Exercise 8-1 Edit Distance
Compute the edit distance between the words CLASSIFICATION and CLUSTERING.

Exercise 8-2 Manhattan Distance and Edit Distance
Given an alphabet \( A = \{a_1, \ldots, a_n\} \), the histogram of a sequence \( S = (s_1, \ldots, s_l) \) is defined as \( H(S) = (h_1(S), \ldots, h_n(S)) \) with \( h_k(S) = |\{s_i|i \in \{1, \ldots, l\}, s_i = a_k\}| \)

Given two sequences \( S = (s_1, \ldots, s_l) \) and \( T = (t_1, \ldots, t_r) \), prove or disprove:
(a) The Manhattan Distance \( L_1(H(S), H(T)) \) is a lower bound for the Edit Distance \( D_{edit}(S, T) \).
(b) The modified Manhattan Distance
\[
D(H(S), H(T)) = \sum_{i=1}^{n} \begin{cases} 
    h_i(S) - h_i(T), & \text{if } h_i(S) > h_i(T) \\
    0, & \text{else}
\end{cases}
\]
is a lower bound for the Edit Distance \( D_{edit}(S, T) \).

Exercise 8-3 Normalized Time Series
(a) For a given time series \( X = (3, 5, 10, 4, 1, 7, 7, 9, 1, 3) \), compute the z-score normalization \( \hat{X} \) of \( X \).
(b) Prove or disprove the following statement for a z-score normalized time series \( \hat{X} = (\hat{x}_1, \ldots, \hat{x}_n) \):
\[
\sum_{i=1}^{n} \hat{x}_i = 0
\]
(c) Prove or disprove the following statement for a z-score normalized time series \( \hat{X} = (\hat{x}_1, \ldots, \hat{x}_n) \):
\[
\sum_{i=1}^{n} \hat{x}_i^2 = n
\]

Exercise 8-4 Uniform and Dynamic Time Warping
Given the following two time series:
\( X = (3, 5, 9, 2, 3, 6, 3) \) and \( Y = (3, 4, 6, 10, 1, 3, 2, 7, 4) \), compute the following distances:
(a) Uniform Time Warping Distance $D_{UTW}^2$

(b) Dynamic Time Warping $DTW^2$

(c) k-Dynamic Time Warping Distance $D_{k-DTW}^2$ where $k = 3$ (Optional)

Visualize the optimal alignment between the time series.