# TIMOTHY D. GOODRICH

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## RESEARCH INTERESTS

Graph theory, algorithm design, combinatorial optimization, experimental mathematics, quantum computing

## EDUCATION

**North Carolina State University** Aug 2014 – Expected Dec 2018
*Ph.D., Computer Science* *Raleigh, NC*

- 4.0/4.0 GPA
- Passed Ph.D. written (qualifying) exam
- Specialized coursework: Advanced Algorithms, Scalable Parallel Algorithms, Software Science
- Researcher in *Theory in Practice* group under Dr. Blair D. Sullivan

**Valparaiso University** Aug 2010 – May 2014
*B.S., Mathematics & Computer Science* *Valparaiso, IN*

- 4.0/4.0 GPA
- Member of honors college with senior thesis
- Budapest Semesters in Mathematics program, Fall 2013 (4.0/4.0 GPA)

## ACADEMIC RESEARCH

### Graduate

- Primary work includes the development and optimization of embedding algorithms for adiabatic quantum computation, advised by Blair D. Sullivan.
- Additional work in bounding structural sparsity behavior in random graph models.

### Undergraduate

- *Sorting Permutations with Finite-Depth Stacks* advised by Dr. Lara Pudwell Aug 2011 – May 2013
- *Optimizing Pharmaceutical Drug Distribution* advised by Dr. Zsuzsanna Szaniszlo Oct 2012 – Apr 2013
- *Applying Genetic Algorithms to Solve Logic-Based Games* advised by Dr. Gregory Hume Aug 2010 – May 2011

## PUBLICATIONS

### Full Papers

- M. Farrell, **T. D. Goodrich**, N. Lemons, F. Reidl, F. Sánchez Villaamil, and B. D. Sullivan. Hyberbolicity, degeneracy, and expansion of random intersection graphs. Internet Mathematics Vol 1, No 1 (2017).
- A. Chin, **T. Goodrich**, M. OBrien, F. Reidl, B. Sullivan, and D. van der Poel. Asymptotic Analysis of Equivalences and Core-Structures in Kronecker-Style Graph Models. IEEE International Conference on Data Mining 2016 (ICDM'16).
- M. Farrell, **T. D. Goodrich**, N. Lemons, F. Reidl, F. Sánchez Villaamil, and B. D. Sullivan. Hyberbolicity, degeneracy, and expansion of random intersection graphs. 12th Workshop on Algorithms and Models for the Web-graph (WAW'15).

### Extended Abstract

- **T. D. Goodrich**, T. S. Humble, and B. D. Sullivan. Optimizing Adiabatic Quantum Program Compilation using a Graph-Theoretic Framework. SIAM Workshop on Network Science 2016.
- A. J. Chin, **T. D. Goodrich**, M. P. O'Brien, F. Reidl, B. D. Sullivan and A. van der Poel. Analyzing Local Density in Kronecker Models. SIAM Workshop on Network Science 2016.
- M. Farrell, **T. D. Goodrich**, N. Lemons, F. Reidl, F. Sánchez Villaamil, and B. D. Sullivan. Hyberbolicity, degeneracy, and expansion of random intersection graphs. SIAM Workshop on Network Science 2015.

### Preprint

- **T. D. Goodrich**, B. D. Sullivan, T. S. Humble. Optimizing Adiabatic Quantum Program Compilation using a Graph-Theoretic Framework.

## PRESENTATIONS

**Graduate (2014–Present)**

- *Optimizing Adiabatic Program Compilation Using a Graph-Theoretic Framework.* QCI Seminar; Oak Ridge National Laboratory (Oak Ridge, TN); December 14, 2016.
- *Optimizing Adiabatic Program Compilation Using a Graph-Theoretic Framework.* Lightning Talk Session, SIAM Workshop on Network Science (NS16); The Westin Boston Waterfront (Boston, MA); July 15, 2016.
- *Optimizing Quantum Program Compilation using a Graph-Theoretic Framework.* Poster Session, NCSU 11th Annual Graduate Student Research Symposium; North Carolina State University (Raleigh, NC); March 23, 2016.
- *Hyperbolicity, Degeneracy, and Expansion of Random Intersection Graphs.* 12th Workshop on Algorithms and Models for the Web-graph (WAW2015); EURANDOM (Eindhoven, Netherlands); December 12, 2015.
- *Extracting Key Structural Properties from Graph-Based Models.* Poster Session, NSF Data Science Workshop 2015; University of Washington (Seattle, WA); August 6, 2015.
- *Parameterized Algorithms in Scientific Data Analysis.* Poster Session, Mathematics in Data Science Workshop; ICERM (Providence, RI); July 29, 2015.

