# Local Brooks' Theorems

*Magnús M. Halldórsson*, Reykjavík University, 102 Reykjavík, Iceland

**Abstract**

A coloring of a graph is an assignment of discrete "colors" to the vertices so that adjacent vertices receive different colors. A theorem of Brooks states that every graph of maximum degree $\Delta$ that is neither a clique nor an odd cycle can be colored with $\Delta$ colors. Informally, we say that such a $\Delta$-coloring of an $n$-vertex graph is $t(n)$-*local* if the color assigned to a node $v$ does not depend on the colors assigned to nodes of distance more than $t(n)$ from $v$. Such local colorings correspond to the existence of efficient distributed algorithms to compute $\Delta$-colorings. We introduce past and present work on such local $\Delta$-colorings, and in particular sketch recent results on randomized distributed $\Delta$-coloring algorithms.

**Keywords:** graphs, vertex colorings, Brooks' theorem, distributed algorithms.