

Extremal problems in Eulerian digraphs

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Graphs and digraphs behave quite differently, and many classical results for graphs are often trivially false when extended to general digraphs. Therefore it is usually necessary to restrict to a smaller family of digraphs to obtain meaningful results. One such very natural family is Eulerian digraphs, in which the in-degree equals out-degree at every vertex.

In this talk, we discuss several natural parameters for Eulerian digraphs and study their connections. In particular, we show that for any Eulerian digraph G with n vertices and m arcs, the minimum feedback arc set (the smallest set of arcs whose removal makes G acyclic) has size at least $m^2/2n^2 + m/2n$, and this bound is tight. Using this result, we show how to find subgraphs of high minimum degrees, and also long cycles in Eulerian digraphs. These results were motivated by a conjecture of Bollobás and Scott.

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