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Principal specializations of the t-chromatic symmetric function

We introduce the t-chromatic symmetric function, a variant of Stanley's chromatic symmetric function in which the variable t records the number of distinct colors used in a proper coloring. Although this t-variant is equivalent to the classical chromatic symmetric function as a graph invariant, its principal specializations retain substantially more information.

Our construction is motivated by the work of Bajo–Beck–Vindas-Meléndez on the q-chromatic polynomial and the conjecture of Loehr–Warrington that the nth principal specialization of the chromatic symmetric function distinguishes trees on at most n vertices, both of which stem from Stanley's longstanding question of whether the classical chromatic symmetric function distinguishes trees. We prove that the third principal specialization of the t-chromatic symmetric function distinguishes caterpillars with three spine vertices as well as elongated bistars. We conjecture, based on computational data, that the fourth principal specialization distinguishes all caterpillars.

This is joint work with Aram Bingham, Kyle Celano, Rosa Orellana, Jianping Pan, and Mary Claire Simone.