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*
BS in Mathematics, BA in Political Science, MS in Computer Science (expected). Overall GPA: 4.12. Math GPA: 4.14. Key graduate classes: algebra, algebraic geometry, topology and geometry, analysis, probability theory. Other key classes: real, complex, and functional analysis, elementary, algebraic, and analytic number theory, discrete math, complexity theory, 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

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

The Three Rows Game: Repetitions in Pak-Stanley Labels *October 2022*
National Diversity in STEM Conference

The G-Shi Arrangement: Games on Paths, Trees, and More *August 2022*
Summer at the Institute for Computational and Experimental Research in Mathematics

The G-Shi Arrangement and the Three Rows Game *July 2022*
Summer at the Institute for Computational and Experimental Research in Mathematics

G-Shi Arrangements and Parking Functions *June 2022*
Summer at the Institute for Computational and Experimental Research in Mathematics

The Lindström-Gessel-Viennot Lemma: Tiling, Paths, and Determinants *March 2022*
Stanford Undergraduate Mathematics Organization Symposium

Locks and Learning: A Demonstration of Mathematical Storytelling *October 2021*
Seattle Public Schools Teacher Mathematics Conference

Towards a Tokuyama's Formula for Symplectic Groups *August 2021*
Stanford Undergraduate Research Institute in Mathematics

Novel Proofs of Tokuyama's Formula *July 2021*
Stanford Undergraduate Research Institute in Mathematics

Chip-Firing: From Algebra to Sandpiles *June 2021*
Stanford University Directed Reading Program

The Probabilistic Method and Sum-Free Subsets of Abelian Groups *May 2021*
Stanford University

How to Drive Students Away From Math: A Tutorial *October 2020*
Seattle Public Schools Teacher Mathematics Conference

Knot So Hard: An Introduction to Petal Projections *February 2020*
Western Washington Community College Student Mathematics Conference

Split Petal Projections, Knot Colorings and Determinants *August 2019*
Summer Institute of Mathematics at the University of Washington

Teaching and Work Experience

Grader in Stanford's Department of Mathematics *2021 -*
Evaluated students in Stanford's honors math sequence on discrete math and probability theory, as 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

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

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

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.

Publications and Papers

[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`