

Sparsity from a game theoretic perspective

Hal Kierstead
Arizona State University

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Venue: Room 102, Shanghai Center for Mathematical Sciences

Abstract:

Nešetřil and Ossona de Mendez introduced the notion of graph classes *with bounded expansion* and the more general notion of *nowhere-dense* graph classes. These concepts generalize those of graph classes with bounded tree-width, minor-closed classes, bounded degree classes, etc. This classification is informative as many interesting properties of simple sparse classes are shared with more general classes, while results on the general classes can often be sharpened for simpler classes. Moreover, the Nešetřil-Ossona de Mendez formulation is remarkably robust; there are many apparently disparate notions that turn out to be equivalent.

In applications it is often useful to use characterizations due to Zhu of bounded-expansion or nowhere-dense classes in terms of the *generalized coloring numbers* $\text{scol}_r(G)$ of a graph G . These numbers had been introduced earlier by Yang and me to extend the classes of graphs known to have bounded generalized *game* coloring numbers. Zhu's result implies that these are exactly the classes with bounded expansion. For each distance r , the strong r -coloring number $\text{scol}_r(G)$ is determined by an "optimal" ordering of the vertices of G . We study



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the question of whether it is possible to find a single “uniform” ordering that is “good” for all distances r . We show that the answer to this question is essentially “yes”. Our results give new characterizations of bounded-expansion and nowhere-dense graph classes.

Much of this talk will be on joint work with Jan van den Heuvel, Department of Mathematics, London School of Economics and Political Science.