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Ky Fan's Lemma for Metric Spaces and an Approximation to the Goldbach's Problem

Given a metric space (X, d) and a subset $K \subseteq X$ we say K is d-convex if for every $x, y \in K$, the segment between them defined as

$$[x, y] := \{z \in X : d(x, y) = d(x, z) + d(z, y)\}$$

satisfy $[x, y] \subseteq K$. We generalize this notion to subsets where this condition is satisfied for a subset of segments that cover the subset. Then we show versions of a Ky Fan's Lemma on spaces with this property. As an application, we introduce an approximation to the Goldbach's problem.

Keywords: Metric space, d-convexity, Ky Fan's Lemma, Goldbach's problem.

MSC: 52A40; 11P32.