Coloring Reconfiguration

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Abstract

Reconfiguration is the concept of moving between different states of a system by transforming one state into another using some prescribed transformation rule. Reconfiguration problems are often modeled using graphs. For a given reconfiguration problem, we define a *reconfiguration graph*, which reformulates the problem in the language of graph theory. Each vertex of the reconfiguration graph represents a valid state of the system (equivalently, solution to the problem), and two vertices are adjacent when one corresponding state is reconfigurable to the other by a single reconfiguration step (i.e. a single application of the transformation rule).

An α, β-*Kempe swap* in a properly colored graph interchanges the colors on some component of the subgraph induced by colors α and β. Two k-colorings of a graph are k-*Kempe equivalent* (or k-*equivalent*) if we can form one from the other by a sequence of Kempe swaps (never using more than k colors). We introduce the k-COLORING RECONFIGURATION problem, which asks whether two given (proper) k-colorings of a graph G are k-equivalent, and discuss our contribution(s) towards it.

Keywords: graph coloring, Kempe swap, Kempe equivalence.