

Lecture 4: Lower Bounds for Cycle Finding and Approximations

Instructor: *Or Zamir***Homework Questions**

1. A *Distance Oracle* with stretch k is a data structure that preprocesses a graph, and then supports queries of the form “What is the distance between u and v ?” with an answer that is between the real distance between these vertices in the preprocessed graph to k times that distance. Prove that assuming fine-grained conjectures learned in class, there can be no stretch k distance oracle with $m^{1+\frac{1}{100k}}$ preprocessing time and $m^{\frac{1}{100k}}$ query time.
2. In class we only showed how decrease the amount of cycles of size 4 to be $n^{1.99}$. Generalize the proof for C_k for any fixed constant k .