$termvar,\ x,\ y,\ z,\ f$
$typevar,\ X,\ Y,\ Z$
$index,\ i,\ j,\ k$

$t,\ c,\ s$	$::=$	
	$\mid\ x$	
	$\mid$ triv	
	$\mid$ box	
	$\mid$ unbox	
	$\mid$ error	
	$\mid\ \Lambda(X <: A).t$	
	$\mid\ [A]t$	
	$\mid\ \lambda(x : A).t$	
	$\mid\ t_1\ t_2$	
	$\mid\ (t_1, t_2)$	
	$\mid$ fst t	
	$\mid$ snd t	
	$\mid$ succ t	
	$\mid\ 0$	
	$\mid$ case t of $t_3 \to t_1, t_4 \to t_2$	
	$\mid\ []$	
	$\mid\ t :: t'$	
	$\mid\ (t)$	S
	$\mid$ squash	
	$\mid$ split	
$n,\ m$	$::=$	
	$\mid\ 0$	
	$\mid$ succ n	
v	$::=$	
	$\mid$ triv	
	$\mid\ []$	
	$\mid$ squash$_S$	
	$\mid$ split$_S$	
	$\mid$ box$_A$	
	$\mid$ unbox$_A$	
	$\mid\ \Lambda(X <: A).t$	
	$\mid\ \lambda(x : A).t$	
	$\mid\ n$	
K	$::=$	
	$\mid\ \star$	
$A,\ B,\ C,\ D,\ E,\ S,\ U$	$::=$	
	$\mid\ X$	
	$\mid$ List A	
	$\mid\ \forall(X <: A).B$	
	$\mid\ \top$	
	$\mid\ \mathbb{S}$	
	$\mid\ \mathbb{K}$	

$$
\begin{array}{lll}
 & | & \mathsf{Unit} \\
 & | & \mathsf{Nat} \\
 & | & ? \\
 & | & A_1 \to A_2 \\
 & | & A_1 \times A_2 \\
 & | & (A) \qquad\qquad \mathsf{S}
\end{array}
$$

$$
\begin{array}{lll}
\Gamma & ::= & \\
 & | & \cdot \\
 & | & \Gamma, X <: A \\
 & | & \Gamma, x : A
\end{array}
$$

$\boxed{\Gamma \vdash A : \star}$

$$\frac{\Gamma_1 \vdash A : \star}{\Gamma_1, X <: A, \Gamma_2 \vdash X : \star}\ \textsc{K\_var}$$

$$\frac{}{\Gamma \vdash \mathsf{Unit} : \star}\ \textsc{K\_unit}$$

$$\frac{}{\Gamma \vdash \mathsf{Nat} : \star}\ \textsc{K\_nat}$$

$$\frac{}{\Gamma \vdash ? : \star}\ \textsc{K\_unitype}$$

$$\frac{\Gamma \vdash A : \star}{\Gamma \vdash \mathsf{List}\ A : \star}\ \textsc{K\_list}$$

$$\frac{\Gamma \vdash A : \star \quad \Gamma \vdash B : \star}{\Gamma \vdash A \to B : \star}\ \textsc{K\_arrow}$$

$$\frac{\Gamma \vdash A : \star \quad \Gamma \vdash B : \star}{\Gamma \vdash A \times B : \star}\ \textsc{K\_prod}$$

$$\frac{\Gamma, X <: A \vdash B : \star}{\Gamma \vdash \forall (X <: A).B : \star}\ \textsc{K\_forall}$$

$\boxed{\Gamma\ \mathrm{Ok}}$

$$\frac{}{\cdot\ \mathrm{Ok}}\ \textsc{Ok\_empty}$$

$$\frac{\Gamma\ \mathrm{Ok} \quad \Gamma \vdash A : \star}{(\Gamma, X <: A)\ \mathrm{Ok}}\ \textsc{Ok\_typeVar}$$

$$\frac{\Gamma\ \mathrm{Ok} \quad \Gamma \vdash A : \star}{(\Gamma, x : A)\ \mathrm{Ok}}\ \textsc{Ok\_var}$$

