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The correlation between f -chromatic class and g_c -chromatic class of a simple graph

An f -coloring, a g_c -coloring of graph G is an edge-coloring such that the edge-induced subgraph of each color is a $(0, f)$ -factor, (g, d) -factor, respectively.

Theorem 1. (S.L. Hakimi and O. Kariv, 1986) A simple graph G has either $\chi'_f(G) = \Delta_f(G)$ (f -class 1), or $\chi'_f(G) = \Delta_f(G) + 1$ (f -class 2), where $\Delta_f(G) = \max_{v \in V(G)} \{\lceil \frac{d(v)}{f(v)} \rceil\}$.

Theorem 2. (H. Song and G. Liu, 2005) A simple graph G has either $\chi'_{g_c}(G) = \delta_g(G)$ (g_c -class 1), or $\chi'_{g_c}(G) = \delta_g(G) - 1$ (g_c -class 2), where $\delta_g(G) = \min_{v \in V(G)} \{\lfloor \frac{d(v)}{g(v)} \rfloor\}$.

Problem. (G. Liu and X. Zhang) What kinds of simple graphs G have coincident classification results between f -coloring and g_c -coloring when $\{v : d(v) = \Delta_f(G)f(v)\} = \{v : d(v) = \delta_g(G)g(v)\}$?