Triple Row Switch Modification of Latin Squares

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The row cycle switching operation modifies two rows of a latin square to create new squares from existing ones. There are latin squares which are rigid with respect to row cycle switching, they are usually called *perfect latin squares.* In our research, we extended this concept by examining the modification of three rows simultaneously. We observed that, in this context, there are no rigid latin squares; instead, the number of possible triple row switches increases exponentially with the size of the latin square. This observation relates to an old conjecture of Erdős and Rényi [1], solved by Voorhove [2], for $k = 3$ in 1979 and Schrijver [3], for general k in 1998.

The next question is whether any two latin squares can be transformed into each other through a sequence of triple row switching modifications. To explore this, we designed and implemented a heuristic algorithm with a time complexity $O(n^5)$. Our experimental results suggest that the answer is positive. Our future goal is to improve the algorithm to effectively generate random latin squares.

This is a joint work with my supervisor Gábor P. Nagy (Budapest/Szeged).

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[2] M. Voorhoeve, A lower bound for the permanents of certain (0,1)-matrices, *Indagationes Mathematicae (Proceedings)*, **82(1)** (1979), 83–86.

[3] A. Schrijver, Counting 1-factors in regular bipartite graphs. *Journal of Combinatorial Theory, Series B.* **72(1)** (1998), 122–35.