$\boxed{\Gamma \vdash A <: B}$

$$\frac{\Gamma\ \mathrm{Ok}}{\Gamma \vdash A <: A}\ \textsc{S\_Refl}$$

$$\frac{\Gamma \vdash A <: B \quad \Gamma \vdash B <: C}{\Gamma \vdash A <: C}\ \textsc{S\_Trans}$$

$$\frac{\Gamma\ \mathrm{Ok}}{\Gamma \vdash A <: \top}\ \textsc{S\_Top}$$

$$\frac{\Gamma\ \mathrm{Ok}}{\Gamma \vdash (? \to ?) <: \mathbb{K}}\ \textsc{S\_ArrowK}$$

$$\frac{\Gamma\ \mathrm{Ok}}{\Gamma \vdash (? \times ?) <: \mathbb{K}}\ \textsc{S\_ProdK}$$

$$\frac{\Gamma\ \mathrm{Ok}}{\Gamma \vdash (\mathsf{List}\ ?) <: \mathbb{K}}\ \textsc{S\_ListK}$$

$$\frac{\Gamma\ \mathrm{Ok}}{\Gamma \vdash \mathsf{Nat} <: \mathbb{S}}\ \textsc{S\_Nat}$$

$$\frac{\Gamma\ \mathrm{Ok}}{\Gamma \vdash \mathsf{Unit} <: \mathbb{S}}\ \textsc{S\_Unit}$$

$$\frac{\Gamma \vdash A <: \mathbb{S}}{\Gamma \vdash \mathsf{List}\ A <: \mathbb{S}}\ \textsc{S\_ListSL}$$

$$\frac{X <: A \in \Gamma \quad \Gamma\ \mathrm{Ok}}{\Gamma \vdash X <: A}\ \textsc{S\_Var}$$

$$\frac{\Gamma \vdash A <: B}{\Gamma \vdash \mathsf{List}\ A <: \mathsf{List}\ B}\ \textsc{S\_List}$$

$$\frac{\Gamma \vdash A <: \mathbb{S} \quad \Gamma \vdash B <: \mathbb{S}}{\Gamma \vdash A \to B <: \mathbb{S}}\ \textsc{S\_ArrowSL}$$

$$\frac{\Gamma \vdash A <: \mathbb{S} \quad \Gamma \vdash B <: \mathbb{S}}{\Gamma \vdash A \times B <: \mathbb{S}}\ \textsc{S\_ProdSL}$$

$$\frac{\Gamma \vdash A_1 <: A_2 \quad \Gamma \vdash B_1 <: B_2}{\Gamma \vdash A_1 \times B_1 <: A_2 \times B_2}\ \textsc{S\_Prod}$$

$$\frac{\Gamma \vdash A_2 <: A_1 \quad \Gamma \vdash B_1 <: B_2}{\Gamma \vdash A_1 \to B_1 <: A_2 \to B_2}\ \textsc{S\_Arrow}$$

$$\frac{\Gamma, X <: A \vdash B_1 <: B_2}{\Gamma \vdash \forall (X <: A).B_1 <: \forall (X <: A).B_2}\ \textsc{S\_Forall}$$

$\boxed{\Gamma \vdash t : A}$

$$\frac{x : A \in \Gamma \quad \Gamma\ \mathrm{Ok}}{\Gamma \vdash x : A}\ \textsc{varP}$$

$$\frac{\Gamma\ \mathrm{Ok}}{\Gamma \vdash \mathsf{box} : \forall (X <: \mathbb{S}).(X \to ?)}\ \textsc{Box}$$

$$\frac{\Gamma\ \mathrm{Ok}}{\Gamma \vdash \mathsf{unbox} : \forall (X <: \mathbb{S}).(? \to X)}\ \textsc{Unbox}$$

$$\frac{\Gamma\ \mathrm{Ok}}{\Gamma \vdash \mathsf{squash} : \forall (X <: \mathbb{K}).(X \to ?)}\ \textsc{squash}$$

$$\frac{\Gamma\ \mathrm{Ok}}{\Gamma \vdash \mathsf{split} : \forall (X <: \mathbb{K}).(? \to X)}\ \textsc{split}$$

$$\frac{\Gamma\ \mathrm{Ok}}{\Gamma \vdash \mathsf{triv} : \mathsf{Unit}}\ \textsc{unitP}$$

$$\frac{\Gamma\ \mathrm{Ok}}{\Gamma \vdash 0 : \mathsf{Nat}}\ \textsc{zeroP}$$

$$\frac{\Gamma \vdash t : \mathsf{Nat}}{\Gamma \vdash \mathsf{succ}\ t : \mathsf{Nat}}\ \textsc{succ}$$

$$\frac{\Gamma \vdash t : \mathsf{Nat} \quad \Gamma \vdash t_1 : A \quad \Gamma, x : \mathsf{Nat} \vdash t_2 : A}{\Gamma \vdash \mathsf{case}\, t\, \mathsf{of}\, 0 \to t_1, (\mathsf{succ}\, x) \to t_2 : A}\ \textsc{ncase}$$

