An independent check of the 33 sets of mutually orthogonal Latin squares in arXiv:2611.16299

Papex Labs

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Result

All 33 sets of mutually orthogonal Latin squares (MOLS) published with C. D. Rosin's paper "Improved Lower Bounds for Mutually Orthogonal Latin Squares (MOLS) at 33 Orders" (arXiv:2611.16299v1) pass two checkers written for this record, without using the author's script. For each of the 33 files, the file holds m arrays of size n × n over the symbols 0, …, n−1, every row and every column of every array contains each symbol once, and every pair of distinct arrays is orthogonal. This gives N(n) ≥ m for the 33 pairs (n, m) in the paper's Table 1, where N(n) is the largest number of MOLS of order n. In each of the 33 orders, m is larger than the lower bound in the 2024 table of Miller, Abel, Valkov and Fraser, by 1 to 5. The adjacency matrix published with the paper is a strongly regular graph with parameters (484, 126, 40, 30) and equals the graph built from the four squares of order 22.

Question addressed

For which orders n can the known lower bound on N(n), the largest number of mutually orthogonal Latin squares of order n, be raised? Rosin's paper reports new sets at 33 orders between 22 and 494, with constructions found by GPT-6 Astra. The squares themselves are public, so the lower bounds can be checked from the files alone. The paper's repository offers one checker, written by the author. This record reports a check that uses neither that script nor the construction code.

Result summary

Order n: number of squares checked (lower bound in the 2024 table). 22: 4 (3); 45: 7 (6); 50: 7 (6); 54: 9 (8); 60: 6 (5); 72: 8 (7); 74: 6 (5); 78: 7 (6); 80: 10 (9); 85: 7 (6); 90: 8 (6); 92: 7 (6); 96: 11 (10); 98: 7 (6); 144: 14 (10); 162: 9 (6); 175: 7 (6); 183: 7 (6); 192: 9 (7); 207: 9 (8); 225: 9 (8); 288: 17 (15); 324: 11 (8); 328: 9 (7); 335: 9 (6); 427: 12 (7); 430: 11 (6); 442: 11 (7); 456: 11 (7); 469: 11 (8); 482: 7 (6); 486: 9 (8); 494: 11 (6). Files: repository github.com/Constructive-Codes/MOLS, commit 8fd0ea0f22c29b60b9c7c7a694bc9ae594e0af05, directory mols/ (33 files). With these files, the 2024 table has no order n with 11 ≤ n < 500 below 4 (the only one was 22) and no order with 69 ≤ n < 500 below 6 (the only one was 74).

Method or derivation

1. Checker A (Python): reads each file strictly (the header "n m" must match the file name; exactly n · m data rows of n integers in 0..n−1), tests every row and every column as a set of

n distinct symbols, and tests each pair of squares by marking the n^2 ordered pairs in a table. 2. Checker B (C), written separately: the same strict reading; rows and columns tested with a stamp array; orthogonality tested in a different form: for each symbol s of square A, the n cells holding s must carry n different symbols of square B. 3. Controls: damaged inputs (one entry changed; two rows of one square swapped; a wrong square count; a missing row) must be rejected. 4. Graph: the 484×484 matrix is tested for symmetry, zero diagonal, degree 126, and 40 or 30 common neighbours for adjacent or non-adjacent pairs. It is also compared entry by entry with the graph on the cells of a 22×22 array in which two cells are adjacent if they share a row, a column, or a symbol in one of the four squares. 5. Earlier bounds: the 33 set sizes are compared by script with (a) Table 1 of Miller et al. 2024, read from the text of the open repository copy of that paper, (b) Table 3.87 of the Handbook of Combinatorial Designs, 2nd edition, as shipped in SageMath, and (c) the "2024" column of the paper's own table. 6. Newer work: arXiv (nine queries, papers since June 2024) and Crossref (six queries, items since December 2024) were searched by title and abstract for papers that state new lower bounds on N(n). The checkers and scripts were written and run by an AI assistant (Claude) on 19 November 2026.

Evidence basis

Checker A: 33 of 33 files pass (7.7 s). Checker B: 33 of 33 files pass (1.1 s). Checker B rejects all four damaged controls; checker A was run on the first two and rejects both. Graph: every test holds, and the matrix equals the graph of the four order-22 squares in row-major cell order. Earlier bounds: for all 33 orders the set size in the file equals the paper's "Constructed" value, the paper's "2024" value equals the Miller et al. table, and the stated gain equals the difference. The Miller et al. table differs from the Handbook table, as shipped in SageMath, at nine orders below 500 (14, 18, 35, 48, 54, 63, 96, 108, 486). These are the improvements that paper lists, apart from order 60, whose update the SageMath copy already carries. Three of the nine (54, 96, 486) are among the 33. Newer work: among 90 arXiv papers and 498 Crossref items read by title and abstract, the only ones stating new lower bounds on N(n) are Rosin's paper and Abel, Janiszczak and Staszewski (2025), whose results are already in the 2024 table. Machine: Apple M5, macOS, Python 3.15.2, Apple clang 21.0.0. SHA-256 digests of the 33 input files and of the graph file are kept with the logs.

