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A Fuzzy Generalization of Latin Squares

In *Six Permutation Patterns Force Quasirandomness* by Crudele, Dukes, and Noel (2024), the authors introduce the notion of a fuzzy permutation matrix and what we now call a fuzzy Latin square. A fuzzy permutation matrix is a way of combinatorially embedding a permutation matrix of order k in a matrix of order $n \geq k$. We say a Latin square is partially reduced if its first row is $1, 2, \dots, n$. In the same way that a partially reduced Latin square can be expressed as a sum of permutation matrices, a fuzzy Latin square is a linear combination of fuzzy permutation matrices which total to a constant matrix.

Expanding on their work, we bound the dimension of partially reduced Latin squares of order n as a vector space using the representation theory of the symmetric group, investigate vanishing fuzzy Latin squares, and compute the fuzzy Latin squares with six terms.

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