

Garry Bowlin (Binghamton)

Maximum Frustration in Signed Complete Bipartite Graphs

Abstract for the Combinatorics Seminar 2009 February 9

The *frustration index* of a signed graph is the smallest number of edges whose sign reversal yields a balanced signed graph (i.e., where all cycles have positive sign product). In 1966, Petersdorf showed that the maximum frustration of a signed complete graph K_n is equal to $\lfloor (n-1)^2/4 \rfloor$, and it is achieved by the all-negative signing. This is the only interesting graph family for which the problem has been solved. Using convex geometry, I show that the maximum frustration for a signed $K_{l,r}$ is bounded above by

$$r \cdot \lfloor l/2 \rfloor \cdot \left[1 - 2^{-\lfloor l/2 \rfloor} \binom{l-1}{\lfloor l/2 \rfloor} \right]$$

and that this bound is achieved by a signing of $K_{l,2^{l-1}}$.

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Last update: **2020/01/29 19:03**

