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Turan's theorem with colors

We consider a generalization of Turán's theorem for edge-colored graphs. Suppose that R (red) and B (blue) are graphs on the same vertex set of size n. We conjecture that if R and B each have more than $(1 - 1/k)n^2/2$ edges, and K is a $(k+1)$-clique whose edges are arbitrarily colored with red and blue, then $R \cup B$ contains a colored copy of K, for all $k + 1 \notin \{4, 6, 8\}$. If $k + 1 \in \{4, 6, 8\}$, then the same conclusion holds except for one specific edge-coloring of K_{k+1}.

We prove this conjecture for all 2-edge-colorings of K_{k+1} that contain a monochromatic K_k. This provides a new proof of Turán's theorem. We also prove the conjecture for $k + 1 \in \{3, 4, 5\}$.

This is joint work with Ajit Diwan.