Exercise 1: Knuth-Morris-Pratt Algorithm

Consider the pattern $P = BBABAB$ and the text $T = ABBABBABABBABABBA$.

(a) Compute the array $S$ of the Knuth-Morris-Pratt algorithm.

(b) Use the Knuth-Morris-Pratt algorithm to find all appearances of $P$ in $T$. Document the steps analogously to the lecture.

Exercise 2: Rabin-Karp Algorithm

Let $T$ be a given text of length $n$ and let $P_1, \ldots, P_k$ be $k$ patterns, each of length exactly $m$. The goal is to know if there is at least one pattern in the text, that is, we want to answer True if there exists at least one index $i \in \{1, \ldots, k\}$ such that $P_i \in T$, and answer False if for any $i \in \{1, \ldots, k\}$, $P_i \notin T$. It is easy to solve this problem in $O(k(n + m))$ by running the Rabin-Karp algorithm once for each pattern. Give an algorithm (based on Rabin-Karp) that requires only $O(n + km)$. 