1047-05-414 **Luis A Goddyn*** (goddyn@math.sfu.ca), Mathematics, Simon Fraser University, Burnaby, BC V5A 1S6, Canada. *The rank-chromatic number and the rank-flow number.* Preliminary report.

A new family of graph chromatic numbers and flow numbers arises as a restriction to graphs of a natural matrix optimization problem. For any graph G and positive integer k we define the *k-rank-flow number* of G to be

$$\phi_k(G) = \min_{\vec{G}} \max_{P} \frac{d(P)}{d^+(P)} \ \in \ \mathbb{Q} \cup \{\infty\}.$$

Here $\vec{G}$ ranges over the orientations of G, and P ranges over the ordered partitions $(V_0, V_1, \ldots, V_k)$ of $V(\vec{G})$ into $k+1$ parts. Also $d(P)$ is the number of arcs of $\vec{G}$ whose ends lie in distinct parts of P, and $d^+(V)$ is the number of those arcs, say uv with $u \in V_i$, $v \in V_j$, for which $i < j$.

Dually, we may define the *k-rank-chromatic number*, in terms of strong orientations P of all the subgraphs of G having Betti number k (details omitted).

Then $\phi_1(G)$ is just the circular flow index of G, and $\chi_1(G)$ is just the circular chromatic number of G. The *rank-chromatic sequence* $[\chi_1(G),\ \chi_2(G),\ \ldots,\ \chi_{n-1}(G)]$ carries significantly more information than the ordinary chromatic number does, and similary for the *rank-flow sequence*. I will describe the connection to geometry, and determine some values and bounds for these invariants. (Received February 02, 2009)