

Games, Puzzles, and Computation

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007 Kemeny Hall, 4:00 pm
(Tea 3:30 pm 300 Kemeny Hall)

Abstract

One can frame a game or a puzzle as a decision problem: from this configuration, does the puzzle have a solution? Can Black win the game? The computational complexity of the decision problem can then be investigated. I will begin by reviewing the properties of Turing machines and of the complexity classes I'll be discussing (NP-complete, PSPACE-complete, etc.), then briefly present several recent hardness results, including sliding-block puzzles, sliding-coin puzzles, TipOver, Rush Hour, Sokoban, hinged polygon dissections, plank puzzles, the Dyson telescope game, Amazons, and Konane.

These results are all applications of a larger framework of computation in terms of generalized games (as opposed to Turing machines), called Constraint Logic. In this framework, cellular automata are zero-player games, puzzles are one-player games, and ordinary games are two-player games. Surprisingly, some team games turn out to be undecidable, even though they are played with finite physical resources.

Joint work with Erik Demaine and others.