Aufgabe 5.1. [Minimization] (10 points)
Consider the deterministic tree automaton with $F = T/2, 0/0, Suc/1, Nil/0, Cons/2$, $Q = \{z, nz, e, ne, t, tz\}$, $Q_f = \{t, tz\}$, and the rules:

\[
\begin{align*}
0 & \rightarrow z & Suc(z) & \rightarrow nz & Suc(nz) & \rightarrow nz \\
Nil & \rightarrow e & Cons(tz, e) & \rightarrow ne & Cons(t, e) & \rightarrow ne & Cons(tz, ne) & \rightarrow ne & Cons(t, ne) & \rightarrow ne \\
T(z, e) & \rightarrow tz & T(nz, e) & \rightarrow t & T(z, ne) & \rightarrow t & T(nz, ne) & \rightarrow t
\end{align*}
\]

1. What, intuitively, is the language of this automaton?

2. Complete the tree automaton, without changing its language. Specify the completed automaton.

3. Perform the minimization algorithm. Document, for each iteration, the current relation $P$, and the reason why you did not include some pair of states into $P$ (or, equivalently, why you split an equivalence class).

Aufgabe 5.2. [Ground Instances] (10 points)

1. (TATA Ex. 1.9) Let $t \in T(F, X)$ be a linear term. Prove that the set of ground instances of $t$ is regular.

2. Does this also hold for non-linear terms? Proof or counterexample.

Note: An instance of a term is obtained by substituting its variables by terms. A ground instance is an instance that contains no variables.