CS 6505 - Homework 11

Caitlin Beecham

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We reduce CLIQUE to the bowtie problem. We wish to solve CLIQUE on a graph G using BOWTIE. From G, construct a series of graphs G_i as follows. The graph G_i is the graph obtained by making two copies of G and adding an edge between v_i and u_i where u_i is v_i's copy in the second copy of G. The cost of copying G is $O(n^2)$ (We make a new 2n by 2n adjacency matrix and copy the corresponding entries into the right places), then we add the edge u_iv_i in $O(1)$ time. Constructing all the G_i's takes $O(n^3)$ time. Now, for each G_i, we run BOWTIE, if ever BOWTIE returns Yes, we return Yes for Clique (using the same integer g for both). Otherwise, if we iterate through all G_i's without returning Yes, we return No. The overall runtime of this algorithm is $O(n^3 + n * T(2n, g))$ where $T(2n, g)$ is the runtime of BOWTIE on a graph with 2n vertices looking for a bowtie of size 2g.