# Lucas Shigeru Stinchcombe

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## Education

**Simon Fraser University** September 2022 – Current
*Master of Science, Computing Science* *Burnaby, BC, Canada*

- Research in classical simulation of quantum algorithms.

**McGill University** September 2013 – May 2017
*Bachelor of Science, Honours Computer Science* *Montreal, QC, Canada*

- Honours project in adversarial strategies for zero-knowledge proofs for NP.

## Research Experience

**Research Intern** August 2024 - Current
*Conducted under Ichiro Hasuo at the National Institute of Informatics* *Tokyo, Japan*

- Researching categorical constructions for predicate transformers of quantum programs using fibrations.
- Studying the connections between fibrational approaches and effectus theory for backwards semantics.

**Graduate Research Assistant** September 2022 - Current
*Conducted under Matthew Amy at Simon Fraser University* *Burnaby, BC*

- Proved the classical simulation of a class of quantum algorithms used in quantum simulation benchmarks.
- Researching the hardness of T-count optimization on Clifford+T circuits.

**Undergraduate Research** January 2017 - May 2017
*Conducted under Claude Crépeau at McGill University* *Montreal, QC*

- Contributed to constructing zero-knowledge proofs in a setting with constant number of commitments.
- Performed computational simulations of adversarial strategies on a protocol for 3-Colorability.

**Undergraduate Research** August 2015 - February 2015
*Conducted under Olivier Tremblay-Savard at McGill University* *Montreal, QC*

- Analyzed the gameification of the $k$-Clique problem in a market-place game in which players build sets of nodes corresponding to cliques of a graph.

## Publications and Preprints

**Polynomial-Time Classical Simulation of Hidden Shift Circuits via Confluent Rewriting of Symbolic Sums** [ arxiv:2408.02778 ] Quantum 2024 *Under review*
*Matthew Amy, Lucas Shigeru Stinchcombe*

- Demonstrates that a formal rewrite system for boolean path sums is *confluent* in general. Applying the rewrite system results to a widely used benchmark algorithm resolves the conjecture of its polynomial-time classical simulation.

**Practical Relativistic Zero-Knowledge for NP** [ arxiv:1912.08939 ] ITC 2020
*Claude Crépeau, Arnaud Y. Massenet, Louis Salvail, Lucas Shigeru Stinchcombe, Nan Yang*

- Exhibits two novel zero-knowledge protocols for 3-Colorability that use two local provers and three entangled provers, requiring only one edge, 2 bits and 2 trits of communication per prover.

## Talks

**Polynomial-time Classical Simulation of Roetteler's Shifted Bent Function Algorithm** [ POPL24:PlanQC ] [ BIRS:24w5307 ] January, May 2024 *PlanQC 2024, BIRS 2024*

- Presented preliminary results of *Polynomial-Time Classical Simulation of Hidden Shift Circuits via Confluent Rewriting of Symbolic Sums* at PlanQC 2024 and BIRS 2024 workshops.

## Teaching Experience

**Category Theory Reading Group** August 2024 – Current
*National Institute of Informatics* *Tokyo, Japan*

- Delivered weekly lectures on category theory, based on *Categories for the Working Mathematician* by Saunders Mac Lane.

**CMPT 476: Introduction to Quantum Algorithms Teaching Assistant** Jan 2024 – April 2024
*Simon Fraser University* *Burnaby, BC*

## Work Experience

**Senior Software Engineer** August 2017 - August 2021
*Bloomberg L.P.* *Tokyo, Japan*

- Optimization of a C++ implementation of Myer's difference algorithm resulting in tenfold speed up.
- Developed command-line tools to investigate and manipulate a proprietary binary format of exchange data.
- Designed and implemented a large-scale distributed ingestion system of market data to a central visualization tool.

**Lead Software Engineer** September 2015 – June 2017
*Nimbus Learning* *Montreal, QC*

- Developed a platform to connect tutors and students and analytics to identify struggling students.
- Licensed to twenty five universities across North America.

**Software Engineer Intern** May 2016 – August 2016
*Rakuten* *Tokyo, Japan*

- Wrote an application health library to monitor services in Java with the SpringBoot framework.

## Miscellaneous Achievements and Projects

**Dobson Cup 2017** March 2017

- Semifinalist of the Dobson Cup for Entrepreneurship
- Registered as Apollo, an education startup which was later incorporated as Nimbus Learning.

**Mhacks 2015** September 2015

- First place in the Android app category.
- Built a prototype application to compute efficient commutes using real-time user data.

## Technical Skills

**Natural Languages**: English (Native), Japanese (Fluent), French (Intermediate)
**Programming Languages**: C++, Python