α, β, α, β, γ, δ	type variables
n, m, i, j	index variables

$n,\ m$	$::=$		cohort index
	$\mid$	0	
	$\mid$	$n + 1$	
$\alpha^+,\ \beta^+,\ \gamma^+,\ \delta^+$	$::=$		positive variable
	$\mid$	α^+	
	$\mid$	α^{+n}	
	$\mid$	$\beta^\pm$	
$\alpha^-,\ \beta^-,\ \gamma^-,\ \delta^-$	$::=$		negative variable
	$\mid$	α^-	
	$\mid$	α^{-n}	
	$\mid$	$\alpha^\pm$	
$\alpha^\pm,\ \beta^\pm$	$::=$		positive or negative variable
	$\mid$	$\alpha^\pm$	
	$\mid$	$\alpha^{\pm n}$	
σ	$::=$		substitution
	$\mid$	$\cdot$	
	$\mid$	id	
	$\mid$	P/α^+	
	$\mid$	N/α^-	
	$\mid$	$\vec{P}/\overrightarrow{\alpha^+}$	
	$\mid$	$\vec{N}/\overrightarrow{\alpha^-}$	
	$\mid$	$\mathbf{pmas}\,/\overrightarrow{\alpha^+}$	
	$\mid$	$\mathbf{nmas}\,/\overrightarrow{\alpha^-}$	
	$\mid$	$\overrightarrow{\widetilde{\alpha^+}}/\overrightarrow{\alpha^+}$	
	$\mid$	$\overrightarrow{\widehat{\alpha^-}}/\overrightarrow{\alpha^-}$	
	$\mid$	$\overrightarrow{\alpha^-}/\overrightarrow{\widehat{\alpha^-}}$	
	$\mid$	μ	
	$\mid$	$\widehat{\sigma}$	
	$\mid$	$\sigma_1 \circ \sigma_2$	
	$\mid$	$\vec{\alpha}_1/\vec{\alpha}_2$	
	$\mid$	(σ)	S
	$\mid$	$\overline{\sigma_i}^{\,i}$	concatenate
	$\mid$	$\mathbf{nf}\,(\sigma')$	M
	$\mid$	$\sigma'\vert_{vars}$	M
e	$::=$		entry of a unification solution
	$\mid$	$\widehat{\alpha}^+ :\approx P$	
	$\mid$	$\widehat{\alpha}^- :\approx N$	
	$\mid$	$\widehat{\alpha}^+ :\geqslant P$	
	$\mid$	(e)	S
	$\mid$	$\widehat{\sigma}(\widehat{\alpha}^+)$	M
	$\mid$	$\widehat{\sigma}(\widehat{\alpha}^-)$	M
	$\mid$	$e_1\ \&\ e_2$	M
$\widehat{\sigma}$	$::=$		unification solution (substitution)

	$\mid$	$\cdot$		
	$\mid$	e		
	$\mid$	$\widehat{\sigma}\backslash vars$		
	$\mid$	$\widehat{\sigma}\mid vars$		
	$\mid$	$\widehat{\sigma}_1 \cup \widehat{\sigma}_2$		
	$\mid$	$\overline{\widehat{\sigma}_i}^{\,i}$		concatenate
	$\mid$	$(\widehat{\sigma})$	S	
	$\mid$	$\mathbf{nf}\,(\widehat{\sigma}')$	M	
	$\mid$	$\widehat{\sigma}'\vert_{vars}$	M	
	$\mid$	$\widehat{\sigma}_1\ \&\ \widehat{\sigma}_2$	M	
$\widehat{\tau},\ \widehat{\rho}$	$::=$			anti-unification substitution
	$\mid$	$\cdot$		
	$\mid$	$\widehat{\alpha}^- :\approx N$		
	$\mid$	$\widehat{\alpha}^- :\approx N$		
	$\mid$	$\overrightarrow{\alpha^-}/\overrightarrow{\widehat{\alpha}^-}$		
	$\mid$	$\overrightarrow{N}/\overrightarrow{\widehat{\alpha}^-}$		
	$\mid$	$\widehat{\tau}_1 \cup \widehat{\tau}_2$		
	$\mid$	$\overline{\widehat{\tau}_i}^{\,i}$		concatenate
	$\mid$	$(\widehat{\tau})$	S	
	$\mid$	$\widehat{\tau}'\vert_{vars}$	M	
	$\mid$	$\widehat{\tau}_1\ \&\ \widehat{\tau}_2$	M	
$P,\ Q$	$::=$			positive types
	$\mid$	α^+		
	$\mid$	$\downarrow N$		
	$\mid$	$\exists\alpha^-.P$		
	$\mid$	$[\sigma]P$	M	
$N,\ M$	$::=$			negative types
