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DYSKRETNA**

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Preprint Nr MD 067
(otrzymany dnia 11.06.2013;
nowa wersja - 7.12.2013)

**Kraków
2013**

Redaktorami serii preprintów Matematyka Dyskretna są:
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Distinguishing graphs by edge-colourings*

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Abstract

We introduce the *distinguishing index* $D'(G)$ of a graph G as the least number d such that G has an edge-colouring with d colours that is only preserved by the trivial automorphism. This is an analog to the notion of the distinguishing number $D(G)$ of a graph G , which is defined for colourings of vertices. We obtain a general upper bound $D'(G) \leq \Delta(G)$ unless G is a small cycle C_3 , C_4 or C_5 .

We also introduce the *distinguishing chromatic index* $\chi'_D(G)$ defined for proper edge-colourings of a graph G . A correlation with distinguishing vertices by colour walks introduced in [13] is shown. We prove that $\chi'_D(G) \leq \Delta(G) + 1$ except for four small graphs C_4 , K_4 , C_6 and $K_{3,3}$. It follows that each connected Class 2 graph G admits a minimal proper edge-colouring, i.e., with $\chi'(G)$ colours, preserved only by the trivial automorphism.

Keywords: distinguishing index; distinguishing chromatic index; automorphism; symmetry breaking in graphs

Mathematics Subject Classifications: 05C25, 05C80, 03E10