Shuhang Xue

Email: xues047@gmail.com Website: https://www.shuhangxue.com Nationality: China

Education

Carleton College, Northfield, MN Sep 2019 - expected Mar 2023
B.A. in Mathematics,
GPA 3.91, GPA in Math 4.0

Research & Expository Articles

- Boehnke, B., Scheirer, S. & **Xue, S.** Relative Topological Complexity and Configuration Spaces. Bull. Iran. Math. Soc. (2022). https://doi.org/10.1007/s41980-022-00723-x.
- (Chicago REU Paper) **Xue, Shuhang.** Brown Representability and its Variants in Context. (2022).
- (Preprint) Boehnke, B., Gillis, C., Liu, H., **Xue, S.** The purely cosmetic surgery conjecture is true for the Kinoshita-Terasaka and Conway knot families. (2020).

Research Experiences

Relative Topological Complexity, with Professor **Steve Scheirer** Dec. 2020 – Apr. 2022

- Informally, Topological complexity of a space is the minimum number of "continuous rules" needed to describe how to move between any two points in the space. We generalized it to the relative notion concerning continuous rules between two subspaces and proved related bounds using algebraic methods. Most significantly, we proved specific upper and lower bounds of some relative topological complexities in configuration spaces under any one of two sets of conditions.

REU at the University of Chicago, with Professor **Peter May** Jun. 2022 – Sep. 2022

- Studied classic homotopy theory topics like fiber bundles, (co)fibrations, obstruction theory, cobordism, and spectra & general (co)homology theories.
- Wrote a paper comparing Frank Adams' variant of Brown Representability and Amnon Neeman's Representability in triangulated categories.
- Attended REU lecture series on complex dynamics, random trees, Random Walk and the Heat Equation, quadratic forms over fields, and Professor May's "categorical topology."

Knot Theory in BSM Summer Research Program Jun. 2020 – Sept. 2020

- Studied Alexander and Jones polynomials on knots, Heegaard Floer Homology, Dehn-surgeries.
- Investigated a question in low-dimensional topology — Purely Cosmetic Surgery Conjecture (PCSC).
- Proved PCSC on Conway and Kinoshita-Terasaka knot families.

Other Studies in Mathematics

Budapest Semester in Mathematics (BSM) Aug. 2021 – Dec. 2021
Studied Graph Theory, Commutative Algebra, and Functional Analysis

Senior Thesis on the Riemann Zeta function Jun. 2022 – ongoing
Studied claims on the Zeta function in Riemann's Memoir, Hardy's proof on the infinitude of zeros on the critical strip, and properties of general L-functions.

IAS/PCMI Undergraduate Summer School Jun. 2021 – Aug. 2021
Studied Quadratic forms and introduction to Milnor K-theory.

Core Classes in Math

Algebra/Geometry: Seminar in algebraic geometry, Galois theory, Representation theory (planned), Commutative algebra, Geometric group theory, and Elementary number theory.
Topology: Independent study in algebraic topology, Topology.
Analysis: Complex analysis, Functional analysis, Measure theory, Real analysis, Differential geometry, and Intro to Analytic number theory. **Combinatorics:** Graph Theory.

Highlights of Liberal Arts Education

Physics: Classical mechanics, Atomic & nuclear physics, Independent study in intolerance adhesive. **Computer Science:** Data structure. **Political Science:** Politics of contemporary China. **History:** University and slavery. **Art History:** Modern art: 1890-1945. **Music Instrument:** Erhu, Recorder. **English:** How we read, Terrorism and the novel, The rise of the novel.

Communications in Mathematics

- **Speaker, MAA Conference, North Central Section, Fall 2021** Presented research on relative topological complexity in configuration spaces.
- **Speaker, NUMS (Northfield Undergraduate Mathematics Symposium), Fall 2020 & 2021** Presented knot theory research in 2020 and relative topological complexity research in 2021.
- **Cofounder, Algebra Club at Carleton College** A club open to all people interested in algebra. I give talks regularly on algebraic topology.
- **Member, People of Color in Math (Club) at Carleton College** A club dedicated to encouraging people of color to study mathematics.

Teaching Experiences

- **Tutor at Math Skill Center** at Carleton Dec. 2019 – Jun. 2021
- **Grader** for **Complex Analysis, Measure Theory, Differential Geometry,** and **Math Structures**
- **Teaching Assistant** for **Real Analysis** Winter 2022

Honors and Awards

- **Kolenkow-Reitz Research Fellow** (awarded $5500), Carleton College 2022
- **Dean's List**, Carleton College 2021-2022
- **1st Prize, the 35th Chinese Regional Mathematics Olympiad**, China 2018