**Undergraduate (2010–2014)**

- *Quickening Stochastic Local Search Algorithms with Markov Clustering.* Poster Session, Internship Presentation; Oak Ridge National Laboratory (Oak Ridge, TN); August 7, 2014.
- *Characterizing Degeneracy in Random Network Generators.* Undergraduate Colloquium; Valparaiso University (Valparaiso, IN); January 24, 2014.
- *An Empirical Study of Social Clustering in R-MAT Generated Graphs.* Poster Session, Joint Mathematics Meetings 2014, Baltimore Convention Center (Baltimore, MD); January 17, 2014.
- *An Empirical Study of Social Clustering in R-MAT Generated Graphs.* Poster Session, Internship Presentation; Oak Ridge National Laboratory (Oak Ridge, TN); August 8, 2013.
- *Simulation Modeling and Analysis of Coal Shipping Operations.* Celebration of Undergraduate Scholarship; Valparaiso University (Valparaiso, IN); April 23, 2013.
- *Sorting Permutations with Finite-Depth Stacks.* Poster Session, Celebration of Undergraduate Scholarship; Valparaiso University (Valparaiso, IN); April 23, 2013.
- *Characterizing Finite-Depth Stack-Sortable Permutations.* Conference on Undergraduate Mathematics; Rose-Hulman Institute of Technology (Terre Haute, IN); April 20, 2013.
- *Sorting Permutations with Finite-Depth Stacks.* Poster Session, Joint Mathematics Meetings 2013; San Diego Convention Center (San Diego, CA); January 11, 2013.
- *Characterizing Programs Over $SL_2(\mathbb{N})$.* Poster Session, REU Presentation; University of Massachusetts Amherst (Amherst, MA); July 31, 2012.
- *Characterizing Programs Over $SL_2(\mathbb{N})$.* REU Presentation; University of Massachusetts Amherst (Amherst, MA); July 13, 2012.
- *Sorting Permutations with a Finite-Depth Stack.* Poster Session, Celebration of Undergraduate Scholarship; Valparaiso University (Valparaiso, IN); April 24, 2012.
- *Sorting Permutations with a Finite-Depth Stack.* Indiana Section MAA Meeting; Ball State University (Muncie, IN); March 24, 2012.
- *Sorting Permutations with an Infinite-Depth Stack.* Undergraduate Colloquium; Valparaiso University (Valparaiso, IN); April 30, 2012.
- *Applying Genetic Algorithms to Solve Logic-Based Games.* Poster Session, Celebration of Undergraduate Scholarship; Valparaiso University (Valparaiso, IN); April 20, 2011.

## PROFESSIONAL DEVELOPMENT

- Barnraising for Data-Intensive Discovery; MDI Biological Laboratory (Bar Harbor, ME); May 1–6, 2016.
- D-Wave System Training, Attendee; Oak Ridge National Laboratory (Oak Ridge, TN); March 29–30, 2016.
- WAW2015 Workshop and School, Attendee; EURANDOM (Eindhoven, Netherlands); December 7–11, 2015.
- NSF Data Science Workshop 2015, Attendee; University of Washington (Seattle, WA); August 5–7, 2015.
- Mathematics in Data Science Workshop, Presenter; ICERM (Providence, RI); July 28–30, 2015.

