Some properties of the conjugacy class sizes of a finite group
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Let $G$ be a finite group and $\text{cs}(G)$ the set consisting of the sizes of the conjugacy classes of $G$. Addressing the question of the relations between the set $\text{cs}(G)$ and the structure of the group $G$, I will first review some classical as well as some more recent results. Next, I will talk about a graph related to the set $\text{cs}(G)$. The prime graph on class sizes $\Delta(G)$ is defined as the simple undirected graph having the primes that divide some $n \in \text{cs}(G)$ as vertices, and as edges the pairs of distinct primes $\{p, q\}$ such that the product $pq$ divides some $n \in \text{cs}(G)$. I will discuss a few properties of the graph $\Delta(G)$ and, in particular, the existence of some large complete subgraphs. Finally, I will mention the connections with a similar graph related to the degrees of the irreducible characters of a finite group.