

Exercise Sheet 8 for Algorithms of Bioinformatics (Winter 2025/26)

Hand In: Until 2025-12-12 18:00, on ILIAS.

Problem 1

20 points

Construct the Aho-Corasick automaton for

$$P[0..p) = [\text{aaa}, \text{abaaabbab}, \text{abab}, \text{abababab}, \text{bab}] .$$

Problem 2

50 points

Suppose that you are given a dictionary S_1, \dots, S_d of strings within $\{0, 1\}^*$, with the total length of the dictionary being $D = |S_1| + \dots + |S_d|$. You are also given a string S , of length N . In this question, we wish to compute a modified type of alignment between S and the dictionary S_1, \dots, S_d . More precisely, we must write S as a concatenation of dictionary strings as well as extra 0s and 1s, minimizing the number of added 0s and 1s.

For example, if $S_1 = 000, S_2 = 101$ and $S = 000010101$, then a solution is $S = S_1 0 S_2 01$, which has cost 3 due to the inserted 0 and 01. This is optimal as well: one cannot use either 000 nor 101 more than once, and we have in fact done this.

Design an algorithm to find an optimal such alignment. For full credit, your algorithm should use $O(N \min(d, \sqrt{D}))$ time; $O(N\sqrt{D})$ time or $O(ND)$ time will give partial credit.