x	term variable		
α	type variable		
t	$::=$		term
	$\|$	x	variable
	$\|$	$\lambda(x : \tau) \Rightarrow t$	abstraction
	$\|$	$\lambda\{\alpha : *\} \Rightarrow t$	type abstraction
	$\|$	$t_1\ t_2$	application
	$\|$	$t\ [\tau]$	type application
τ	$::=$		type
	$\|$	α	type variable
	$\|$	$\tau_1 \to \tau_2$	arrow
	$\|$	$\forall\,(\alpha : *), \tau$	universal quantification
Γ	$::=$		typing environment
	$\|$	$\emptyset$	empty
	$\|$	$\Gamma, x : \tau$	variable
	$\|$	$\Gamma, \alpha : *$	type variable
v	$::=$		value
	$\|$	$\lambda(x : \tau) \Rightarrow t$	abstraction

Initial environment: $\Gamma = \quad \emptyset$

$\boxed{\Gamma \vdash t : \tau}$ Typing rules

$$\frac{x : \tau \in \Gamma}{\Gamma \vdash x : \tau}\ \textsc{T\_Var}$$

$$\frac{\Gamma, x : \tau_1 \vdash t : \tau_2 \qquad \Gamma \vdash \tau_1 : *}{\Gamma \vdash (\lambda(x : \tau_1) \Rightarrow t) : \tau_1 \to \tau_2}\ \textsc{T\_Abs}$$

$$\frac{\alpha \notin \Gamma \qquad \Gamma, \alpha : * \vdash t : \tau}{\Gamma \vdash (\lambda\{\alpha : *\} \Rightarrow t) : \forall\,(\alpha : *), \tau}\ \textsc{T\_TyAbs}$$

$$\frac{\Gamma \vdash t_1 : \tau_2 \to \tau_1 \qquad \Gamma \vdash t_2 : \tau_2}{\Gamma \vdash t_1\ t_2 : \tau_1}\ \textsc{T\_App}$$

$$\frac{\Gamma \vdash t : \forall\,(\alpha : *), \tau_2 \qquad \Gamma \vdash \tau_1 : * \qquad [\alpha \mapsto \tau_1]\tau_2 \rhd \tau_2'}{\Gamma \vdash t\ [\tau_1] : \tau_2'}\ \textsc{T\_TyApp}$$

$\boxed{\Gamma \vdash \tau : *}$ Type τ is well formed

$$\frac{\alpha : * \in \Gamma}{\Gamma \vdash \alpha : *}\ \textsc{K\_Var}$$

$$\frac{\Gamma \vdash \tau_1 : * \qquad \Gamma \vdash \tau_2 : *}{\Gamma \vdash (\tau_1 \to \tau_2) : *}\ \textsc{K\_Arrow}$$

$$\frac{\alpha \notin \Gamma \qquad \Gamma, \alpha : * \vdash \tau : *}{\Gamma \vdash (\forall\,(\alpha : *), \tau) : *}\ \textsc{K\_Forall}$$

$\boxed{t \longrightarrow t'}$ Operational semantics

$$\frac{t_2 \longrightarrow t_2'}{t_1\ t_2 \longrightarrow t_1\ t_2'} \quad \text{E\_APP1}$$

$$\frac{t \longrightarrow t'}{t\ v \longrightarrow t'\ v} \quad \text{E\_APP2}$$

$$\frac{[x \mapsto v]t \rhd t'}{(\lambda(x : \tau) \Rightarrow t)\ v \longrightarrow t'} \quad \text{E\_APPABS}$$

$$\frac{t \longrightarrow t'}{(\lambda\{\alpha : *\} \Rightarrow t) \longrightarrow (\lambda\{\alpha : *\} \Rightarrow t')} \quad \text{E\_TABS}$$

$$\frac{t \longrightarrow t'}{t\ [\tau] \longrightarrow t'\ [\tau]} \quad \text{E\_TAPP}$$

$$\frac{[\alpha \mapsto \tau]v \rhd v'}{(\lambda\{\alpha : *\} \Rightarrow v)\ [\tau] \longrightarrow v'} \quad \text{E\_TAPPABS}$$

