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Minimal and minimum size latin bitrades of each genus

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Abstract: Suppose that T° and $T^\star$ are partial latin squares of order n, with the property that each row and each column of T° contains the same set of entries as the corresponding row or column of $T^\star$. In addition, suppose that each cell in T° contains an entry if and only if the corresponding cell in $T^\star$ contains an entry, and these entries (if they exist) are different. Then the pair $T = (T^\circ, T^\star)$ forms a latin bitrade. The size of T is the total number of filled cells in T° (equivalently $T^\star$). The latin bitrade is minimal if there is no latin bitrade $(U^\circ, U^\otimes)$ such that $U^\circ \subseteq T^\circ$. Drápal (2003) represented latin bitrades in terms of row, column and entry cycles, which he proved formed a coherent digraph. This digraph can be considered as a combinatorial surface, thus associating each latin bitrade with an integer genus, which is a robust structural property of the latin bitrade. For each genus $g \geq 0$, we construct a latin bitrade of smallest possible size, and also a minimal latin bitrade of size $8g + 8$.

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