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The 15 Puzzle on an Arbitrary Graph

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The 15 Puzzle, invented over one hundred years ago by N. Chapman and popularized by Sam Loyd, can be described as a game played on a certain graph with 16 vertices, using 15 counters (numbered from 1 to 15) placed on 15 of the vertices, in which a counter can move from its current vertex to an unoccupied neighboring vertex. By a sequence of moves one wants to get the counters into another specified configuration. From a given the initial configuration, that is possible for exactly half of the $16!$ possible final configurations.

In the generalization, the graph is an arbitrary connected, simple, finite graph. The question is: from a given initial configuration, what fraction of the final configurations can be solved? This fraction is 1 or .5, almost but not quite always.

This talk is based on a paper by Richard M. Wilson, "Graph puzzles, homotopy, and the alternating group", from the American Mathematical Monthly in 1974.

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