x		term variable		
α		type variable		
T		type		
n				

t	::=			term
	|	x		variable
	|	$\lambda(x : \tau) \to t$		abstraction
	|	$\lambda\{\alpha : \kappa\} \to t$		type abstraction
	|	$t_1\, t_2$		application
	|	$t[\tau]$		type application
	|	$t : \tau$		type annotation
	|	(t)	S	parenthesis

v	::=			value
	|	$\lambda(x : \tau) \to t$		abstraction

κ	::=			kind
	|	$*$		star
	|	$\kappa_1 \to \kappa_2$		kind arrow
	|	(t)	S	parenthesis

τ	::=			type
	|	α		type variable
	|	T		type
	|	$\tau_1 \to \tau_2$		arrow
	|	$\lambda(\alpha : \kappa), \tau$		operator abstraction
	|	$\forall\,(\alpha : \kappa), \tau$		forall
	|	$\tau_1\, \tau_2$		operator application
	|	(τ)	S	parenthesis

Γ	::=			typing environment
	|	$\emptyset$		empty
	|	$\Gamma, x : \tau$		variable
	|	$\Gamma, T : \kappa$		abstract type
	|	$\Gamma, \alpha : \kappa$		type variable

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

$$\frac{}{[\alpha \mapsto \tau]\alpha \triangleright \tau} \quad \textsc{SubstT\_Var1}$$

$$\frac{}{[\alpha \mapsto \tau]\alpha \triangleright \alpha} \quad \textsc{SubstT\_Var2}$$

$$\frac{}{[\alpha \mapsto \tau]T \triangleright T} \quad \textsc{SubstT\_Type}$$

$$\frac{[\alpha \mapsto \tau_1]\tau_2 \triangleright \tau_2' \quad [\alpha \mapsto \tau_1]\tau_3 \triangleright \tau_3'}{[\alpha \mapsto \tau_1]\tau_2 \to \tau_3 \triangleright \tau_2' \to \tau_3'} \quad \textsc{SubstT\_Arrow}$$

$$\frac{}{[\alpha \mapsto \tau_1]\lambda(\alpha : \kappa), \tau_2 \triangleright \lambda(\alpha : \kappa), \tau_2} \quad \textsc{SubstT\_Abs1}$$

$$\frac{[\alpha \mapsto \tau_1]\tau_2 \triangleright \tau_2'}{[\alpha \mapsto \tau_1]\lambda(\alpha : \kappa), \tau_2 \triangleright \lambda(\alpha : \kappa), \tau_2'} \quad \textsc{SubstT\_Abs2}$$

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$$\frac{}{[\alpha \mapsto \tau_1]\forall\,(\alpha : \kappa), \tau_2 \triangleright \forall\,(\alpha : \kappa), \tau_2} \quad \text{SUBSTT\_FORALL1}$$

$$\frac{[\alpha \mapsto \tau_1]\tau_2 \triangleright \tau_2'}{[\alpha \mapsto \tau_1]\forall\,(\alpha : \kappa), \tau_2 \triangleright \forall\,(\alpha : \kappa), \tau_2'} \quad \text{SUBSTT\_FORALL2}$$

$$\frac{\begin{array}{c} [\alpha \mapsto \tau_1]\tau_2 \triangleright \tau_2' \\ [\alpha \mapsto \tau_1]\tau_3 \triangleright \tau_3' \end{array}}{[\alpha \mapsto \tau_1]\tau_2\,\tau_3 \triangleright \tau_2'\,\tau_3'} \quad \text{SUBSTT\_APP}$$

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

$$\frac{x : \tau \in \Gamma}{\Gamma \vdash x : \tau} \quad \text{T\_VAR}$$

$$\frac{\begin{array}{c} \Gamma, x : \tau_1 \vdash t : \tau_2 \\ \Gamma \vdash \tau_1 : * \end{array}}{\Gamma \vdash \lambda(x : \tau_1) \to t : \tau_1 \to \tau_2} \quad \text{T\_ABS}$$

$$\frac{\begin{array}{c} \Gamma \vdash t_1 : \tau_2 \to \tau_1 \\ \Gamma \vdash t_2 : \tau_2 \end{array}}{\Gamma \vdash t_1\,t_2 : \tau_1} \quad \text{T\_APP}$$

$$\frac{\begin{array}{c} \Gamma, \alpha : \kappa \vdash t : \tau \\ \alpha \notin \Gamma \end{array}}{\Gamma \vdash \lambda\{\alpha : \kappa\} \to t : \forall\,(\alpha : \kappa), \tau} \quad \text{T\_TYABS}$$

$$\frac{\begin{array}{c} \Gamma \vdash t : \forall\,(\alpha : \kappa), \tau_2 \\ \Gamma \vdash \tau_1 : \kappa \\ [\alpha \mapsto \tau_1]\tau_2 \triangleright \tau_2' \end{array}}{\Gamma \vdash t[\tau_1] : \tau_2'} \quad \text{T\_TYAPP}$$

$$\frac{\begin{array}{c} \Gamma \vdash t : \tau_2 \\ \tau_1 \equiv \tau_2 \end{array}}{\Gamma \vdash (t : \tau_1) : \tau_1} \quad \text{T\_ANNOT}$$

