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**Mehtaab Sawhney\*** (msawhney@mit.edu), **Ashwin Sah**, **David Stoner** and **Yufei Zhao**. *A Reverse Sidorenko Inequality*.

We prove a number of tight graph homomorphism inequalities, where, for a fixed  $H$ , we wish to maximize the number of homomorphism from  $G$  to  $H$  (after exponentially normalizing by the size of  $G$ ) under certain degree constraints on  $G$  (e.g.,  $d$ -regular). A highlight of our results is that, among  $d$ -regular graphs of the same size, a disjoint complete bipartite graphs has the most number of proper  $q$ -colorings. Our results also extend to irregular graphs and list colorings. These results settle a number of conjectures by Kahn, Galvin-Tetali, Galvin, and Cohen-Csikvári-Perkins-Tetali. (Received September 16, 2019)