Homework 1

The goal of this homework is to examine the topics related to pairwise sequence alignment and dynamic programming.

Problem 1. Pairwise Sequence Alignment (10)

When performing pairwise sequence alignment, assume a match score of 1, a gap penalty of 3 and a mismatch score of -1. Find the global optimal alignment of two sequences: AGATT and AGTT.

(a) Write down the recursive function of this dynamic programming problem.

(b) Fill in the dynamic programming table which stores the alignment scores of any subsequence alignment. Use the back pointers to the entry/entries that lead to the maximal score for any entry.

(c) Show the trace-back path/paths to obtain an optimal alignment. If there are multiple solutions, show all of them along with their trace-back paths.

Problem 2. Dynamic Programming Practice (10)

The longest increasing subsequence problem for a set of numbers is to find a subsequence of a given set of numbers, in which elements are in sorted order, from lowest to highest. The subsequence of numbers is not necessarily contiguous. For example, in sequence (9, 5, 8, 7, 15), the longest increasing subsequence is (5, 8, 15).

Provide a dynamic programing algorithm to find the longest subsequence for a sequence of integers. Assume that all integers are unique.