

# Homework 1

September 5, 2014

## Exercise 1

THEOREM 3.3.4 is about the principle of structural induction on arithmetic expressions. On p 31 there is the general principle and on p 32 the three first cases are written out. Write out the remaining cases!

## Exercise 2

Suppose we want to change the evaluation strategy of our language so that the then and the else branches of an if expression are evaluated (in that order) before the guard is evaluated. Show how the evaluation rules need to change to achieve this effect (Exercise 3.5.18).

## Exercise 3

We can define the reflexive, transitive closure of  $\rightarrow$  by the rules

$$\frac{}{t \rightarrow^* t} \qquad \frac{t \rightarrow t_1 \quad t_1 \rightarrow^* t'}{t \rightarrow^* t'}$$

We also can define

$$\frac{}{t \Rightarrow t} \qquad \frac{t \Rightarrow t_1 \quad t_1 \Rightarrow t'}{t \Rightarrow t'} \qquad \frac{t \rightarrow t'}{t \Rightarrow t'}$$

Show that we have  $t \rightarrow^* t'$  if, and only if,  $t \Rightarrow t'$ . You should use the proof technique of induction by derivation described page 37.