TEMPERATURE TWO IN DOMINEERING

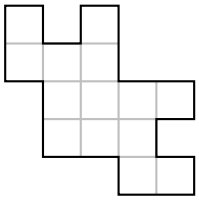
Gabriel C. Drummond-Cole
Department of Mathematics, State University of New York, Stony Brook, NY 11794, USA
blafard@math.sunysb.edu

Abstract

Determining the precise temperature values accessible in the game of Domineering is an outstanding question [5]. We demonstrate a position of temperature two, higher than any previously known temperature.

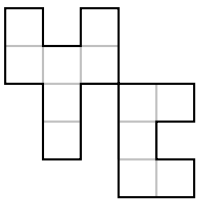
Main Result

Domineering, discussed in Winning Ways [1] and On Numbers and Games [2], is a game played with dominoes on a rectangular board tiled with squares. Players take turn placing dominoes on unoccupied squares on the board. Each domino covers two squares. Left must place all her dominoes with a "vertical" orientation while Right must place hers with "horizontal" orientation. The following domineering position has game theoretic value $\{2* \mid -2*\}$ The values can easily be calculated by hand or obtained with the software of Aaron Siegel [8] or David Wolfe [9].



The temperature for a switch $\{G| -G\}$ where G is within an infinitessimal shift of a number k, is k, so this position has temperature two.

A moderately experienced Domineering player can tell immediately that there is only one reasonable move for the vertical player, to a position which decomposes into components of value $2*$ and 0.



By symmetry the best move for the horizontal player is the reflection of this move about the diagonal.

More recently, Shankar and Sridharan [7] did a computer search on subsets of rectangular boards of area at most thirty-two and found a number of positions of temperatures between 1.5 and 2. Two remains the highest known temperature of any position in Domineering.

References

[1] Berlekamp, Elwyn R., Conway, John H., and Guy, Richard K. *Winning Ways for Your Mathematical Plays.* A K Peters, 2001.

[2] Conway, John H.. *On Numbers and Games.* A K Peters, 2001.

[5] Guy, Richard K. Unsolved Problems in Combinatorial Games. *Games of No Chance* **MSRI Publication 29** (1996) 475–491.

[7] Shankar, AJ and Sridharan, Manu. New Temperatures in Domineering. *INTEGERS* **5** (2005) 13 pages.

[8] Siegel, Aaron. Combinatorial Game Suite software. `http://cgsuite.sourceforge.net/` (2004).

[9] Wolfe, David. Games Toolkit software. `http://homepages.gac.edu/~wolfe/games/` (2004).