Exercise 1 (10 points)
Consider the tree $T_i$ which is constructed in the $i$-th step of McCreight’s algorithm. Proof that

a) All nodes with the only possible exception of the node corresponding to the locus of $head_i(t)$ have a valid suffix link.

b) In step $i$, the algorithm visits the contracted locus of $head_i(t)$ in $T_{i-1}$.

Exercise 2 (10 points)
Compare Ukkonen’s and McCreight’s algorithm for suffix tree construction. Describe the basic idea of both algorithms. Are there similarities between the algorithms? Where are the differences?

Exercise 3 (10 points)
Let $s, t \in \Sigma^*$ and $|s| = |t| = n$. Show that the number of all possible different alignments of $s$ and $t$ is exponential in the length of the sequences. To achieve this, you can proceed as follows.

a) Show that $\binom{2n}{n}$ is a lower bound for the total number of alignments.

b) Use Stirling’s formula ($n! \approx \sqrt{2\pi n} \cdot n^n \cdot e^{-n}$ as $n \to \infty$) to show that this number grows exponentially in $n$.

Exercise 4 (10 points)
Consider the method of Amir et al. for Approximate Text Indexing With One Error. Why is it necessary to modify the algorithm if exact matches exist?