An Upper Bound for the Minimum No-Three-In-Line Problem

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In the October 1976 Mathematical Games column in Scientific American, Martin Gardner laid out what he called the “Minimum No-Three-In-Line” Problem. The problem was to place as few queens as possible on an n-by-n chessboard so that no three queens are in a line, but adding one more queen to any open square on the board would create three in a line (where lines are defined by the moves a chess queen can make). Many readers sent Gardner work they did on the problem, but no one addressed the issue of finding upper bounds for the necessary number of queens.

We sought such an upper bound for the necessary number of queens. Using techniques derived from similar combinatorial chessboard problems, we discovered an algorithm to efficiently place queens onto the chessboard. By algebraically quantifying where this algorithm places its pieces, we determined that at most $1.4108n + 5.87$ queens are needed.

This is joint work with John Schmitt (Middlebury) and Greg Warrington (UVM).