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On Isomorphisms of Finite Cayley Graphs

For a finite group G and a self-inverse subset $S \subset G \setminus \{1\}$, the associated *Cayley graph* is the graph $\mathrm{Cay}(G,S)$ with vertex set G and with x adjacent to y iff $yx^{-1} \in S$. Clearly each $\sigma \in \mathrm{Aut}(G)$ induces an isomorphism from $\mathrm{Cay}(G,S)$ to $\mathrm{Cay}(G,S^\sigma)$. A group G is called a *CI-group* if, for all $S, T \subset G$, $\mathrm{Cay}(G,S) \cong \mathrm{Cay}(G,T)$ iff $S^\sigma = T$ for some $\sigma \in \mathrm{Aut}(G)$. The problem of seeking finite CI-groups is a long-standing open problem in the area of Cayley graphs. Here we show that a CI-group G has form $G = U \times V$, where $(|U|,|V|) = 1$, U is abelian with all Sylow subgroups elementary abelian, and V belongs to an explicitly determined list of groups. Then we discuss the problem of completely classifying finite CI-groups.