Algorithms 2
Exercise 8

1. **Dictionary Matching** Consider the problem of finding the occurrences of any of a given set of $k$ patterns $P_1, \cdots, P_k$ in a text $T$. You may assume that the size of any pattern is $m$, and the size of $T$ is $n$.

   (a) Describe a method based on the KMP algorithm to solve this problem. What is the running time of this method?

   (b) Describe a method based on the Rabin-Karp algorithm to solve this problem. What is the (expected) running time of this method? Note that the algorithm should not return any false positives. Also, you may assume that the prime $q$ is at least $m$.

   (c) How would the previous answer change, if at all, given that the patterns all have different lengths?

2. **2D Matching** Consider the problem of finding the occurrences of a two-dimensional pattern $P$ of size $m \times m$, in a two dimensional text $T$ of size $n \times n$. Formally, we say $P$ occurs at location $(i, j)$ in $T$ if $\forall 1 \leq k \leq m, \forall 1 \leq \ell \leq m, p_{k,\ell} = t_{i+k-1,j+\ell-1}$.

   (a) Describe a method based on the KMP algorithm to solve this problem. What is the running time of this method?

   (b) Describe a method based on the Rabin-Karp algorithm to solve this problem. What is the (expected) running time of this method? (Previous notes apply, but may be adapted to this problem.)