Groverize Monotone Local Search.
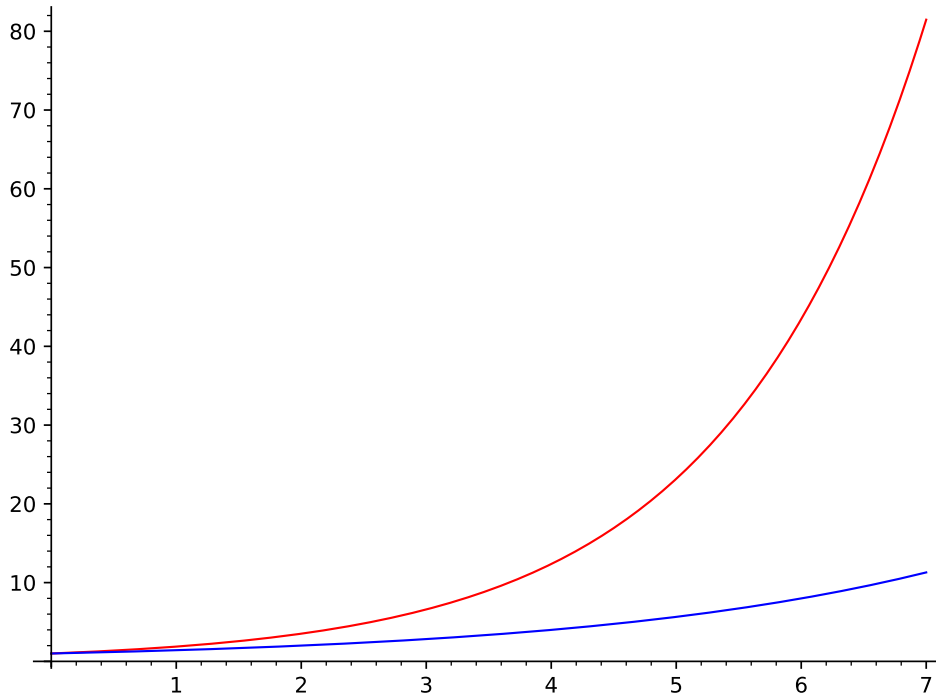
David Ponarovsky

April 24, 2023

1 Introduction.

We follow the study of [Fom+15], who relate between the parametrized complexity to the general average case complexity. Crudely put, they shown that for particular wide range of NP hard problems, a solution which run exponentially at some complexity parameter, for example the tree-width of a graph, can be used to derive a batter than bruteforce solution for the general problem. We continue their work by plugin the Grover search [Gro96] routine instead the original sampling process.

$$\sum_{k'\leq k}\frac{1}{\sqrt{p(k')}}\cdot c^{k'-t}N^{\mathcal{O}(1)} \leq \max_{k'\leq k}\left(\frac{\binom{n-|X|}{t}}{\binom{k'}{t}}\right)^{\frac{1}{2}}\cdot c^{k'-t}N^{\mathcal{O}(1)} =$$

$$\left(\max_{k'\leq k}\frac{\binom{n-|X|}{t}}{\binom{k'}{t}}\cdot c^{2\left(k'-t\right)}\right)^{\frac{1}{2}}N^{\mathcal{O}(1)} = \left(\max_{k\leq n-|X|}\frac{\binom{n-|X|}{t}}{\binom{k}{t}}\right)^{\frac{1}{2}}\cdot c^{2(k-t)}N^{\mathcal{O}(1)} \leq$$

$$\Rightarrow \left(2-\frac{1}{c^2}\right)^{\frac{n-|X|}{2}}N^{\mathcal{O}(1)}$$

References

[Gro96]   Lov K. Grover. *A fast quantum mechanical algorithm for database search*. 1996. arXiv: quant-ph/9605043 [quant-ph].

[Fom+15]   Fedor V. Fomin et al. *Exact Algorithms via Monotone Local Search*. 2015. arXiv: 1512.01621 [cs.DS].