VISHNU NITTOOR

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EDUCATION

University of Toronto – Honours Bachelor of Science – CGPA: 4.0/4.0 *2021-2025*

Double Specialist in Computer Science (Theory of Computation) and Mathematics. **A+** in all mathematics and computer science courses.

Scholarships and Awards: DCS Research Award. Dean's List. University of Toronto Beatty Scholar, Howard Ferguson Provincial Scholarship and the Dr. James A. & Connie P. Dickson Scholarship In Science & Mathematics.

PROFILE

I am pursuing a research career in computer science, with a current focus on computer graphics. My general interests are broad and theory-driven, including other areas such as formal verification, differential privacy, and artificial intelligence.

My mathematics background is rich and expansive, encompassing studies in mathematical analysis, modern algebra, abstract linear algebra, probability theory, topology, and geometry. My commitment to mathematics both inspires and is informed by my research in computer science.

RESEARCH

Tight Proofs of Privacy for Differentially Private Automata
Department of Computer Science Research Award *May 2023 – August 2023*

- Worked with Prof. Azadeh Farzan (University of Toronto) on the formal verification of differential privacy for a class of automata (DiPA automata) using probabilistic liftings and couplings.
- Constructed a 'shift-coupling' parametrization of proofs or privacy, and studied the search for a tight privacy bound as an optimization problem. Found results relating various relaxations, and characterized the problem of deciding privacy in this parametrized framework.
- Supported by a research award ($7,500) from the University of Toronto Department of Computer Science.

A Monte-Carlo Analysis of Competitive Balance and Reliability across Tournament Structures
Research Publication *July 2020 - September 2020*

- Authored and published paper in the mathematics of ranking, guided by Prof Tim Chartier (Davidson College) through the Pioneer Research Program. https://doi.org/10.1137/20s1367040
- Spent 10 weeks learning ranking methods, and used Monte Carlo analysis to evaluate competitive balance and reliability metrics across tournament structures.
- Presented work at the Midwest Sports Analytics Conference. My work was recognized by Prof Amy Langville, author of a textbook in my references.

On detecting face cycles in incrementally constructed planar graphs
Research Project *October 2019 - March 2019*

- Research in computational geometry under the supervision of Dr. Sashikumar Venkatraman (Google, India).
- Compared wireframe models against cycle basis algorithms and considers the incremental addition of edges. Resulted as a project while working on computational geometry algorithms for Pentalink, a turn-based strategy game.
- Presented at the 2021 ASSU Undergraduate Research Conference at the University of Toronto.

Sigmoid Labs (now acquired by Google)
Research Internship *June 2018 - July 2018*

- Worked closely with CEO and developed an iterative algorithm to solve a research-based mathematical problem regarding detecting train crossings.
- Built an accelerated visual animation of past trains' locations as a research tool.
- Generated significant, widely-appreciated data for the firm, and presented my work to 10+ coworkers.

TEACHING EXPERIENCE

The Fields Institute for Research in Mathematical Sciences
Teaching Instructor *February 2023 - Present*

- Taught several week-long workshops to children of grades 3-6 about topology, cryptography, and problem-solving while drawing on interdisciplinary connections to art, geography, and history.
- Developed engaging lesson plans from inception, creating various problem-sheets, themed puzzles, and interactive logic games. Integrated safe and hands-on activities such as cutting and pasting to teach concepts in topology.

Computational Thinking Club
Founder and President *August 2019 - March 2021*

- Led team of 5 organizers, brainstormed and devised an introductory curriculum in discrete mathematics and computer science. Coordinated organizers to devise a semester-long data science course for high-school students including lectures, notes, worksheets, assignments, and exams.
- Held weekly lessons for 30+ members from grades 7-12 in programming, algorithms, data science, and data visualization. Conducted some problem-solving sessions that introduced topics in game theory and number theory from a computational perspective.

SELECTED PROJECTS

Blitz Notes
Co-Director, Co-Founder, Lead Developer *April 2018 - May 2021*

- Developed an IB and IGCSE high school notes website with 500,000+ page views from over 173,000 users in 189 countries. Assembled and led a team of 30+ people in creating up-to-date content, of which over 100+ pages consisted of my contributions.
- Used Flask, Bootstrap, and Python to program automatic integrations with the notes editor, and built a custom Markdown-HTML rendering engine.

Pentalink (Video Game)

Creative Director, Lead Programmer, and Game Developer *September 2019 - December 2019*

- Helped design a pen-and-paper strategy game inspired by planar geometry, and transformed it into a local multiplayer video game with 1000+ downloads.
- Worked with and led Pentalink's creative team for game design; Engineered state-system, levels, graphics, algorithms, AI, UI/UX elements.
- Worked on procedural level generation, GUI design, used game engine LÖVE2D, and programmed entirely in Lua.

AWARDS AND RECOGNITIONS

Indian National Olympiad in Informatics (2020) National Round Qualifier
Project Euler (2019) Top 1% Award; solved 100+ problems