$\boxed{\Gamma \vdash \tau : \kappa}$ Kinding

$$\frac{\alpha : \kappa \in \Gamma}{\Gamma \vdash \alpha : \kappa} \quad \text{K\_VAR}$$

$$\frac{T : \kappa \in \Gamma}{\Gamma \vdash T : \kappa} \quad \text{K\_ABSTYPE}$$

$$\frac{\Gamma, \alpha : \kappa_1 \vdash \tau : \kappa_2}{\Gamma \vdash \lambda(\alpha : \kappa_1), \tau : \kappa_1 \to \kappa_2} \quad \text{K\_ABS}$$

$$\frac{\begin{array}{c} \Gamma \vdash \tau_1 : \kappa_2 \to \kappa_1 \\ \Gamma \vdash \tau_2 : \kappa_2 \end{array}}{\Gamma \vdash \tau_1\,\tau_2 : \kappa_1} \quad \text{K\_APP}$$

$$\frac{\begin{array}{c} \Gamma \vdash \tau_1 : * \\ \Gamma \vdash \tau_2 : * \end{array}}{\Gamma \vdash \tau_1 \to \tau_2 : *} \quad \text{K\_ARROW}$$

$$\frac{\Gamma, \alpha : \kappa \vdash \tau : *}{\Gamma \vdash \forall\,(\alpha : \kappa), \tau : *} \quad \text{K\_FORALL}$$

$\boxed{\tau_1 \equiv \tau_2}$ Type equivalence

$$\frac{}{\tau \equiv \tau} \quad \text{EQ\_Refl}$$

$$\frac{\tau_2 \equiv \tau_1}{\tau_1 \equiv \tau_2} \quad \text{EQ\_Symm}$$

$$\frac{\begin{array}{c} \tau_1 \equiv \tau_2 \\ \tau_2 \equiv \tau_3 \end{array}}{\tau_1 \equiv \tau_3} \quad \text{EQ\_Trans}$$

$$\frac{}{\alpha \equiv \alpha} \quad \text{EQ\_Var}$$

$$\frac{}{T \equiv T} \quad \text{EQ\_AbsType}$$

$$\frac{\begin{array}{c} \tau_1 \equiv \tau_1' \\ \tau_2 \equiv \tau_2' \end{array}}{\tau_1 \to \tau_2 \equiv \tau_1' \to \tau_2'} \quad \text{EQ\_Arrow}$$

$$\frac{\tau_1 \equiv \tau_2}{\forall (\alpha : \kappa), \tau_1 \equiv \forall (\alpha : \kappa), \tau_2} \quad \text{EQ\_Forall}$$

$$\frac{\tau_1 \equiv \tau_2}{\lambda(\alpha : \kappa), \tau_1 \equiv \lambda(\alpha : \kappa), \tau_2} \quad \text{EQ\_Abs}$$

$$\frac{\begin{array}{c} \tau_1 \equiv \tau_1' \\ \tau_2 \equiv \tau_2' \end{array}}{\tau_1\, \tau_2 \equiv \tau_1'\, \tau_2'} \quad \text{EQ\_App}$$

$$\frac{[\alpha \mapsto \tau_2]\tau_1 \triangleright \tau_1'}{(\lambda(\alpha : \kappa), \tau_1)\, \tau_2 \equiv \tau_1'} \quad \text{EQ\_AppAbs}$$

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

$$\frac{}{[x \mapsto v]x \triangleright v} \quad \text{Subst\_Var1}$$

$$\frac{}{[x_1 \mapsto v]x_2 \triangleright x_2} \quad \text{Subst\_Var2}$$

$$\frac{}{[x \mapsto v]\lambda(x : \tau) \to t \triangleright \lambda(x : \tau) \to t} \quad \text{Subst\_Abs1}$$

$$\frac{[x_1 \mapsto v]t_1 \triangleright t_2}{[x_1 \mapsto v]\lambda(x_2 : \tau) \to t_1 \triangleright \lambda(x_2 : \tau) \to t_2} \quad \text{Subst\_Abs2}$$

$$\frac{[x \mapsto v]t_1 \triangleright t_2}{[x \mapsto v]\lambda\{\alpha : \kappa\} \to t_1 \triangleright \lambda\{\alpha : \kappa\} \to t_2} \quad \text{Subst\_TAbs}$$

$$\frac{\begin{array}{c} [x \mapsto v]t_1 \triangleright t_1' \\ [x \mapsto v]t_2 \triangleright t_2' \end{array}}{[x \mapsto v]t_1\, t_2 \triangleright t_1'\, t_2'} \quad \text{Subst\_App}$$

$$\frac{[x \mapsto v]t_1 \triangleright t_2}{[x \mapsto v]t_1[\tau] \triangleright t_2[\tau]} \quad \text{Subst\_TApp}$$

$$\frac{[x \mapsto v]t_1 \triangleright t_2}{[x \mapsto v]t_1 : \tau \triangleright t_2 : \tau} \quad \text{Subst\_Annot}$$

$\boxed{t_1 \longrightarrow t_2}$ Evaluation

$$\frac{t_2 \longrightarrow t_2'}{t_1\ t_2 \longrightarrow t_1\ t_2'} \quad \text{E\_App1}$$

$$\frac{t_1 \longrightarrow t_1'}{t_1\ v \longrightarrow t_1'\ v} \quad \text{E\_App2}$$

$$\frac{[x \mapsto v]t \triangleright t' \quad t' \longrightarrow t''}{(\lambda(x : \tau) \to t)\ v \longrightarrow t''} \quad \text{E\_AppAbs}$$

$$\frac{t \longrightarrow t'}{\lambda\{\alpha : \kappa\} \to t \longrightarrow t'} \quad \text{E\_TAbs}$$

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

$$\frac{t \longrightarrow t'}{(t : \tau) \longrightarrow t'} \quad \text{E\_Annot}$$

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Definition rules:         45 good     0 bad
Definition rule clauses: 94 good     0 bad
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