# Automorphisms of Latin Squares

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A Latin Square $L$ of order $n$ is an $n \times n$ array containing $n$ symbols from $[n] = \{1, 2, \ldots, n\}$ such that each element of $[n]$ appears once in each row and each column of $L$. Rows and columns of $L$ are indexed by elements of $[n]$.
An automorphism $\alpha$ of a Latin square is a permutation such that the triple $(\alpha, \alpha, \alpha)$ maps the Latin square $L$ to itself by permuting its rows, columns and symbols by $\alpha$. Let $Aut(n)$ be the set of all automorphisms of Latin squares of order $n$. Whether a permutation $\alpha$ belongs to $Aut(n)$ depends only on the cycle structure of $\alpha$. Stones *et al.* [1] characterized $\alpha \in Aut(n)$ for which $\alpha$ has at most three non-trivial cycles (that is, cycles other than fixed points). A notable feature of this characterisation is that the length of the longest cycle of $\alpha$ is always divisible by the length of every other cycle of $\alpha$. In this research we prove a related result for automorphisms with four non-trivial cycles.

***Keywords:*** Latin Square, Automorphism, Cycle Structure, Permutation.

## References

1. Stones, D.S., Vojtěchovský, P. and Wanless, I.M., 2012. Cycle structure of autotopisms of quasigroups and Latin squares. *Journal of Combinatorial Designs*, *20*(5), pp.227-263.