

COMBINATORICS
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Extremal problems on diameter-critical graphs

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Abstract: A graph is called diameter- k -critical if its diameter is k , and the removal of any edge strictly increases the diameter. In this talk, we will present several results related to a conjecture often attributed to Murty and Simon, regarding the maximum number of edges that any diameter- k -critical graph can have. In particular, we disprove a longstanding conjecture of Caccetta and Häggkvist (that in every diameter-2-critical graph, the average edge-degree is at most the number of vertices), which promised to completely solve the extremal problem for diameter-2-critical graphs. On the other hand, we prove that the same claim holds for all higher diameters, and is asymptotically tight, resolving the average edge-degree question in all cases except diameter-2. We also apply our techniques to prove several bounds for the original extremal question, including the correct asymptotic bound for diameter- k -critical graphs, and an upper bound of $(\frac{1}{6} + o(1))n^2$ for the number of edges in a diameter-3-critical graph. This is a joint work with Po-Shen Loh.

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