Decision Making Under Interval Uncertainty as a Natural Example of a Quandle

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In many real-life situations, we need to select an alternative from a set of possible alternatives. In many such situations, we have a well-defined objective function $u(a)$ that describes our preferences. If we know the exact value of $u(a)$ for each alternative a, then we select the alternative with the largest value of $u(a)$. In practice, however, we usually know the consequences of each decision a only with some uncertainty. As a result, for each alternative a, instead of the exact utility value $u(a)$, we only know the interval of possible values $[\underline{u}(a), \overline{u}(a)]$. In this paper, we show that the resulting problem of decision making under interval uncertainty is a natural example of a *quandle*, i.e., of a general class of operations introduced in knot theory.