$\boxed{[\alpha \mapsto \tau_1]\tau_2 \rhd \tau_3}$ Type substitution

$$\frac{}{[\alpha \mapsto \tau]\alpha \rhd \tau} \quad \text{SUBSTT\_VAR1}$$

$$\frac{\alpha_1 \neq \alpha_2}{[\alpha_1 \mapsto \tau]\alpha_2 \rhd \alpha_2} \quad \text{SUBSTT\_VAR2}$$

$$\frac{[\alpha \mapsto \tau_1]\tau_2 \rhd \tau_2' \qquad [\alpha \mapsto \tau_1]\tau_3 \rhd \tau_3'}{[\alpha \mapsto \tau_1](\tau_2 \to \tau_3) \rhd \tau_2' \to \tau_3'} \quad \text{SUBSTT\_ARROW}$$

$$\frac{\alpha_1 \neq \alpha_2 \qquad [\alpha_1 \mapsto \tau_1]\tau_2 \rhd \tau_2'}{[\alpha_1 \mapsto \tau_1](\forall\,(\alpha_2 : *), \tau_2) \rhd (\forall\,(\alpha_2 : *), \tau_2')} \quad \text{SUBSTT\_FORALL}$$

$\boxed{[x \mapsto v]t_1 \rhd t_2}$ substitution

$$\frac{}{[x \mapsto v]x \rhd v} \quad \text{SUBST\_VAR1}$$

$$\frac{x_1 \neq x_2}{[x_1 \mapsto v]x_2 \rhd x_2} \quad \text{SUBST\_VAR2}$$

$$\frac{}{[x \mapsto v](\lambda(x : \tau) \Rightarrow t) \rhd (\lambda(x : \tau) \Rightarrow t)} \quad \text{SUBST\_ABS1}$$

$$\frac{x_1 \neq x_2 \qquad [x_1 \mapsto v]t_1 \rhd t_2}{[x_1 \mapsto v](\lambda(x_2 : \tau) \Rightarrow t_1) \rhd (\lambda(x_2 : \tau) \Rightarrow t_2)} \quad \text{SUBST\_ABS2}$$

$$\frac{[x \mapsto v]t_1 \rhd t_2}{[x \mapsto v](\lambda\{\alpha : *\} \Rightarrow t_1) \rhd (\lambda\{\alpha : *\} \Rightarrow t_2)} \quad \text{SUBST\_TABS}$$

$$\frac{[x \mapsto v]t_1 \rhd t_1' \qquad [x \mapsto v]t_2 \rhd t_2'}{[x \mapsto v](t_1\ t_2) \rhd t_1'\ t_2'} \quad \text{SUBST\_APP}$$

$$\frac{[x \mapsto v]t_1 \rhd t_2}{[x \mapsto v](t_1\ [\tau]) \rhd (t_2\ [\tau])} \quad \text{SUBST\_TAPP}$$

$\boxed{[\alpha \mapsto \tau]t_1 \rhd t_2}$ substitution of type variable in term

$$\frac{}{[\alpha \mapsto \tau]x \rhd x} \quad \text{TTSUBST\_VAR}$$

$$\frac{[\alpha \mapsto \tau_1]\tau_2 \rhd \tau_2' \qquad [\alpha \mapsto \tau_1]t_1 \rhd t_2}{[\alpha \mapsto \tau_1](\lambda(x:\tau_2) \Rightarrow t_1) \rhd (\lambda(x:\tau_2') \Rightarrow t_2)} \quad \textsc{TtSubst\_Abs}$$

$$\frac{\alpha_1 \neq \alpha_2 \qquad [\alpha_1 \mapsto \tau]t_1 \rhd t_2}{[\alpha_1 \mapsto \tau](\lambda\{\alpha_2 : *\} \Rightarrow t_1) \rhd (\lambda\{\alpha_2 : *\} \Rightarrow t_2)} \quad \textsc{TtSubst\_TAbs}$$

$$\frac{[\alpha \mapsto \tau]t_1 \rhd t_1' \qquad [\alpha \mapsto \tau]t_2 \rhd t_2'}{[\alpha \mapsto \tau](t_1\ t_2) \rhd t_1'\ t_2'} \quad \textsc{TtSubst\_App}$$

$$\frac{[\alpha \mapsto \tau_1]t_1 \rhd t_2 \qquad [\alpha \mapsto \tau_1]\tau_2 \rhd \tau_2'}{[\alpha \mapsto \tau_1](t_1\ [\tau_2]) \rhd (t_2\ [\tau_2'])} \quad \textsc{TtSubst\_TApp}$$

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Definition rules:         30 good    0 bad
Definition rule clauses: 56 good    0 bad
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