A   Polymoprhic Typing Rules

Polymorphic constant signatures:

$\mathsf{sig}(n) = \mathtt{int}$ n an integer constant $\mathsf{sig}(\oplus) = \mathtt{int} \to \mathtt{int} \to \mathtt{int}$ for $\oplus \in \{+, -, *, \% \ldots\}$
$\mathsf{sig}(\mathtt{true}) = \mathtt{bool}$ $\mathsf{sig}(\mathtt{false}) = \mathtt{bool}$
$\mathsf{sig}(\sim) = \forall \alpha. \, \alpha \to \alpha \to \mathtt{bool}$ for $\sim \in \{<, >, =, \leq, \geq\}$
$\mathsf{sig}(\mathtt{[\,]}) = \forall \alpha. \, \alpha \, \mathtt{list}$ $\mathsf{sig}((::)) = \forall \alpha. \, \alpha \to \alpha \, \mathtt{list} \to \alpha \, \mathtt{list}$
$\mathsf{sig}((\, , \,)) = \forall \alpha \beta. \, \alpha \to \beta \to \alpha * \beta$

Constants:

$$\frac{}{\Gamma \vdash \ c \ : \ \tau'} \ \text{CONST}$$ where c is a constant listed above, $\mathsf{sig}(c) = \forall \alpha_1 \ldots \alpha_n. \tau$ and
there exist $\sigma_1, \ldots, \sigma_n$ such that $\tau' = \tau[\sigma_1/\alpha_1; \ldots; \sigma_n/\alpha_n]$

Variables:

$$\frac{}{\Gamma \vdash x : \tau'} \ \text{VAR}$$ where $\forall \alpha_1 \ldots \alpha_n. \tau = \Gamma(x)$ and
there exist $\sigma_1, \ldots, \sigma_n$ such that $\tau' = \tau[\sigma_1/\alpha_1; \ldots; \sigma_n/\alpha_n]$

Connectives:

$$\frac{\Gamma \vdash e_1 : \mathtt{bool} \qquad \Gamma \vdash e_2 : \mathtt{bool}}{\Gamma \vdash e_1 \ \&\& \ e_2 : \mathtt{bool}} \ \text{CONN}$$
$$\frac{\Gamma \vdash e_1 : \mathtt{bool} \qquad \Gamma \vdash e_2 : \mathtt{bool}}{\Gamma \vdash e_1 \ || \ e_2 : \mathtt{bool}} \ \text{CONN}$$

If_then_else rule:

$$\frac{\Gamma \vdash e_c : \mathtt{bool} \qquad \Gamma \vdash e_t : \tau \qquad \Gamma \vdash e_e : \tau}{\Gamma \vdash \mathtt{if} \ e_c \ \mathtt{then} \ e_t \ \mathtt{else} \ e_e : \tau} \ \text{IF}$$

Application rule:

$$\frac{\Gamma \vdash e_1 : \tau_1 \to \tau_2 \qquad \Gamma \vdash e_2 : \tau_1}{\Gamma \vdash e_1 \ e_2 : \tau_2} \ \text{APP}$$

Function rule:

$$\frac{[x : \tau_1] + \Gamma \vdash e : \tau_2}{\Gamma \vdash \mathtt{fun} \ x \ \texttt{->} \ e : \tau_1 \to \tau_2} \ \text{FUN}$$

Let rule:

$$\frac{\Gamma \vdash e_1 : \tau_1 \qquad [x : \mathsf{Gen}(\tau_1, \Gamma)] + \Gamma \vdash e_2 : \tau_2}{\Gamma \vdash \mathtt{let} \ x \ \texttt{=} \ e_1 \ \mathtt{in} \ e_2 : \tau_2} \ \text{LET}$$

Let Rec rule:

$$\frac{[x : \tau_1] + \Gamma \vdash e_1 : \tau_1 \qquad [x : \mathsf{Gen}(\tau_1, \Gamma)] + \Gamma \vdash e_2 : \tau_2}{\Gamma \vdash \mathtt{let} \ \mathtt{rec} \ x \ \texttt{=} \ e_1 \ \mathtt{in} \ e_2 : \tau_2} \ \text{REC}$$