Distance magic labelings of Cartesian products of cycles

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A graph of order n is *distance magic* if it admits a bijective labeling of its vertices with integers from 1 to n such that each vertex has the same sum of the labels of its neighbors. When studying regular graphs, one can use a result by Miklavič and Šparl that associates the property of being distance magic with the eigenvalues and eigenvectors of the adjacency matrix. In the case of Cayley graphs of abelian groups this is particularly useful since we can apply the irreducible group characters. In this talk, we discuss this result and illustrate its application in obtaining a necessary condition for the Cartesian product of cycles $C_m \square C_n$ with $m, n \geq 3$ to be distance magic.

In 2004, Rao, Singh and Parameswaran posed the problem of finding all distance magic labelings of Cartesian products of cycles. In this talk, we show how one can "build" a distance magic labeling of such graphs from certain squares. In addition, we provide a complete characterization of all distance magic labelings of these graphs by showing that each of them is determined by a pair or quadruple of suitable sequences. Some questions and open problems which we find interesting are proposed as well.

This is joint work with Primož Šparl.

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