

# Quandles, racks and shelves

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A *quandle* is a set  $X$  with a binary operation  $*$  :  $X \times X \rightarrow X$  satisfying:

- (i) For all  $x \in X$ ,  $x * x = x$
- (ii) For all  $y \in X$ , the map  $\beta_y : X \rightarrow X$  defined by  $\beta_y(x) = x * y$  is invertible.
- (iii) For all  $x, y, z \in X$ ,  $(x * y) * z = (x * z) * (y * z)$ .

The three axioms of a quandle algebraically encode the three Reidemeister moves in knot theory.

A *rack* is a set with a binary operation that satisfies (ii) and (iii), and a *shelf* is a set with a binary operation satisfying self-distributivity (iii).

In this talk, I will give an introduction to quandles, racks, shelves, and quandle rings. I will also talk about a recent joint work with Matthew Pradeep Goonewardena and Mohamed Elhamdadi on shelves.