On $k$-Rainbow Colorings of Graphs

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Let $G$ be an edge-colored nontrivial connected graph, where adjacent edges may be colored the same. A path $P$ in $G$ is a rainbow path if no two edges of $P$ are colored the same. Rainbow paths have been studied extensively. We present a closely related concept. For an integer $k \geq 2$, a path $P$ in $G$ is a $k$-rainbow path if every subpath of $P$ having length $k$ or less is a rainbow path. An edge coloring of $G$ is a $k$-rainbow coloring if every pair of distinct vertices of $G$ are connected by a $k$-rainbow path in $G$. The minimum number of colors required for a $k$-rainbow coloring of $G$ is its $k$-rainbow connection number. We investigate $k$-rainbow colorings of several well-known classes of connected graphs and establish sharp upper bounds for the $k$-rainbow connection number of a graph in terms of the order of the graph. Other results on $k$-rainbow connection numbers are also presented. This is joint work with Zhenming Bi, Steve Devereaux and Ping Zhang.

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