$$\frac{\Gamma\ \mathrm{Ok} \quad \Gamma \vdash A : \star}{\Gamma \vdash [] : \forall(X <: \top).\mathsf{List}\, X}\ \textsc{empty}$$

$$\frac{\Gamma \vdash t_1 : A \quad \Gamma \vdash t_2 : \mathsf{List}\, A}{\Gamma \vdash t_1 :: t_2 : \mathsf{List}\, A}\ \textsc{cons}$$

$$\frac{\Gamma \vdash t : \mathsf{List}\, A \quad \Gamma \vdash t_1 : B \quad \Gamma, x : A, y : \mathsf{List}\, A \vdash t_2 : B}{\Gamma \vdash \mathsf{case}\, t\, \mathsf{of}\, [] \to t_1, (x :: y) \to t_2 : B}\ \textsc{lcase}$$

$$\frac{\Gamma \vdash t_1 : A_1 \quad \Gamma \vdash t_2 : A_2}{\Gamma \vdash (t_1, t_2) : A_1 \times A_2}\ \textsc{pair}$$

$$\frac{\Gamma \vdash t : A_1 \times A_2}{\Gamma \vdash \mathsf{fst}\, t : A_1}\ \textsc{fst}$$

$$\frac{\Gamma \vdash t : A_1 \times A_2}{\Gamma \vdash \mathsf{snd}\, t : A_2}\ \textsc{snd}$$

$$\frac{\Gamma, x : A \vdash t : B}{\Gamma \vdash \lambda(x : A).t : A \to B}\ \textsc{lam}$$

$$\frac{\Gamma \vdash t_1 : A \to B \quad \Gamma \vdash t_2 : A}{\Gamma \vdash t_1\, t_2 : B}\ \textsc{app}$$

$$\frac{\Gamma, X <: A \vdash t : B}{\Gamma \vdash \Lambda(X <: A).t : \forall(X <: A).B}\ \textsc{Lam}$$

$$\frac{\Gamma \vdash t : \forall(X <: B).C \quad \Gamma \vdash A <: B}{\Gamma \vdash [A]t : [A/X]C}\ \textsc{typeApp}$$

$$\frac{\Gamma \vdash t : A \quad \Gamma \vdash A <: B}{\Gamma \vdash t : B}\ \textsc{Sub}$$

$$\frac{}{\Gamma \vdash \mathsf{error} : A}\ \textsc{error}$$

$\boxed{t_1 \rightsquigarrow t_2}$ call by name

$$\frac{}{\mathsf{unbox}_A\,(\mathsf{box}_A\, t) \rightsquigarrow t}\ \textsc{rd\_retracT}$$

$$\frac{A \neq B}{\mathsf{unbox}_A\,(\mathsf{box}_B\, t) \rightsquigarrow \mathsf{error}}\ \textsc{rd\_retracTE}$$

$$\frac{}{\mathsf{split}_U\,(\mathsf{squash}_U\, t) \rightsquigarrow t}\ \textsc{rd\_retractU}$$

$$\frac{U_1 \neq U_2}{\mathsf{split}_{U_1}\,(\mathsf{squash}_{U_2}\, t) \rightsquigarrow \mathsf{error}}\ \textsc{rd\_retractUE}$$

$$\frac{t \rightsquigarrow t'}{\mathsf{succ}\, t \rightsquigarrow \mathsf{succ}\, t'}\ \textsc{rd\_succ}$$

$$\frac{}{\mathsf{case}\, 0\, \mathsf{of}\, 0 \to t_1, (\mathsf{succ}\, x) \to t_2 \rightsquigarrow t_1}\ \textsc{rd\_ncase0}$$

$$\frac{}{\mathsf{case}\,(\mathsf{succ}\, t)\, \mathsf{of}\, 0 \to t_1, (\mathsf{succ}\, x) \to t_2 \rightsquigarrow [t/x]t_2}\ \textsc{rd\_ncaseSucc}$$

$$\frac{t \rightsquigarrow t'}{\mathsf{case}\ t\ \mathsf{of}\ 0 \to t_1, (\mathsf{succ}\ x) \to t_2 \rightsquigarrow \mathsf{case}\ t'\ \mathsf{of}\ 0 \to t_1, (\mathsf{succ}\ x) \to t_2}\ \text{RD\_NCASE1}$$

$$\frac{t_1 \rightsquigarrow t_1'}{\mathsf{case}\ t\ \mathsf{of}\ 0 \to t_1, (\mathsf{succ}\ x) \to t_2 \rightsquigarrow \mathsf{case}\ t\ \mathsf{of}\ 0 \to t_1', (\mathsf{succ}\ x) \to t_2}\ \text{RD\_NCASE2}$$

