

# Shi Jie Samuel Tan

LinkedIn: samueltan97

Github: shi-jie-samuel-tan

Mobile : +1-484-588-1896

Email : stan97@umd.edu

## EDUCATION

---

### University of Maryland, College Park

Ph.D. in Computer Science (Temp. Advisors: Andrew Childs and Daniel Gottesman)

College Park, MD

Aug 2023 - Present

### Haverford College

B.S. in Computer Science, Mathematics & Physics, *magna cum laude*, GPA: 3.966

Haverford, PA

Aug 2019 - May 2023

**Graduate Courses:** Information Theory (Spring 2024), Intro to Quantum Information Processing, Quantum Control & Metrology, Quantum Error Correction and Fault Tolerance (Spring 2024), Quantum Mechanics, Randomized Algorithms

**Relevant Undergraduate Courses:** Abstract Algebra, Analysis of Algorithms, Real Analysis, Probability, Scientific Computing, Statistical Physics, Theory of Computation

## RESEARCH EXPERIENCE

---

### University of Maryland

Quantum Computing Research Assistant (PI: Daniel Gottesman)

College Park, MD

Nov 2023 - Present

- Project 1: Finding ways to implement fault-tolerant logical operations on QLDPC codes.

### Los Alamos National Laboratory

Quantum Research Fellow (Mentors: Yigit Subasi & Sam Sleazak)

Los Alamos, NM

Jun 2023 - Present

- Project 1: Designed ancilla state for quantum phase estimation using classical signal processing techniques and analytically proved its average-case optimality. Talk accepted at APS March Meeting 2024. Co-first author manuscript in preparation.
- Project 2: Fixing the quantum metropolis sampling algorithm by modifying the phase estimation protocol and reviewing the quantum detailed balance condition.

### California Institute of Technology

Quantum Computing Research Fellow (Mentors: John Preskill & Chris Pattison)

Pasadena, CA

May 2022 - Present

- Project 1: Numerically analyzed the resilience of surface codes against error bursts caused by cosmic rays. Derived the phase diagram for the accuracy threshold of the MWPM decoder and the teraquop footprint. Presented poster at QEC 2023. First author manuscript in preparation.
- Project 2: Working on the manuscript that proves the existence of an accuracy threshold for Union-Find decoder algorithm.

### University of Maryland

Quantum Computing Research Assistant (Mentor: Matthew Coudron)

College Park, MD

May 2021 - May 2023

- Project 1: Reviewed and proposed minor edits for the construction of block-encodings and syntheses to approximate output probabilities of low-depth 3D quantum circuits. Acknowledged in the [paper](#) accepted by FOCS 2021 & QIP 2021.
- Project 2: Extended the algorithm from Project 1 to approximate output probabilities for low-depth quantum circuits that have not only 3 dimensions but any fixed number of dimensions. Co-first author of [paper](#) presented as a talk at TQC 2022 and presented poster at QIP 2022.
- Project 3: Attempted to design a quasi-polynomial time algorithm for  $AC^0$  postprocessing of 2D geometrically-local low-depth quantum circuits for decision problems.

### Haverford College

Algorithms Research Assistant (PI: Sara Mathieson)

Haverford, PA

May 2020 - May 2023

- Project 1: Validated *thread*, the algorithm to reconstruct ancestral haplotypes from endogamous Amish population and improved the algorithm's accuracy rate to 90%. Co-authored paper published in PLOS Comp. Bio. 2021.
- Project 2: Designed a KNN algorithm to reduce false positives from the identical-by-descent (IBD) segments identified by IBD detection software. First author manuscript in preparation.

## PUBLICATIONS AND PRE-PRINTS

---

- [1] Y. Deng and **S.J.S. Tan (co-first author)**. Random walks on the generalized symmetric group: Cutoff for the one-sided transposition shuffle. *arXiv preprint arXiv:2211.10462*, 2022
- [2] S. Dontha, **S.J.S. Tan (co-first author)**, S. Smith, S. Choi, and M. Coudron. Approximating Output Probabilities of Shallow Quantum Circuits Which Are Geometrically-Local in Any Fixed Dimension. In *Proceedings of the 17th Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC 2022)*, 2022. <https://doi.org/10.4230/LIPIcs.TQC.2022.9>
- [3] K. Finke, M. Kourakos, G. Brown, H.T. Dang, **S.J.S. Tan**, Y. Simons, S. Ramdas, A. Schäffer, R. Kember, M. Bućan, and S. Mathieson. Ancestral haplotype reconstruction in endogamous populations using identity-by-descent. *PLOS Computational Biology*, 2021. <https://doi.org/10.1371/journal.pcbi.1008638>

