use of automated conjecturing software (Python) to find conditions 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.

Topic: Quantum tomography. Pure-state tomography with Pauli observables.

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

**Quantum Computing Lab, VCU**

*Undergraduate Research Assistant*

*2015–2016*

Supervisor: Sevag Gharibian, Ph.D.

Topics: Quantum computational complexity. Complexity of local physical problems, quantum oracle classes (e.g.  $P^{QMA}[\log]$ ), quantum variants of the polynomial hierarchy.

## 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>. 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]. 2016.

## Conference presentations.....

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). 2017.

Sevag Gharibian and **Justin Yirka**. *The complexity of estimating local physical quantities*. Poster at 20<sup>th</sup> Conference on Quantum Information Processing (QIP). 2017.

**Justin Yirka**. *Evaluation of TCP header fields for data overhead efficiency*. Poster at 30<sup>th</sup> National Conference on Undergraduate Research (NCUR). 2016.

**Justin Yirka**. *Evaluation of TCP header fields for data overhead efficiency*. Poster at VCU Symposium for Undergraduate Research and Creativity. 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. 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)

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### **Presidential Scholarship**

\$110,000, Virginia Commonwealth University

2014–2018

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

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**Event grants for seminar series by VCU RamDev software development club**  
\$1,900, VCU Student Government Association 2016–2018

**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

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**Pure Mathematics Award**  
VCU College of Humanities and Sciences 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

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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 1<sup>st</sup> year student**  
*Honors 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.

Other.....

## Instructor

*CPR, first-aid, and lifeguarding courses*

*2016–2018*

Department of Parks and Recreation, Prince William County, VA

## Service

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University service (VCU).....

### Student Advisory Board member

*Department of Computer Science*

*2016–2018*

- 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*

*2016–2018*

- 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

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**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) 2017–2018*

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*

### **VA Governor's Cybersecurity Cup**

*Networking fundamentals (e.g. TCP/IP, OSI model)*

*Fall 2012*

Learned and competively demonstrated cybersecurity fundamentals with a focus on network security. Qualified for invitation to 2013 VA Governor's Cybersecurity Conference and CTF.