Abstract

The graph isomorphism (GI) problem has plagued mathematicians and theoretical computer scientists for decades. The statement of the problem is simple: given any two graphs $G$ and $G'$, is $G$ isomorphic to $G'$? However, no algorithm (currently) exists that can answer this question in $O(p(n))$ (polynomial time) for *any* two graphs, where $n$ is the number of vertices in each graph. Babai presented an approach to GI that solves the problem in $\exp\left((\log n)^{\mathcal{O}(1)}\right)$ *Babai* [2016, 2018]. This bound is called *quasipolynomial* time; it is the best known bound for solving the graph isomorphism problem for any two graphs.

Babai's 2016 manuscript is a difficult read for many, even for those who have a graph theory or algebra background. Much of the machinery the *Babai* [2016] paper used was either developed specifically for solving GI over the last forty years or novel to that paper, which means understanding Babai's quasipolynomial result starts with specialized results from the 1980s, in particular, *Luks* [1982]. Therefore, the goal of this project is to give a rigorous introduction to Babai's quasipolynomial result, including an overview of motivating ideas and useful prerequisite knowledge. No graph theory knowledge is required, but general knowledge of mathematics at the graduate level is assumed.

References

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