Programming Paradigms 2022
Session 13 : Reasoning about programs

Preparing for the session

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Where nothing else is mentioned, chapters and page numbers refer to *Programming in Haskell*.

The video podcast

You can watch the podcast on YouTube via the course page on Moodle.

Tuesday 6 December 2022 – Reasoning about programs

Please read

- Chapter 16 of *Programming in Haskell*.

Learning goals for the session

- To be able to use induction on the natural numbers to reason about Haskell programs
- To be able to use induction on lists to reason about Haskell programs
- To be able to use induction to prove properties of functors and other structures

How you should prepare before we meet on Tuesday

Before we meet, watch the podcast and read the text. You can do this in any order you like. Also see if you can solve the following two small discussion problems. We will talk about them in class.

1. Prove by induction on lists that

   $$\text{length } (\text{xs } +\!+ \text{ ys}) = \text{length xs} + \text{length ys}$$

   for all lists xs and ys.

2. On page 240 we see the definition of the flatten function. Define the function

   ```
   bingo :: Tree -> Integer
   ```

   by

   ```
   bingo (Leaf n) = 1
   bingo (Node l r) = bingo l + bingo r
   ```

   and explain what it computes. Prove by induction on trees that

   $$\text{length } (\text{flatten t}) = \text{bingo t}$$

What happens on Tuesday?

When we meet, students that have been contacted by me who will present the solutions to the small discussion problems above.

Problems for Tuesday

For the plenary session we will solve and discuss a collection of problems that can be found on a separate page, available on the day of the session.