1. According to Piazza post [@1180](https://piazza.com/class/jzqwd6s59yh6bm?cid=1180), this means we have to prove , there existsa weighted vertex cover problem whose linear programming solution , where is the optimal (minimum) weight. We can break this problem down into 2 cases:

We want to show . We proved in lecture that , where is a vector of real numbers between and returned by the algorithm. . QED.

Let . Then . Let’s consider a graph with vertices. Let there be an edge between every pair of vertices in . Let the weight for each vertex. It’s obvious then that the optimal weighted vertex cover is any vertices (a vertex cover of a graph is the complement of an independent set in the graph, and all possible independent sets of such a graph as we described have cardinality of because every pair of vertices is connected by an edge). The optimal linear programming solution has for every vertex, and so (it’s impossible for to be less than because then the average would be less than , and that cannot satisfy the constraint .