## ORAL AND POSTER PRESENTATIONS

---

- [1] “Tapered Quantum Phase Estimation.” APS March Meeting 2024, March 4-8, 2024.
- [2] “Resilience of the surface code to error bursts.” 6th International Conference on Quantum Error Correction (QEC), October 30-November 3, 2023.
- [3] “Proving the existence of an accuracy threshold for the Union-Find decoder.” Caltech SFP Summer Seminar Day, August 18, 2022.
- [4] “Comparison of cohort-based identical-by-descent (IBD) segment finding methods for endogamous populations.” In Proceedings of the 13th ACM International Conference on Bioinformatics, Computational Biology and Health Informatics (ACM-BCB 2022), August 7-10, 2022. <https://doi.org/10.1145/3535508.3545104>
- [5] “Approximating Output Probabilities of Shallow Quantum Circuits which are Geometrically-local in any Fixed Dimension.” 17th Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC 2022), July 11-15, 2022.
- [6] “Approximating Output Probabilities of Shallow Quantum Circuits which are Geometrically-local in any Fixed Dimension.” 25th Annual Conference on Quantum Information Processing (QIP 2022), Poster Presentation, 2022.
- [7] “Improvements to ancestral haplotype reconstruction in pedigrees.” 7th-8th International Conference on Algorithms for Computational Biology (AlCoB 2020 & 2021), November 9-11, 2021.
- [8] “Improvements to ancestral haplotype reconstruction in pedigrees.” Research in Computational Molecular Biology - 25th Annual International Conference (RECOMB 2021), August 29-September 1, 2021.
- [9] “Simulation of Low-Depth Quantum Circuits.” University of Maryland Research Experience for Undergraduates Combinatorics and Algorithms for Real Problems (REU-CAAR) Research Presentation, August 13, 2021.
- [10] “Validating Ancestral Haplotype Reconstruction In Endogamous Populations using Identical-by-Descent.” Haverford College Marian E. Koshland Integrated Natural Sciences Center (KINSC) Undergraduate Science Research Symposium, 2020.

## AWARDS AND FELLOWSHIPS

---

2023	MathQuantum Graduate Fellowship (University of Maryland)
2023	QuICS Lanczos Graduate Fellowship (University of Maryland)
2023	Louis B. Green Prize in Physics and Astronomy (Haverford College)
2023	Phi Beta Kappa
2023	Los Alamos National Laboratory Quantum Computing Summer School Fellowship
2023	Singloh Hsu Scholarship (Haverford College)
2023	Computing Research Association (CRA) Outstanding Undergraduate Researcher Award Finalist
2022	Caltech Summer Undergraduate Research Fellowship
2022	ACM-BCB 2022 Undergraduate Travel Award
2022	Philly Codefest 2022 (Best Hack for Social Good)
2022	Marian E. Koshland Integrated Natural Sciences Center Summer Scholarship (Haverford College)
2022	QIP 2022 Student Travel Award
2021	An Zhu-Google University of Maryland REU-CAAR Fellowship
2020	Brian Kovaric Fellowship (Haverford College)
2020	Major League Hacks (MLH) Local Hack Day International Winner
2019	HackNY, New York City (Honorable Mention)
2018	Singapore Technologies Engineering Ltd Overseas Scholarship (Turned down)
2018	Singapore Armed Forces Army Learning Innovation Award
2016	Prime Minister's Book Prize (Ministry of Education, Singapore)

## WORK EXPERIENCE

---

<b>Haverford College</b>	Haverford, PA
<i>Teaching Assistant</i>	<i>Aug 2020 - May 2023</i>
<ul style="list-style-type: none"><li>• Hold office hours and grade for analysis of algorithms, quantum mechanics and theory of computation</li><li>• Run Math Question Center &amp; tutor multivariable calculus, real analysis, linear &amp; abstract algebra</li></ul>	
<b>Innospark</b>	Singapore
<i>Junior Software Developer</i>	<i>Jul 2018 - Jan 2019</i>
<ul style="list-style-type: none"><li>• Built APIs for prototype submitted to Singapore's Ministry of Health &amp; National University Hospital</li></ul>	
<b>BigBulb Studio</b>	Singapore
<i>Co-founder and Software Developer</i>	<i>Nov 2017 - Apr 2019</i>
<ul style="list-style-type: none"><li>• Offered tech consulting and developed company websites for small and medium enterprises</li></ul>	
<b>Singapore Armed Forces</b>	Singapore
<i>Assistant Platoon Commander (1st Lieutenant)</i>	<i>Jan 2016 - Nov 2017</i>
<ul style="list-style-type: none"><li>• Trained over 100 officer cadets into logistics officers and planned local and overseas military exercises</li></ul>	

## OUTREACH AND COMMUNITY SERVICE

---

<b>CodeForPhilly</b>	Philadelphia, PA
<i>Co-lead and Software Engineer (MATchmapper)</i>	<i>Feb 2020 - May 2023</i>
<ul style="list-style-type: none"><li>• Co-founded <a href="#">MATchmapper</a> to offer data insights on the opioid crisis for Health Federation Philadelphia and the Department of Public Health</li><li>• Constructed Django web application and data pipeline to scrape public databases and built PostgreSQL database and interactive map on Heroku for more than 500 healthcare providers</li></ul>	
<b>Haverford College</b>	Haverford, PA
<i>Co-head of HaverCode</i>	<i>Nov 2019 - May 2023</i>
<ul style="list-style-type: none"><li>• Organize computer science-related academic, industry and social events for faculty and students</li></ul>	