$$\frac{t_2 \rightsquigarrow t_2'}{\mathsf{case}\ t\ \mathsf{of}\ 0 \to t_1, (\mathsf{succ}\ x) \to t_2 \rightsquigarrow \mathsf{case}\ t\ \mathsf{of}\ 0 \to t_1, (\mathsf{succ}\ x) \to t_2'}\ \text{RD\_NCASE3}$$

$$\frac{}{\mathsf{case}\ []\ \mathsf{of}\ [] \to t_1, (x :: y) \to t_2 \rightsquigarrow t_1}\ \text{RD\_LCASEEMPTY}$$

$$\frac{}{\mathsf{case}\ (t_1 :: t_2)\ \mathsf{of}\ [] \to t_3, (x :: y) \to t_4 \rightsquigarrow [t_1/x][t_2/y]t_4}\ \text{RD\_LCASECONS}$$

$$\frac{t_1 \rightsquigarrow t_1'}{t_1 :: t_2 \rightsquigarrow t_1' :: t_2}\ \text{RD\_HEAD}$$

$$\frac{t_2 \rightsquigarrow t_2'}{t_1 :: t_2 \rightsquigarrow t_1 :: t_2'}\ \text{RD\_TAIL}$$

$$\frac{t \rightsquigarrow t'}{\mathsf{case}\ t\ \mathsf{of}\ [] \to t_1, (x :: y) \to t_2 \rightsquigarrow \mathsf{case}\ t'\ \mathsf{of}\ [] \to t_1, (x :: y) \to t_2}\ \text{RD\_LCASE1}$$

$$\frac{t_1 \rightsquigarrow t_1'}{\mathsf{case}\ t\ \mathsf{of}\ [] \to t_1, (x :: y) \to t_2 \rightsquigarrow \mathsf{case}\ t\ \mathsf{of}\ [] \to t_1', (x :: y) \to t_2}\ \text{RD\_LCASE2}$$

$$\frac{t_2 \rightsquigarrow t_2'}{\mathsf{case}\ t\ \mathsf{of}\ [] \to t_1, (x :: y) \to t_2 \rightsquigarrow \mathsf{case}\ t\ \mathsf{of}\ [] \to t_1, (x :: y) \to t_2'}\ \text{RD\_LCASE3}$$

$$\frac{}{(\lambda(x : A_1).t_2)\ t_1 \rightsquigarrow [t_1/x]t_2}\ \text{RD\_BETA}$$

$$\frac{x \notin \mathsf{FV}(t)}{\lambda(x : A_1).t\ x \rightsquigarrow t}\ \text{RD\_ETA}$$

$$\frac{}{\mathsf{fst}\ (t_1, t_2) \rightsquigarrow t_1}\ \text{RD\_PROJ1}$$

$$\frac{}{\mathsf{snd}\ (t_1, t_2) \rightsquigarrow t_2}\ \text{RD\_PROJ2}$$

$$\frac{}{(\mathsf{fst}\ t, \mathsf{snd}\ t) \rightsquigarrow t}\ \text{RD\_ETAP}$$

$$\frac{t_1 \rightsquigarrow t_1'}{t_1\ t_2 \rightsquigarrow t_1'\ t_2}\ \text{RD\_APP1}$$

$$\frac{t_2 \rightsquigarrow t_2'}{t_1\ t_2 \rightsquigarrow t_1\ t_2'}\ \text{RD\_APP2}$$

$$\frac{t \rightsquigarrow t'}{\mathsf{fst}\ t \rightsquigarrow \mathsf{fst}\ t'}\ \text{RD\_FST}$$

$$\frac{t \rightsquigarrow t'}{\mathsf{snd}\ t \rightsquigarrow \mathsf{snd}\ t'}\ \text{RD\_SND}$$

$$\frac{t_1 \rightsquigarrow t_1'}{(t_1, t_2) \rightsquigarrow (t_1', t_2)}\ \text{RD\_PAIR1}$$

$$\frac{t_2 \rightsquigarrow t_2'}{(t_1, t_2) \rightsquigarrow (t_1, t_2')}\ \text{RD\_PAIR2}$$

$$\frac{}{[A](\Lambda(X <: B).t) \rightsquigarrow [A/X]t}\ \text{RD\_TYPEBETA}$$

$$\frac{t_1 \rightsquigarrow t_2}{[A]t_1 \rightsquigarrow [A]t_2}\ \text{RD\_TYPEAPP}$$

```
Definition rules:         78 good    0 bad
Definition rule clauses: 142 good    0 bad
```