

# 1 Tutorial

## 1.1 Syntax

$$\begin{aligned}
 \text{Expr} ::= & \text{Num} \mid \\
 & \text{Bool} \mid \\
 & \Delta \text{Expr} \mid \\
 & \text{Expr} \odot \text{Expr} \mid \\
 & \text{Expr} \leq \text{Expr} \mid \\
 & \text{Expr} \text{ nand } \text{Expr} \mid \\
 & \text{if } \text{Expr} \text{ then } \text{Expr} \text{ else } \text{Expr},
 \end{aligned} \tag{1}$$

where  $\text{Num}$  is a predefined set of integer numbers (a.k.a.  $\mathbb{Z}$ ) and  $\text{Bool}$  is a predefined set of boolean values.

## 1.2 Typing

Convention:  $e, e', e'', \dots \in \text{Expr}$ ,  $b, b' \in \text{Bool}$  and  $n, n' \in \text{Num}$ .

$$\frac{}{n : \text{Number}} \tag{2}$$

$$\frac{}{b : \text{Boolean}} \tag{3}$$

$$\frac{e : \text{Number}}{\Delta e : \text{Number}} \tag{4}$$

$$\frac{e : \text{Number} \quad e' : \text{Number}}{e \odot e' : \text{Number}} \tag{5}$$

$$\frac{e : \text{Number} \quad e' : \text{Number}}{e \leq e' : \text{Boolean}} \tag{6}$$

$$\frac{e : \text{Boolean} \quad e' : \text{Boolean}}{e \text{ nand } e' : \text{Boolean}} \tag{7}$$

$$\frac{e : \text{Boolean} \quad e' : \text{Number} \quad e'' : \text{Number}}{\text{if } e \text{ then } e' \text{ else } e'' : \text{Number}} \tag{8}$$

$$\frac{e : \text{Boolean} \quad e' : \text{Boolean} \quad e'' : \text{Boolean}}{\text{if } e \text{ then } e' \text{ else } e'' : \text{Boolean}} \tag{9}$$