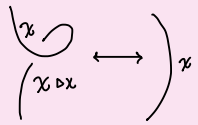
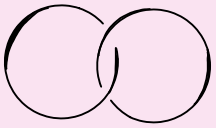
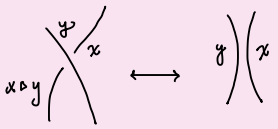
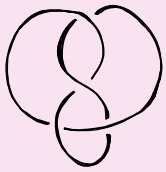


Quandles: Tying Together Algebra and Knot Theory



Mentor: Ally Nagasawa-Hinck, anagasawahinck@ucdavis.edu
Time: Weekly time TBD
Location: TBD



Description: In this weekly seminar, we will explore the fascinating world of classical knots through the emerging theory of quandles. Quandles provide us mathematicians with powerful algebraic tools to study and classify knots using algebraic invariants.
During the first half of the quarter, we will build a strong foundation by familiarizing ourselves with key concepts in classical knot theory and essential algebraic structures. With this shared understanding, we will then dive into the study of quandles—exploring their properties, applications, and computational aspects. Through hands-on examples and discussions, we will not only analyze quandles but also experiment and play with them, gaining deeper insights into their role in knot theory. [1]

Prerequisites: None

Text: *Quandles* by Mohamed Elhamdadi and Sam Nelson (no purchase required)

Meeting Format and Expectations: Each week, we will meet for 90 minutes. I will begin every meeting with a brief lecture-style presentation, followed by a short break. The remaining time will be spent working in small groups on practice problems from the text and related sources. This seminar will give you many opportunities to engage in doing mathematics collaboratively—discussing ideas, asking questions, and presenting solutions. You are not expected to complete problems before our meetings. I hope to keep the time commitment outside of seminar sessions minimal.

Learning Goals:

- Develop a foundational understanding of classical knot theory and algebra by exploring knot diagrams, Reidemeister moves, modules, and other algebraic tools
- Learn the theory of quandles as algebraic structures, understand their axioms, and explore their role as knot invariants
- Use quandles to study knots, understand how they can be used to distinguish knots and contribute to broader mathematical understanding
- Feel comfortable asking questions and working collaboratively with peers on mathematical problem solving

1. If the only words you recognize in the seminar description are 'study' and 'mathematician,' and you're a curious mathematician eager to explore new ideas, then this seminar is for you!

Rough outline for quarter:

1. **Introduction to Knots [ch 1.1, 1.2]**
    a. Community guidelines and expectations
    b. Definitions of classical knots, knot diagrams, Reidemeister moves
2. **What is an algebraic structure? [ch. 2.1]**
    a. Binary operations
    b. Homomorphisms
    c. Operation tables
3. **Equivalence Relations and Quotient Spaces [ch 2.2]**
    a. Definitions
    b. Examples in set theory, algebra, and classical knots
4. **Crash course on modules [ch 2.3]**
    a. Intuition
    b. Definition
    c. Examples in linear algebra and abstract algebra
5. **Kei Part 1 [ch 3.1]**
    a. Construction
    b. Fundamental kei
6. **Kei Part 2 [ch 3.1]**
    a. Homomorphisms
    b. Examples
    c. Counting invariant
7. **Quandles part 1 [ch 3.2]**
    a. Construction and relationship to Reidemeister moves
8. **Quandles part 2 [ch 3.2]**
    a. Quandle homomorphisms,
    b. Colorings
    c. Latin quandles
9. **Quandles part 3**
    a. TBD