Multipartite Ramsey numbers via strongly regular graphs

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Abstract

Let s, k be positive integers with $k \geq 2$ and $G_1, G_2, \ldots, G_k$ be simple graphs. The *set multipartite Ramsey number*, denoted by $M_s(G_1, G_2, \ldots, _G k)$, is the smallest positive integer c such that any k-coloring of the edges of $K_{c\times s}$ contains a monochromatic copy of G_i in color i for some $i \in \{1, 2, \ldots, k\}$. The *size multipartite Ramsey number*, denoted by $m_c(G1, G2, \ldots, G_k)$, is the smallest positive integer s such that any k-coloring of the edges of $K_{c\times s}$ contains a monochromatic copy of G_i in color i for some $i \in \{1, 2, \ldots, k\}$.

Parsons, in one of his reports in Mathematical Reviews, wrote that

> *Of all the results in Ramsey graph theory, the most intriguing are those which relate families of Ramsey numbers to other areas of mathematics, particularly algebra and combinatorial designs.*

In the case of multipartite Ramsey numbers, this was evidenced in the first result considered in the literature, where Beineke and Schwenk (1975) proved a lower bound for bipartite Ramsey numbers by utilizing Hadamard matrices. Later in 2019, Perondi and Carmelo investigated sharp bounds on set multipartite Ramsey numbers of particular complete bipartite graphs by establishing a novel construction based on Hadamard matrices and strongly regular graphs.

In this talk, I will survey results in multipartite Ramsey numbers connected to strongly regular graphs and present our generalization of Perondi and Carmelo's results.

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