	$\mid$	α^-		
	$\mid$	$\uparrow P$		
	$\mid$	$\forall\alpha^+.N$		
	$\mid$	$P \rightarrow N$		
	$\mid$	$[\sigma]N$	M	
$\overrightarrow{\alpha^+},\ \overrightarrow{\beta^+},\ \overrightarrow{\gamma^+},\ \overrightarrow{\delta^+}$	$::=$			positive variable list
	$\mid$	$\cdot$		empty list
	$\mid$	α^+		a variable
	$\mid$	$\overrightarrow{\alpha^+}$		a variable
	$\mid$	$\overline{\overrightarrow{\alpha^+}_i}^{\,i}$		concatenate lists
$\overrightarrow{\alpha^-},\ \overrightarrow{\beta^-},\ \overrightarrow{\gamma^-},\ \overrightarrow{\delta^-}$	$::=$			negative variables
	$\mid$	$\cdot$		empty list
	$\mid$	α^-		a variable
	$\mid$	$\overrightarrow{\alpha^-}$		variables
	$\mid$	$\overline{\overrightarrow{\alpha^-}_i}^{\,i}$		concatenate lists
$\overrightarrow{\alpha^\pm},\ \overrightarrow{\beta^\pm},\ \overrightarrow{\gamma^\pm},\ \overrightarrow{\delta^\pm}$	$::=$			positive or negative variable list

	$\vert$	$\cdot$		empty list
	$\vert$	$\alpha^{\pm}$		a variable
	$\vert$	$\overrightarrow{\mathbf{pa}}$		variables
	$\vert$	$\overline{\overrightarrow{\alpha^{\pm}}_i}^{\,i}$		concatenate lists
$P,\ Q$	$::=$			multi-quantified positive types
	$\vert$	α^{+}		
	$\vert$	$\downarrow N$		
	$\vert$	$\exists\overrightarrow{\alpha^{-}}.P$		$P \neq \exists \ldots$
	$\vert$	$[\sigma]P$	M	
	$\vert$	$[\widehat{\tau}]P$	M	
	$\vert$	$[\widehat{\sigma}]P$	M	
	$\vert$	$[\mu]P$	M	
	$\vert$	(P)	S	
	$\vert$	$P_1 \vee P_2$	M	
	$\vert$	$\mathbf{nf}\,(P')$	M	
$N,\ M$	$::=$			multi-quantified negative types
	$\vert$	α^{-}		
	$\vert$	$\uparrow P$		
	$\vert$	$P \to N$		
	$\vert$	$\forall\overrightarrow{\alpha^{+}}.N$		$N \neq \forall \ldots$
	$\vert$	$[\sigma]N$	M	
	$\vert$	$[\widehat{\tau}]N$	M	
	$\vert$	$[\mu]N$	M	
	$\vert$	$[\widehat{\sigma}]N$	M	
	$\vert$	(N)	S	
	$\vert$	$\mathbf{nf}\,(N')$	M	
$\vec{P},\ \vec{Q}$	$::=$			list of positive types
	$\vert$	$\cdot$		empty list
	$\vert$	P		a singel type
	$\vert$	$\overline{\vec{P}_i}^{\,i}$		concatenate lists
	$\vert$	$\mathbf{nf}\,(\vec{P}')$	M	
$\vec{N},\ \vec{M}$	$::=$			list of negative types
	$\vert$	$\cdot$		empty list
	$\vert$	N		a singel type
	$\vert$	$\overline{\vec{N}_i}^{\,i}$		concatenate lists
	$\vert$	$\mathbf{nf}\,(\vec{N}')$	M	
$\Delta,\ \Gamma$	$::=$			declarative type context
	$\vert$	$\cdot$		empty context
	$\vert$	$\overrightarrow{\alpha^{+}}$		list of variables
	$\vert$	$\overrightarrow{\alpha^{-}}$		list of variables
	$\vert$	$\overrightarrow{\alpha^{\pm}}$		list of variables
	$\vert$	$vars$		
	$\vert$	$\overline{\Gamma_i}^{\,i}$		concatenate contexts
	$\vert$	(Γ)	S	
	$\vert$	$\Theta(\widehat{\alpha}^{+})$	M	

	$\mid$	$\Theta(\widehat{\alpha}^{-})$	M	
Θ	$::=$			unification type variable context