Limitations

Only the published squares were checked. The constructions described in the paper and the construction code written by the model were not checked; nothing here says how the squares were found. "Improved" is relative to the 2024 table and to two literature searches by title and abstract. A result published elsewhere, or inside a paper whose abstract does not mention it, would be missed. One paper from November 2026 on incomplete MOLS (doi:10.1002/jcd.70046) was read only in abstract. The paper's Theorems 2 and 3 ($N(n) \geq 4$ for all $n > 10$; $N(n) \geq 6$ for all $n > 68$) were confirmed here only for $n < 500$, against the 2024 table. For $n \geq 500$ they rest on earlier theorems that this record did not re-derive: Hanani's bound $N(n) \geq 6$ for $n > 76$, $n \notin \{82, 90\}$, as quoted by Miller et al., and Wilson's Theorem 5.1, as cited by the paper. The Handbook table agrees for $500 \leq n < 10000$. The statement that the strongly regular graph was previously unknown was not checked. Both checkers were written by one AI assistant in one session and run on one machine; they share one reading of the definition, though not the code. This is a check of files, not peer review of the paper.

Novelty basis

No new mathematical result is claimed. The paper reports its own verification script and a reconstruction of the squares by a second model from the written descriptions. This record adds

a check by a different party, with two new checkers, and a comparison of the paper's "previous bound" column with the 2024 table.

Claim scope

Claimed statement For each of the 33 pairs (n, m) listed in the result summary, the file for that order in the repository at the stated commit is a set of m mutually orthogonal Latin squares of order n. Therefore $N(n) \geq m$ for these 33 orders.

Assumptions The files are those at commit 8fd0ea0f22c29b60b9c7c7a694bc9ae594e0af05 of github.com/Constructive-Codes/MOLS. The two checkers implement the definition correctly; their agreement and the rejected controls support this but do not prove it. The Python interpreter, the C compiler and the machine behaved correctly.

Canonical statement Theorem 1 and Table 1 (column "Constructed") of C. D. Rosin, arXiv:2611.16299v1. https://arxiv.org/abs/2611.16299

Difference from canonical Agrees with Theorem 1 as stated. It is narrower than the paper: it checks the final squares, not the constructions, and it confirms Theorems 2 and 3 only for $n < 500$.

References

[1] Christopher D. Rosin. Improved Lower Bounds for Mutually Orthogonal Latin Squares (MOLS) at 33 Orders. *arXiv*, 2026. arXiv:2611.16299
Uses data

[2] Christopher D. Rosin. Data and code for "Improved Lower Bounds for Mutually Orthogonal Latin Squares (MOLS) at 33 Orders". 2026. https://github.com/Constructive-Codes/MOLS
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[3] Alice Miller, R. Julian R. Abel, Ivaylo Valkov, Douglas Fraser. Implementing the MOLS Table for n Up to 500. *Symmetry*, 2024. https://doi.org/10.3390/sym16121678
Compares with

[4] R. Julian R. Abel, Ingo Janiszczak, Reiner Staszewski. Improvements for lower bounds of mutually orthogonal Latin squares of sizes 54, 96 and 108. *Designs, Codes and Cryptography*, 2025. https://doi.org/10.1007/s10623-025-01629-5
Cites

[5] R. Julian R. Abel, Charles J. Colbourn, Jeffrey H. Dinitz. Mutually orthogonal Latin squares (MOLS), in: Handbook of Combinatorial Designs, 2nd edition. *Chapman & Hall/CRC*, 2007. https://doi.org/10.1201/9781420010541
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[6] Richard M. Wilson. Concerning the number of mutually orthogonal Latin squares. *Discrete Mathematics*, 1974. https://doi.org/10.1016/0012-365x(74)90148-4
Cites

AI involvement

11 fields · 11 from Claude Code (claude-fable-5-2)

Table 1: Record text

Who	Model	Fields
Claude Code (claude-fable-5-2), unchanged	claude-fable-5-2	Title, Result, Result summary, Question addressed, Method or derivation, Evidence basis, Novelty basis, Limitations, Language, Field, Keywords

No AI work listed.

Names, models and roles are self-reported. Text origins were computed by Papex from what the AI apps prepared or proposed through Papex.

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