Communications of the ACM

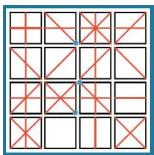**Opinion**

Computing Applications

Last byte

Puzzled: Designs on Square Grids

Welcome to, as usual, three new puzzles. However, unlike previous columns, where solutions to two were known (and included in the related Solutions and Sources in the next issue), this time expect to see solutions to all three in June.

By Peter Winkler

Posted May 1 2012

1. In composing this puzzle, writer/mathematician Barry Cipra was inspired by a work called "Straight Lines in Four Directions and All Their Possible Combinations" by the great American artist Sol Lewitt. You are given 16 unit squares, each containing a different combination of vertical crossing line, horizontal crossing line, SW-NE diagonal, and SE-NW diagonal. The object is to tile a 4×4 grid with these squares (without rotating them) in such a way that no line ends before it hits the edge of the grid or, alternatively, prove it cannot be done. Figure 1 shows a failed attempt, with dangling ends circled.

2. Cipra also composed an entertaining curved version. In it, each unit square contains one of the 16 possible combinations of four quarter circles, each of radius 1/2 and centered at a corner. Can you tile a 4×4 grid with these squares so no path ends before it hits the edge of the grid? Or, better still, can you arrange the tiles so an even number of quarter circles meet at each edge shared by two squares? Figure 2 shows a failed attempt, again with dangling ends circled.

3. We now upgrade to a 5×5 grid in a puzzle passed to me by my Dartmouth colleague Vladimir Chernov. In it, each unit square is blank or has one diagonal drawn in. How many non-blanks can you pack in without any two diagonals meeting at a corner? Figure 3 shows a legal configuration with 15 diagonals. Can you beat it with 16 diagonals? Or prove 15 is the maximum possible?
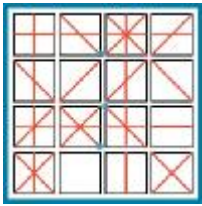
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Figures

Figure 1.
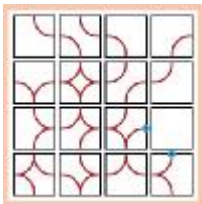

Figure 2.

Figure 3.

Footnotes

Readers are encouraged to submit prospective puzzles for future columns to puzzled@cacm.acm.org.

About the Authors

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