	$\mid$	$\cdot$		empty context
	$\mid$	$\overrightarrow{\widetilde{\alpha}^{+}}$		list of variables
	$\mid$	$\overrightarrow{\widehat{\alpha}^{-}}$		list of variables
	$\mid$	vars		
	$\mid$	$\overline{\Theta_i}^{\,i}$		concatenate contexts
	$\mid$	(Θ)	S	
	$\mid$	$\Theta\vert_{\mathit{vars}}$		leave only those variables that are in the set
	$\mid$	$\Theta_1 \cup \Theta_2$		
Ξ	$::=$			anti-unification type variable context
	$\mid$	$\cdot$		empty context
	$\mid$	$\overrightarrow{\widehat{\alpha}^{-}}$		list of variables
	$\mid$	$\overline{\Xi_i}^{\,i}$		concatenate contexts
	$\mid$	(Ξ)	S	
	$\mid$	$\Xi_1 \cup \Xi_2$		
	$\mid$	$\Xi'\vert_{\mathit{vars}}$	M	
$\vec{\alpha},\ \vec{\beta}$	$::=$			ordered positive or negative variables
	$\mid$	$\cdot$		empty list
	$\mid$	$\overrightarrow{\alpha^{+}}$		list of variables
	$\mid$	$\overrightarrow{\alpha^{-}}$		list of variables
	$\mid$	$\overrightarrow{\alpha^{\pm}}$		list of variables
	$\mid$	$\overrightarrow{\widetilde{\alpha}^{+}}$		list of variables
	$\mid$	$\overrightarrow{\widehat{\alpha}^{-}}$		list of variables
	$\mid$	$\vec{\alpha}_1 \backslash \mathit{vars}$		setminus
	$\mid$	Γ		context
	$\mid$	vars		
	$\mid$	$\overline{\vec{\alpha}_i}^{\,i}$		concatenate contexts
	$\mid$	$(\vec{\alpha})$	S	parenthesis
	$\mid$	$[\mu]\vec{\alpha}$	M	apply moving to list
	$\mid$	$\mathbf{ord}\ \mathit{vars}\ \mathbf{in}\ P$	M	
	$\mid$	$\mathbf{ord}\ \mathit{vars}\ \mathbf{in}\ N$	M	
	$\mid$	$\mathbf{ord}\ \mathit{vars}\ \mathbf{in}\ P$	M	
	$\mid$	$\mathbf{ord}\ \mathit{vars}\ \mathbf{in}\ N$	M	
vars	$::=$			set of variables
	$\mid$	$\varnothing$		empty set
	$\mid$	$\mathbf{fv}\ P$		free variables
	$\mid$	$\mathbf{fv}\ N$		free variables
	$\mid$	$\mathbf{fv}\ \mathbf{imP}$		free variables
	$\mid$	$\mathbf{fv}\ \mathbf{imN}$		free variables
	$\mid$	$\mathit{vars}_1 \cap \mathit{vars}_2$		set intersection
	$\mid$	$\mathit{vars}_1 \cup \mathit{vars}_2$		set union
	$\mid$	$\mathit{vars}_1 \backslash \mathit{vars}_2$		set complement
	$\mid$	$\mathbf{mv}\ \mathbf{imP}$		movable variables
	$\mid$	$\mathbf{mv}\ \mathbf{imN}$		movable variables
	$\mid$	$\mathbf{uv}\ N$		unification variables

	$\vert$	$\mathbf{uv}\ P$		unification variables
	$\vert$	$\mathbf{fv}\ N$		free variables
	$\vert$	$\mathbf{fv}\ P$		free variables
	$\vert$	$(vars)$	S	parenthesis
	$\vert$	$\overrightarrow{\alpha}$		ordered list of variables
	$\vert$	$[\mu]vars$	M	apply moving to varset
	$\vert$	$\mathbf{dom}\,(\widehat{\sigma})$	M	
	$\vert$	$\mathbf{dom}\,(\widehat{\tau})$	M	
	$\vert$	$\mathbf{dom}\,(\Theta)$	M	
μ	$::=$			
	$\vert$	$\cdot$		empty moving
	$\vert$	$pma1 \mapsto pma2$		Positive unit substitution
