

1047-05-71

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Chromatic Graphs, Ramsey Numbers, and the Flexible Atom Conjecture.

Let K_N denote the complete graph on N vertices with vertex set $V = V(K_N)$ and edge set $E = E(K_N)$. For $x, y \in V$, let xy denote the edge between the two vertices x and y . Let L be any finite set and $\mathcal{M} \subseteq L^3$. Let $c : E \rightarrow L$. Let $[n]$ denote the integer set $\{1, 2, \dots, n\}$.

Briefly, \mathcal{M} can be thought of as a set of colored triangles. Every triangle that is in \mathcal{M} is *mandatory* and every triangle that is not in \mathcal{M} is *forbidden*. We try to color the edges of K_N so that every colored triangle in \mathcal{M} appears (and no forbidden triangle appears) and so that if a color is part of a triangle in \mathcal{M} , then every edge with that color participates in that triangle.

We investigate for which sets of triangles there exist colorings which obey these conditions as well as connections to relation algebras. We discuss our proof of a special case of the flexible atom conjecture which states that every finite relation algebra with one flexible atom is representable on a finite set, continuing the work of Jipsen, Maddux, and Tuza in 1995. This represents a joint work with J. Alm and R. Maddux. (Received January 14, 2009)