

Fractional Vertex Cover Reliability of Graphs

David Brown, Caitlynn Clawson, Aysel Erey, Rudy Garcia, Carter Green, Derek Hein, Samuel Powell*, Utah State University

Let G be a graph and let $0 \leq p, q$ and $p+q \leq 1$. Suppose that each vertex of G gets a weight of 1 with probability p , $1/2$ with probability q and 0 with probability $1 - p - q$, and vertex weight probabilities are independent. The *fractional vertex cover reliability* of G , denoted by $\text{FRel}(G; p, q)$, is the probability that the sum of weights at the end-vertices of every edge in G is at least 1. In this talk, we determine the graphs which maximize $\text{FRel}(G; p, q)$ for all values of p and q in the classes of trees, connected unicyclic, and bicyclic graphs with fixed order, and determine the graphs which minimize it in the classes of trees, and connected unicyclic graphs with fixed order. Our results on optimal graphs extend some known results in the literature about independent sets.

Keywords: reliability, vertex cover, fractional graph theory, optimal graphs