

ROBIN TRUAX
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RESEARCH INTERESTS

Algebra, combinatorics, and their application to other fields in pure and applied math, especially political methodology and complexity theory.

EDUCATION

Stanford University 2020 - 2024

Expected: Mathematics (BS), Political Science (BA), Computer Science (MS), Art (Minor).

Overall GPA: 4.11. Math GPA: 4.13. Key graduate classes: modern algebra, algebraic geometry, algebraic topology, differential topology, differential geometry, real analysis, probability theory, complexity theory, game theory. Key undergraduate classes: complex and functional analysis, elementary, algebraic, and analytic number theory, discrete math, etc.

University of Washington 2019 - 2020

Audited multiple graduate classes in abstract algebra using Dummit and Foote, Aluffi, Awodey.

North Seattle College 2019 - 2020

Dual enrollment simultaneous with high school. Overall GPA: 3.96. Math GPA: 4.0. Took classes in multivariable calculus, vector calculus, linear algebra, differential equations, symbolic logic, etc.

RESEARCH EXPERIENCE

Computational Correlation for Boolean Decision Trees 2022 -

Studied various notions of multitask efficiency for Boolean decision trees using the metrics of size and depth. Used combinatorics and graph theory to develop a notion of “computational correlation” and prove properties about the model. Individual project with Li-Yang Tan at Stanford.

Repetitions in Pak-Stanley Labels of Graphs 2022

Discovered and proved novel results on repetitions in the Pak-Stanley labels for graphs using tools from combinatorics, algebra, and chip-firing. Created computational tools for analyzing the G -Shi arrangement. Group project guided by Gordon Kirby and Susanna Fishel at ICERM.

The Game Theory of Ranked-Choice Voting 2022 -

Studied voting systems using tools from social choice theory. Mathematically formalized and studied the properties of ranked-choice voting. Independent project with Avi Acharya at Stanford.

New Proofs and Analogues of Tokuyama’s Formula 2021

Created novel proofs at the intersection of representation theory and combinatorics. Made progress towards developing analogues of Tokuyama’s Formula for other reductive groups, such as symplectic groups. Group project guided by Slava Naprienko and Daniel Bump at Stanford.

Split Petal Projections and the Knot Determinant 2019 - 2021

Investigated “split petal projections”, a symmetric representation of knots derived from petal projections. Developed algorithms to compute knot determinants of split petal projections directly from petal permutations. Independent project with Allison Henrich from Seattle University.

PRESENTATIONS AND TALKS

Counting Pak-Stanley Labels in the G-Shi Arrangement Joint Mathematics Meetings	<i>January 2023</i>
Repetitions of Pak-Stanley Labels in the G-Shi Arrangement Joint Mathematics Meetings	<i>January 2023</i>
The Three Rows Game: Repetitions in Pak-Stanley Labels National Diversity in STEM Conference	<i>October 2022</i>
The G-Shi Arrangement: Games on Paths, Trees, and More Summer at the Institute for Computational and Experimental Research in Mathematics	<i>August 2022</i>
The G-Shi Arrangement and the Three Rows Game Summer at the Institute for Computational and Experimental Research in Mathematics	<i>July 2022</i>
G-Shi Arrangements and Parking Functions Summer at the Institute for Computational and Experimental Research in Mathematics	<i>June 2022</i>
The Lindström-Gessel-Viennot Lemma: Tiling, Paths, and Determinants Stanford Undergraduate Mathematics Organization Symposium	<i>March 2022</i>
Locks and Learning: A Demonstration of Mathematical Storytelling Seattle Public Schools Teacher Mathematics Conference	<i>October 2021</i>
Towards a Tokuyama's Formula for Symplectic Groups Stanford Undergraduate Research Institute in Mathematics	<i>August 2021</i>
Novel Proofs of Tokuyama's Formula Stanford Undergraduate Research Institute in Mathematics	<i>July 2021</i>
Chip-Firing: From Algebra to Sandpiles Stanford University Directed Reading Program	<i>June 2021</i>
The Probabilistic Method and Sum-Free Subsets of Abelian Groups Stanford University	<i>May 2021</i>
How to Drive Students Away From Math: A Tutorial Seattle Public Schools Teacher Mathematics Conference	<i>October 2020</i>
Knot So Hard: An Introduction to Petal Projections Western Washington Community College Student Mathematics Conference	<i>February 2020</i>
Split Petal Projections, Knot Colorings and Determinants Summer Institute of Mathematics at the University of Washington	<i>August 2019</i>

