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Some new results and conjectures on Costas and honeycomb arrays

An n by n *Costas array* consists of n dots in an n by n array such that there is exactly one dot in each row and each column, and the $n(n-1)$ difference vectors are distinct. A *honeycomb array* with n dots is a set of n dots in the hexagonal grid such that, in each of the three natural directions, the dots occupy exactly n consecutive "rows" of the grid, and the $n(n-1)$ difference vectors are distinct. Costas arrays were defined by Costas in 1975 and honeycomb arrays were defined by Golomb and Taylor in 1984.

We prove that any honeycomb array contains an odd number of dots. The proof makes use of a known result concerning non-attacking queens on a triangular chessboard.

We also consider the problem of finding the maximum number of mutually disjoint n by n Costas arrays. When $n = p-1$ and p is prime, there exist n mutually disjoint n by n Costas arrays. We perform some enumerations for small n and make some conjectures based on the numerical data.

This talk is based on joint work with Simon Blackburn, Jeff Dinitz, Patric Östergård, Anastasia Panoui, and Maura Paterson.