## SOFTWARE EXPERIENCE

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| **Primary Languages:** | C++, Python, LaTeX |
| **Primary Frameworks:** | CUDA, OpenMP, SciPy, NumPy, NetworkX, Seaborn, Flask |
| **Also Familiar with:** | Java, Maple, MATLAB, R, Sage |

## AWARDS AND HONORS

### Graduate

- Travel awards to date: $4,125
- Department of Defense NDSEG Fellowship: $102,000 over 3 years — 2016 – Present
- NC Space Grant Graduate Supplemental Fellowship: $7000 — 2016
- NSF Graduate Fellowship (GRFP) honorable mention — 2016
- NCSU Provost Doctoral Recruitment Fellowship: $25,000 over academic year — 2014
- NCSU College of Engineering Graduate Merit Award: $5000 — 2014

### Undergraduate

- VU MCS Σ (Sigma) Award — 2014
- Budapest Semesters in Mathematics Kitüntetéssel (Honors) — 2013
- VU Lumina Award — 2013
- Indiana Space Grant Consortium Scholarship: $1500 — 2013
- VU CUS Board of Directors Award — 2013
- VU Problem of the Month Winner ×6 — 2011 – 2013
- VU Howard Kibble Hughes Prize: $1000 — 2012
- VU CWRC Undergraduate Research Grant: $500 — 2012
- VU Kermit H. Carlson Memorial Scholarship: $1000 — 2012
- VU Board of Directors Scholarship — 2010 – 2014

## WORK EXPERIENCE

**Oak Ridge National Laboratory** — May 2014 – Aug 2014
*HERE Research Intern* — *Oak Ridge, TN*

- *Quickening Stochastic Local Search Algorithms with Markov Clustering* advised by Dr. Erik M. Ferragut.
- Utilized clustering techniques to speed up standard stochastic local search heuristics.
- Applied enhanced stochastic local search algorithms to approximate Euclidean TSP.

**Oak Ridge National Laboratory** — May 2013 – Aug 2013
*SULI Research Intern* — *Oak Ridge, TN*

- *An Empirical Study of Social Clustering in R-MAT Generated Graphs* advised by Dr. Blair D. Sullivan.
- Characterized the clustering structure in various graph generators, with a concentrated empirical study on the R-MAT generator.
- Contributed to the INDDGO software package.

**University of Massachusetts Amherst** — May 2012 – Aug 2012
*REU Participant* — *Amherst, MA*

- *Characterizing Programs Over $SL_2(\mathbb{N})$* advised by Dr. David A. Mix Barrington.
- Studied the computational power of programs over matrix classes in comparison to arithmetic circuits.

**Experimental Design and Analysis Solutions** — Apr 2009 – Aug 2011
*Intern* — *Spring Hill, TN*

- Worked full time in summers and part time remotely during school.
- Ported BMX app to Android from iOS and renovated a user license/software download site.
- Responsibilities included training other interns on 3D environment painting process and documenting the Ripxx Replay project.

## TEACHING EXPERIENCE

**Valparaiso University** — Valparaiso, IN
*Teaching Assistant*

- Held weekly 2-4 hour help session:
  - *MATH266 (Transitions in Mathematics)* — Spring 2014
- Held weekly 2 hour help session and assisted in 3 hour labs:
  - *CS158 (Algorithms and Abstract Data Types)* — Spring 2013/2014
  - *CS157 (Algorithms and Programming)* — Fall 2011/2012

**Valparaiso University** Valparaiso, IN
*Feb 2011 – May 2013, Jan 2014 – May 2014* *Academic Success Center Tutor*

- Tutored university student in specific course for whole semester.
- Met once or twice weekly for one hour sessions.
- Courses tutored: MATH131 (Calculus I), MATH132 (Calculus II), MATH234 (Differential Equations with Linear Algebra), MATH240 (Statistical Analysis), MATH120 (Game Theory), MATH168 (Discrete Structures I), CS128 (Introduction to Programming), CS157 (Algorithms and Programming), CS225 (Programming Languages).

## MISCELLANEOUS ACTIVITIES

### Undergraduate

- Proctored and kept score for MathCounts Regional Competition — Mar 2011 – 2014
- Trained and led math team to win Indiana College Mathematics Competition — Jan 2013 – Mar 2013
- Competed in Rockwell 2013 Arena Student Simulation Competition — Sep 2012 – Dec 2012
- Developed Android apps and sold over 3000 copies under Watchmaker Dev. — Jul 2011 – Dec 2012

## MEMBERSHIPS

- Society for Industrial and Applied Mathematics — 2014 – Present
- Alpha Lambda Delta National Freshman Honors Society — 2011 – Present
- IEEE Computer Society — 2011 – Present
- Mathematical Association of America — 2011 – Present

## REFERENCES

Available on request.