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Precise Bounds for the Distinguishing Index of the Cartesian Product

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Abstract

The *distinguishing index* $D'(G)$ of a graph G is the least number d such that G has an edge colouring with d colours that is preserved only by the identity automorphism. The distinguishing index of the Cartesian product of graphs was investigated by the authors and Kalinowski. They considered colourings with two colours only and obtained results that do not determine the distinguishing index for all the possible cases.

In this paper we investigate colourings with d colours and determine the exact value of the distinguishing index of the Cartesian product $K_{1,m} \square K_{1,n}$ for almost all m and n. In particular, we supplement the result of [1] for the case when $2^{2m+1} - \lceil \frac{m}{2} \rceil + 1 < n \leq 2^{2m+1}$. We also observe the distinguishing index of the Cartesian product of two graphs in general does not have to depend on the size of the graphs and it can be arbitrarily small.

Keywords: edge colouring; distinguishing index; Cartesian product

2010 MSC: 05C05, 05C15, 08A35, 68R10

1. Introduction

Let c be an edge colouring $c\colon E(G) \to \{1, \ldots, d\}$ of a graph G. We say that an automorphism $\varphi \in \mathrm{Aut}(G)$ is *broken* by the edge colouring c if there exists

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