9th Homework

Prof. Helmut Alt

Introduction to Algorithms

Due: May 15, 2017, 10 a.m.

Exercise 1

11 points

(a) Consider the brute-force algorithm for string-matching on an alphabet Σ of size d. Assume a random text $T \in \Sigma^*$ of length n where each character occurs in each position with the same probability $1/d$. Let $P \in \Sigma^*$ be the pattern searched for of length m. Analyze exactly the expected number of comparisons between characters in terms of d, n, and m.

(b) Implement the brute-force algorithm for string matching, where for a given pattern all positions in the text shall be returned where it occurs (position of its first character). Experiment with sufficiently large real texts to determine empirically the dependance of the rumtime from the sizes m of the pattern and n of the text. Is the analysis from part (a) confirmed (although the text is not really random)?

E.g., use the text in

`http://www.gutenberg.org/files/2701/2701-0.txt`.

Exercise 2

9 points

In *two-dimensional pattern recognition* an $n \times n$-array T and an $m \times m$-array P of characters of an alphabet Σ are given and the task is to find all occurrences of P in T.

(a) Design and anlyze a brute-force algorithm.

(b) How would you modify the Rabin-Karp-algorithm to solve this problem? Analyze the rumtime in the worst case.