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A rainbow version of Mantel's Theorem

One of the first results in extremal graph theory, Mantel's Theorem, asserts that a simple n vertex graph with more than $\frac{1}{4}n^2$ edges has a triangle (three mutually adjacent vertices), and this bound is best possible. Here we consider a colourful variant of the above. Let G_1, G_2, G_3 be three graphs on a common vertex set V and think of each graph as having edges of a distinct colour. Define a rainbow triangle to be three vertices $v_1, v_2, v_3 \in V$ so that $v_i v_{i+1} \in E(G_i)$ (where the indices are treated modulo 3). We will be interested in determining how many edges force the existence of a rainbow triangle. We prove that whenever $|E(G_i)| > (\frac{26-2\sqrt{7}}{81})n^2 \approx 0.2557n^2$ for $1 \leq i \leq 3$, then there exist a rainbow triangle. We provide an example to show this bound is best possible. This is a joint work with Ron Aharoni, Matt DeVos, Sebastian Gonzales and Robert Samal.