# On the regularity of a graph related to conjugacy classes of groups

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**Abstract**

A well-established research area in finite group theory consists in exploring the interplay between the structure of a (finite) group $G$ and certain sets of positive integers, which are naturally associated to $G$. One of those sets, denoted by $\mathrm{cs}(G)$, is the set of conjugacy class sizes of $G$.

In order to have a better understanding of the arithmetical structure of $\mathrm{cs}(G)$, it is useful to introduce the *common divisor graph* $\Gamma(G)$, whose vertex set is $\mathrm{cs}(G) \setminus \{1\}$, and two vertices are adjacent if and only if they are not coprime numbers. Several authors studied several properties concerning this graph.

We are interested in studying the regularity of $\Gamma(G)$ and we conjecture that, for every integer $k \geq 1$, the graph $\Gamma(G)$ cannot be regular unless it is a complete graph with $k+1$ vertices: in this poster we outline the fact that the conjecture is true for $k \leq 4$.

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