

Haggai Liu
Curriculum Vitae
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EDUCATION

- PhD. Mathematics Candidate*** May 2021 - present
Simon Fraser University (SFU)
- GPA 4.24 (A+) on a 4.33-point grading scale
- MSc. Mathematics*** September 2018 - April 2021
Simon Fraser University (SFU)
- GPA 4.13 (A) on a 4.33-point grading scale
 - Thesis: On the cogrowth series of free products of finite groups
- BSc. Computer Science and Mathematics*** September 2012 - December 2017
University of Victoria (UVic)
- GPA 8.51 (A+) Cumulative; 8.89 (A+) Upper-level on a 9-point grading scale

TEACHING SKILLS TRAINING

- Instructional Skills Workshop (ISW) at SFU February 2025
- Took this workshop a second time to refresh my teaching skills
 - Learned how to initiate active and participatory learning
 - Certificate available upon request
- Certificate Program in University Teaching and Learning (CPUTL) January - April 2022
- Instructional Skills Workshop (ISW) at SFU February 2020

RESEARCH INTERESTS

- **Algebraic Combinatorics:** Moduli of curves, Schubert calculus, Representation theory, Cluster algebra, Lie algebra, Young tableaux, Posets and lattices

- **Algebraic Geometry:** Varieties, Schemes, Blow-ups and exceptional divisors
- **Algebraic Topology:** Fundamental Groups, Cell Complexes

RESEARCH EXPERIENCE

Combinatorics and Geometry of Moduli Spaces of Curves

Banff International Research Station (BIRS)

July - August 2024

Banff, Alberta, Canada

Project group members: Vance Blankers, Emily Clader, Iva Halacheva, and Dustin Ross

- Describe a family of hyperplane arrangements depending on a positive integer parameter that generalizes the braid arrangement. Study wonderful compactifications of these arrangements, and build a new class of moduli spaces.

Research Assistant (PhD.)

SFU (Department of Mathematics)

Combinatorics and Algebraic Geometry

Faculty Mentor: Jake Levinson

May 2021 - present

Burnaby, BC, Canada

- Generalize an equivariant fundamental group on a symmetric weighted moduli space of pointed rational curves. Obtain presentations of such groups by examining a particular cell decomposition, relating them to rooted trees and permutahedra.

Research Assistant (MSc.)

SFU (Department of Mathematics)

Analytic and Enumerative Combinatorics

Faculty Mentor: Marni Mishna

May 2020 - April 2021

Burnaby, BC, Canada

- Analyzed the generating function describing walks on an infinite Cayley graph. Obtained degree bounds for this algebraic function by solving a system of polynomial equations derived from the theory of free probability.

Research Assistant (MSc.)

SFU (Department of Mathematics)

Continuous Optimization

Faculty Mentor: Zhaosong Lu

September 2018 - April 2020

Surrey, BC, Canada

- Incomplete: Switched to working with Marni Mishna in the middle of my MSc. degree
- Studied a semidefinite program modelling stress minimization under box constraints.

Research Assistant (BSc.)

UVic (Department of Mathematics and Statistics)

Combinatorics and Graph Theory

Faculty Mentor: Peter Dukes

May - August 2016

Victoria, BC, Canada

- Counted as a Co-op term
- Investigated the structure of facets of cones generated by characteristic vectors of triangles. Wrote Sage code to obtain classifications of such facets.

USRA Research Assistant (BSc.)

UVic (Department of Mathematics and Statistics)

Differential Equations

Faculty Mentor: Slim Ibrahim

May - August 2015

Victoria, BC, Canada

- Studied Euler equations for the Earth's rotation and analyzed the linear estimates for the solutions to the equations, on flat Euclidean space and Spherical space.

