universität innsbruck

Program Verification	SS 2023	LVA 703083+703084
Sheet 6		Deadline: May 3, 2023, 10am

- Prepare your solutions on paper.
- Mark the exercises in OLAT before the deadline.
- Upload your Haskell files in OLAT.
- Marking an exercise means that a significant part of that exercise has been treated.

Exercise 1 *Processing Function Definitions* **13 p.**

Slide 4/21 contains a Haskell function to process data definitions. The task of this exercise is to implement a similar function for checking and processing function definitions w.r.t. slide 3/15.

1. Implement a Haskell function `linear :: Term -> Bool` which decides whether a term is linear or not, cf. slide 3/14. (2 points)
2. Implement a Haskell function

```
checkEquation ::
  SigList ->        -- defined symbols, including f
  SigList ->        -- constructors
  FSym ->           -- f
  FSymInfo ->       -- type of f
  (Term, Term) ->   -- equation (l,r)
  Check ()
```

   that checks whether a single equation satisfies the conditions that are mentioned on slide 3/15. Of course, you should use the provided functions for type-checking, type-inference, etc., as much as possible. (4 points)
3. Implement the Haskell function `processFunctionDefinition` mentioned on Slide 4/23. (3 points)
4. Integrate a check on pattern disjointness into your implementation. In the case that pattern disjointness is violated, the error message should contain a *ground* term which shows the overlap. (4 points)

Once you have completed your implementation, you can test it via `test`, which processes some example program, which should be accepted.
By manually inserting errors into the example program, you can run `test` again, to see whether these errors are detected by your implementation.

Exercise 2 *Correctness of Implementation of Unification* **7 p.**

Study the proof given on slides 4/36–37.

1. Perform the proof of case 3, i.e., where the arguments are $(f(ts), x) : u$ and v. (3 points)
2. Design a proof for the case where in the Haskell algorithm (eliminate) is applied, but where the variable x does *not* occur in the remaining unification problem. (4 points)