TEACHING AND WORK EXPERIENCE

Research in Stanford's Department of Political Science Studied voting systems using computational and formal tools. Developed tools for empirically testing theories. Wrote a paper being submitted for publication.	<i>2022 -</i>
Grader in Stanford's Department of Mathematics Evaluated students in Stanford's honors math sequence on discrete math and probability theory, as	<i>2021 -</i>

well as upper-division courses in graph theory and algebraic geometry.

Community Tutor at North Seattle College *2019 - 2020*

Tutored students in subjects ranging from basic algebra to multivariable calculus, linear algebra, differential equations, as well as computer science in both one-on-one and group settings.

Individual Tutor *2018 - 2020*

Privately tutored students studying calculus, preparing them to pass Advanced Placement exams. Also individually tutored college students in group theory and abstract algebra.

AWARDS AND GRANTS

SACNAS 2022 Travel Scholarship *2022*

WORKSHOPS AND CONFERENCES

Joint Mathematics Meetings *2023*

The American Mathematical Society

National Diversity in STEM Conference *2022*

Society for the Advancement of Chicanos/Hispanics and Native Americans in Science

Summer@ICERM Institute for Computational Combinatorics *2022*

The Institute for Computational and Experimental Research in Mathematics

Seattle Public Schools Teacher Mathematics Conference *2021*

Seattle Public Schools, Virtual

Stanford Undergraduate Research Institute in Mathematics *2021*

Stanford University

Stanford Directed Reading Program *2021*

Stanford University

Seattle Public Schools Teacher Mathematics Conference *2020*

Seattle Public Schools, Virtual

Mathematics Online Reading Program at Harvard University *2020*

Harvard University, Virtual

Western Washington Community College Student Mathematics Conference *2020*

Edmonds College

Summer Institute for Mathematics at the University of Washington *2019*

The University of Washington

OUTREACH AND SERVICE

Mentoring with the PMP (*Helping incarcerated people progress in math by mail.*)

Animating Mathematics (*Programmatically generating animations using manim*)

Created [The Tale of Three Triangles](#). Recognized by math educator Grant Sanderson for

narrative structure and storytelling. Translated into Mandarin. Also created animated proofs of other results in discrete math, such as $R(3, 3) = 6$ and $C_n = \frac{1}{n+1} \binom{2n}{n}$.

Guest Speaking to Future Mathematicians (*Visting classes and clubs*)

Visited advanced high school math classes such as precalculus, IB Math SL/HL, AP Calculus AB/BC to discuss problem-solving and geometric reasoning. Also visited high school and middle school math clubs to provide insight into the beauty and art of mathematics.

Leading Reading Courses (*Teaching the art of problem-solving*)

Led a quarter-long course on The Art and Craft of Problem Solving by Paul Zeitz.

Reviewing for zbMATH (*Helping index papers in knot theory and combinatorics*)

PUBLICATIONS

- [1] A. Henrich, R. Truax. "Petal Projections, Knot Colorings and Determinants". *Involve, a Journal of Mathematics*. Vol. 15 (2022), No. 2, 207–232.
<https://msp.org/involve/2022/15-2/p02.xhtml>
- [2] C. Bennett, L. Martinez, A. Mock, G. Rojas Kirby, R. Truax. "Repetitions of Pak-Stanley Labels in G -Shi Arrangements". *Preprint*. <https://arxiv.org/abs/2210.13613>