VOLUNTEER EXPERIENCE

Marker for High School Math Challengers Competition at SFU

May 3, 2025

Marker for High School Math Challengers Competition at UBC

February 22, 2025

- Graded multiple choice questions
- Helped solve a some competition questions to verify correctness of answer keys
- Certificates available upon request

INSTRUCTIONAL EXPERIENCE

Sessional Instructor at SFU

Mathematics Department

May - August 2025

- Math 251 Surrey Campus

Teaching Assistant (TA) at SFU

Mathematics Department

September 2018 - present

- TA Course Tutorials:
 - Macm 316

- Math 308, 322, 341, 342, 242, 260
- Math 100 clinic
- TA Marker: Math 408, 443
- Workshop:
 - Burnaby Campus:
 - * Algebra Workshop
 - * Applied Calculus Workshop
 - * Calculus Workshop
 - Surrey Campus:
 - * Applied Calculus and Algebra Workshop

Private Tutoring

2013 - present

- Various topics in math, statistics, computer science, and physics
- High school (including AP and IB courses) and post secondary levels
- Occasionally prepare students for math competitions and standardized exams
- Number of clients vary, but usually around 7 per semester

Teaching Assistant Marker at UVic

2014 - 2017

Department of Mathematics and Statistics

- Courses
 - Math 362: Elementary Number Theory
 - Math 236: Elementary Real Analysis
 - Math 202: Calculus IV
 - Math 122: Logic and Foundations
 - Math 101: Calculus II
 - Math 100: Calculus I

AWARDS AND DISTINCTIONS

Graduate Dean Entrance Scholarship (GDES) — SFU	May 2022 - present
Graduate Fellowship — SFU	January 2019
Special Graduate Entrance Scholarship (SGES) — SFU	September 2018
University of Victoria Alumni Undergraduate Scholarship — UVic	November 2017
Howard Petch Scholarship — UVic	September 2016
President's Scholarship — UVic	September 2016

Department of Computer Science 10th Anniversary Scholarship — UVic
Jamie Cassels Undergraduate Research Awards — UVic
Undergraduate Student Research Awards (USRA) — UVic

September 2016
September 2015 - April 2016
May 2015 - August 2015

PUBLICATIONS

V. Blankers, E. Clader, I. Halacheva, H. Liu, and D. Ross. “Moduli Theory of the r -Braid Arrangement” *Forum of Mathematics, Sigma*. Submitted.

J. Levinson, and H. Liu. “Fundamental groups of moduli spaces of real weighted stable curves” *Séminaire Lotharingien de Combinatoire 93B: Proceedings of the 37th Conference on Formal Power Series and Algebraic Combinatorics (FPSAC 2025, Sapporo)*. July 2025.

J. Levinson, and H. Liu. “Moduli Spaces of Weighted Stable Curves and their Fundamental Groups” *Selecta Mathematica*. Submitted.

J. Bell, H. Liu, and M. Mishna. “Cogrowth Series for Free Products of Finite Groups” *International Journal of Algebra and Computation*. January 2023.

PRESENTATIONS

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups May 21, 2025
Canadian Discrete and Algorithmic Mathematics (CanaDAM) 2025: University of Ottawa.

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups April 19, 2025
AMS New England Graduate Student Conference 2025: Brown University.

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups February 25, 2025
University of British Columbia (UBC) Discrete Math Seminar: UBC Vancouver.

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups November 30, 2024
Canadian Mathematical Society (CMS) Winter Meeting 2024: Vancouver.

- Session: Algebraic Geometry

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups October 26, 2024
Binghamton University Graduate Combinatorics, Algebra, and Topology (BUGCAT)
2024: Binghamton, USA.

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups June 3, 2024
Early-Career Conference in Combinatorics (ECCC) 2024: Urbana, USA.

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups June 1, 2024
CMS Summer Meeting 2024: Saskatoon.

- Session: Moduli Spaces in Complex and Algebraic Geometry: Recent Developments

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups March 16, 2024
Graduate Student Combinatorics Conference 2024: Pittsburgh, USA.

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups February 29, 2024
Number Theory and Arithmetic Geometry (NTAG) Seminar: SFU.

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups December 2, 2023
CMS Summer Meeting 2023: Montreal.

- Student Research Session

Enumerative Properties of Cogrowth Series on Free Products of Finite Groups July 24, 2021
Invited talk: Applications of Computer Algebra (ACA) 2021: Online.

Enumerative Properties of Cogrowth Series on Free Products of Finite Groups June 30, 2021
SFU Discrete Math Seminar: Online.

Cone of Weighted Graphs Generated by Triangles August 18, 2016
Canadian Undergraduate Mathematics Conference 2016: UVic.