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A Resolution of Lam's Problem via Satisfiability Solvers

Lam's problem is to determine if a projective plane of order ten exists—a long-standing question since the 1800s when finite projective geometry was first studied. Lam's problem was experimentally resolved via a huge case breakdown and exhaustive computer search in the late 1980s. Despite this fantastic achievement, the resolution relied on special-purpose search code that was never independently verified.

We provide an independent resolution of Lam's problem by reducing the problem to a satisfiability (SAT) problem in Boolean logic that we solve with a combination of SAT solvers and computer algebra systems. Our resolution provides a collection of certificates that a third party can use to verify the nonexistence of a projective plane of order ten.