In order to be admitted to the exam, you have to successfully submit your homework every week, except for 2 weeks. A successful submission is one where you get at least 1 point.

**Handin**  Please submit this homework until Thursday, January 31, either via email to Philipp Schuster (philipp.schuster@uni-tuebingen.de) before 12:00, or on paper at the beginning of the lab.

**Groups**  You can work in groups of up to 2 people. Please include the names and Matrikelnummern of all group members in your submission.

**Points**  For each of the Tasks you get between 0 and 2 points for a total of 6 points. You get:
- 1 point, if your submission shows that you tried to solve the task.
- 2 points, if your submission is mostly correct.

**Task 1: Infinite streams**

Consider the type \( \exists S, \{ \text{seed} : S, \text{step} : S \to \{ \text{Nat}, S \} \} \) as the type of infinite streams of natural numbers. Define a term that given two streams of natural numbers returns a stream of pairs of natural numbers by zipping the two streams pointwise. The term should have type:

\[
\exists S, \{ \text{seed} : S, \text{step} : S \to \{ \text{Nat}, S \} \} \to \exists S, \{ \text{seed} : S, \text{step} : S \to \{ \{ \text{Nat}, \text{Nat} \}, S \} \}
\]

**Task 2: Derivation tree with existential types**

Show that your term from Task 1 indeed has the required type by drawing a derivation tree.

**Task 3: Universal quantification in terms of existential quantification**

In classical logic we have that \( \forall x. A \iff \neg \exists x. \neg A \). Which problem do you encounter when you try to remove all universal quantification from a program by replacing it by existential quantification exploiting this equivalence?