

Fractional Colouring and Precolouring Extension of Graphs

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Suppose we are given a graph in which some vertices are already precoloured, and we want to extend this partial colouring to a colouring of the whole graph. Because of the precoloured vertices, we may need more colours than just the chromatic number. How many extra colours are needed under what conditions has been a well-studied question. We consider the same problem in the context of fractional colourings. One way to define fractional colourings is as follows. We are given an interval $[0, k)$ of real numbers, and we need to assign to each vertex a subset of $[0, k)$ of measure one so that adjacent vertices receive disjoint subsets. The fractional chromatic number is the minimum k for which this is possible. Again assume that certain vertices are already precoloured (i.e., are already assigned a subset of measure one). If we further assume some knowledge about the precoloured vertices (say they are far apart), what value of k is required to guarantee that we can always extend this partial colouring to a fractional colouring of the whole graph? The answer to this questions shows a surprising dependence on the fractional chromatic number of the graph under consideration. Joint work with Daniel Král, Martin Kupec, Jean-Sébastien Sereni and Jan Volec, and with Anshui Li and Tobias Müller.