Homework 6

CS 331H

Due Wednesday, March 1

1. See the Jupyter notebook on the website.

2. Word ladders is a game invented by Lewis Carroll in 1877. In this game, one receives a start word (e.g., SHORT) and an end word (e.g., PATHS), and would like to find a sequence of intermediate words that transform the start word into the end word, one letter at a time, such that every intermediate step is an actual word. At each step, a single letter is changed (but not added or removed). For example:

   $$\text{SHORT} \to \text{SHORE} \to \text{SHARE} \to \text{SCARE} \to \text{SCARS} \to \text{SEARS} \to \text{SEALS} \to \text{SELLS} \to \text{WELLS} \to \text{WALLS} \to \text{WALES} \to \text{MALES} \to \text{MATES} \to \text{MATHS} \to \text{PATHS}$$

   is a valid word ladder.

   Suppose you are given a dictionary (i.e., a list of all n valid words), a start word s and a final word t, and that s and t both have length k. You would like to find the shortest valid word ladder from s to t.

   (a) Show how to reduce this problem to shortest paths on an undirected unweighted graph with at most nk edges.

   (**Hint (rot-13)**: Pbafvqre ercynpvat bar punenpgre ol "?", sbe rknzcyr F?BER.)

   (b) What running time can you get for finding the shortest word ladder?