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Title: Graph Nim

Student Involvement: Primary Author

Abstract:

The game of Nim is at least centuries old, possibly originating in China, but noted in the 16th century in European countries. It consists of several stacks of tokens, and two players alternate taking one or more tokens from one of the stacks, and the player who cannot make a move loses. The formal and intense study of Nim culminated in the celebrated Sprague-Grundy Theorem, which is now one of the centerpieces in the theory of impartial combinatorial games. We study a variation on Nim, played on a graph. Graph Nim, for which the theory of Sprague-Grundy does not provide a clear strategy, was originally developed at the University of Colorado Denver. Graph Nim was rst played on graphs of three vertices. The winning strategy, and losing position, of three vertex Graph Nim has been discovered, but we will expand the game to four vertices and develop the winning strategies for four vertex Graph Nim.