

Typing rules for $L23_{x\Gamma\lambda\beta}$

$$\overline{\Gamma \vdash n : \mathbf{Nat}} \quad \overline{\Gamma \vdash \mathbf{T} : \mathbf{Bool}} \quad \overline{\Gamma \vdash \mathbf{F} : \mathbf{Bool}} \quad \overline{\Gamma \vdash () : \mathbf{Unit}}$$

$$\frac{\Gamma \vdash t_1 : \mathbf{Nat} \quad \Gamma \vdash \mathbf{Nat}}{\Gamma \vdash [t_1 + t_2] : \mathbf{Nat}} \quad \text{Likewise the other arithmetic operators.}$$

$$\frac{\Gamma \vdash t_1 : \mathbf{Nat} \quad \Gamma \vdash t_2 : \mathbf{Nat}}{\Gamma \vdash [t_1 < t_2] : \mathbf{Bool}} \quad \text{Likewise the other relational operators.}$$

$$\frac{\Gamma \vdash t_1 : \mathbf{Bool}}{\Gamma \vdash !t_1 : \mathbf{Bool}} \quad \frac{\Gamma \vdash t_1 : \mathbf{Bool} \quad \Gamma \vdash t_2 : \mathbf{Bool}}{\Gamma \vdash [t_1 \&\& t_2] : \mathbf{Bool}} \quad \text{Or and Xor are like And.}$$

$$\frac{\Gamma \vdash t_1 : \mathbf{Bool} \quad \Gamma \vdash t_2 : \tau_2 \quad \Gamma \vdash t_3 : \tau_2}{\Gamma \vdash [t_1 ? t_2 : t_3] : \tau_2} \quad \frac{\Gamma \vdash t_1 : \tau_1 \quad \Gamma \vdash t_2 : \tau_1}{\Gamma \vdash [t_1 == t_2] : \mathbf{Bool}}$$

$$\frac{\Gamma \vdash t_1 : \tau_1 \quad \Gamma \vdash t_2 : \tau_2}{\Gamma \vdash (t_1, t_2) : \tau_1 \times \tau_2} \quad \frac{\Gamma \vdash t_1 : \tau_1 \times \tau_2}{\Gamma \vdash 1\#t_1 : \tau_1} \quad \frac{\Gamma \vdash t_1 : \tau_1 \times \tau_2}{\Gamma \vdash 2\#t_1 : \tau_2}$$

$$\frac{\Gamma(x) = \tau_1}{\Gamma \vdash x : \tau_1} \quad \frac{\Gamma \vdash t_1 : \tau_1 \quad \Gamma, x : \tau_1 \vdash t_2 : \tau_2}{\Gamma \vdash \{x \ t_1 \ t_2\} : \tau_2}$$