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A rainbow version of Mantel's Theorem

Let G_1, G_2, G_3 be simple graphs on a common vertex set and think of each graph as having edges of a distinct colour. A *rainbow triangle* has three vertices v_1, v_2, v_3 so that $v_i v_{i+1} \in E(G_i)$. We show that if $|E(G_i)| > (\frac{26-2\sqrt{7}}{81})n^2 \approx 0.2557n^2$ for $i = 1, 2, 3$, then there exists a rainbow triangle, thereby answering a question of Diwan and Mubayi. Our result is sharp in the sense that the multiplicative constant cannot be decreased.

This is joint work with R.Aharoni, M.DeVos, S.Gonzales and A.Montejano. We prove the result from first principles. An independent proof using flag algebra method was obtained by E.Culver, B.Lidický, F.Pfender, and J.Volec.