6th Milestone Report for 15-400, Spring 2017

Apoorva Bhagwat

Major Changes :

There have been no major changes.

Accomplishments So Far :

1. As a stepping stone to the main problem, I was exploring the following problem (fractional clustering) : given a graph $G = (V, E)$ and a natural number k, find a set $S \subseteq V$ such that $|S| = k$, and each $v \in S$ has at least $\alpha|S|$ neighbors in S. This problem is a relaxation of clique, and turns out that it hasn't been studied before (at least as far as we can tell). It is NP-hard nevertheless. Prof Venkat Guruswami gave me a proof of the case $\alpha = 3/4$, and I have been working on generalizing it to any constant fraction.

2. This reduction seems to generalize even to some sub-constant values. I'm currently verifying this. It would be interesting to see if the reduction can be modified to work when we also introduce an external sparsity parameter β, such that α and β are both subconstant. The Balcan et al algorithm solves the constant α, β case in quasi-polynomial time, so we can't hope to prove NP-hardness there.

Meeting The Milestone :

I didn't quite meet the milestone as stated, but we have the hardness result for fractional clustering. In the remaining time, I will be working on cleaning up and writing up the NP-hardness result.

Surprises :

None.

Resources Needed :

I haven't felt the need for any more non-trivial resources so far.