Tiling edge-coloured graphs with few monochromatic bounded-degree graphs

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Gerencsér and Gyárfás proved in 1967 that for any 2-colouring of the edges of K_n, it is possible to partition $V(K_n)$ into two monocromatic paths. This result, which has a straightforward proof, motivated many other challenging problems that has been extensively studied in the last years. For instance, an open conjecture of Erdős, Gyárfás and Pyber from 1991 states that for any r-colouring of the edges of K_n there are r monochromatic paths partitioning $V(K_n)$. We can also find in the literature other versions of the problem where instead of partitioning into paths, we are interested in partitioning into trees, cycles, or even power of cycles.

Grinshpun and Sárközy studied a more general version of the problem where they were interested in partitioning $V(K_n)$ into few monochromatic subgraphs which are copies of a given family of bounded degree graphs. They proved that for any family of graphs $\mathcal{F} = \{F_i \ : \ i \in \mathbb{N}\}$ such that $|F_i| = i$ and $\Delta(F_i) \leq D$, the following holds: for any 2-colouring of edges of K_n there is a partition of $V(K_n)$ into at most $2^{O(D \log D)}$ monochromatic subgraphs that are copies of graphs from $\mathcal{F}$. They conjectured that for any r-colouring of the edges of K_n, it is possible to partition $V(K_n)$ into 2^{D^C} monochromatic subgraphs that are copies of graphs from $\mathcal{F}$, where $C = C(r)$ is a constant that only depends on r. In this work, we present the first progress towards Grinshpun–Sárközy's conjecture by establishing a super-exponential bound.

This presentation is based in a joint work with Jan Corsten (LSE, UK).