	$\vert$	$nma1 \mapsto nma2$		Positive unit substitution
	$\vert$	$\mu_1 \cup \mu_2$	M	Set-like union of movings
	$\vert$	$\mu_1 \circ \mu_2$	M	Composition
	$\vert$	$\overline{\mu_i}^{\,i}$		concatenate movings
	$\vert$	$\mu\vert_{vars}$	M	restriction on a set
	$\vert$	μ^{-1}	M	inversion
	$\vert$	$\mathbf{nf}\,(\mu')$	M	
$\widehat{\alpha}^{\pm}$	$::=$			positive/negative unification variable
	$\vert$	$\widehat{\alpha}^{\pm}$		
$\widehat{\alpha}^{+}$	$::=$			positive unification variable
	$\vert$	$\widehat{\alpha}^{+}$		
	$\vert$	$\widehat{\alpha}^{+}\{\Delta\}$		
	$\vert$	$\widehat{\alpha}^{\pm}$		
$\widehat{\alpha}^{-},\ \widehat{\beta}^{-}$	$::=$			negative unification variable
	$\vert$	$\widehat{\alpha}^{-}$		
	$\vert$	$\widehat{\alpha}^{-}_{\{N,M\}}$		
	$\vert$	$\widehat{\alpha}^{-}\{\Delta\}$		
	$\vert$	$\widehat{\alpha}^{\pm}$		
$\overrightarrow{\widetilde{\alpha}^{+}},\ \overrightarrow{\widetilde{\beta}^{+}}$	$::=$			positive unification variable list
	$\vert$	$\cdot$		empty list
	$\vert$	$\widehat{\alpha}^{+}$		a variable
	$\vert$	$\overrightarrow{\widehat{\alpha}^{+}\{\Delta\}}$		from a normal variable
	$\vert$	$\overrightarrow{\widehat{\alpha}^{+}}$		from a normal variable, context unspecified
	$\vert$	$\overline{\overrightarrow{\widetilde{\alpha}^{+}}_{i}}^{\,i}$		concatenate lists
$\overrightarrow{\widehat{\alpha}^{-}},\ \overrightarrow{\widehat{\beta}^{-}}$	$::=$			negative unification variable list
	$\vert$	$\cdot$		empty list
	$\vert$	$\widehat{\alpha}^{-}$		a variable
	$\vert$	Ξ		from an antiunification context
	$\vert$	$\overrightarrow{\widehat{\alpha}^{-}\{\Delta\}}$		from a normal variable
	$\vert$	$\overrightarrow{\widehat{\alpha}^{-}}$		from a normal variable, context unspecified
	$\vert$	$\overline{\overrightarrow{\widehat{\alpha}^{-}}_{i}}^{\,i}$		concatenate lists

P, Q	$::=$			a positive algorithmic type (potentially with metavariables)
	$\mid$	α^{+}		
	$\mid$	$\mathbf{pma}$		
	$\mid$	$\widehat{\alpha}^{+}$		
	$\mid$	$\downarrow N$		
	$\mid$	$\exists \overrightarrow{\alpha^{-}}.\, P$		
	$\mid$	$[\sigma] P$	M	
	$\mid$	$[\widehat{\tau}] P$	M	
	$\mid$	$[\mu] P$	M	
	$\mid$	(P)	S	
	$\mid$	$\mathbf{nf}\ (P')$	M	
N, M	$::=$			a negative algorithmic type (potentially with metavariables)
	$\mid$	α^{-}		
	$\mid$	$\widehat{\alpha}^{-}$		
	$\mid$	$\uparrow P$		
	$\mid$	$P \rightarrow N$		
	$\mid$	$\forall \overrightarrow{\alpha^{+}}.\, N$		
	$\mid$	$[\sigma] N$	M	
	$\mid$	$[\widehat{\tau}] N$	M	
	$\mid$	$[\mu] N$	M	
	$\mid$	(N)	S	
	$\mid$	$\mathbf{nf}\ (N')$	M	
$auSol$	$::=$			
	$\mid$	$(\Xi, Q, \widehat{\tau}_1, \widehat{\tau}_2)$		
	$\mid$	$(\Xi, N, \widehat{\tau}_1, \widehat{\tau}_2)$		
$terminals$	$::=$			
	$\mid$	$\exists$		
	$\mid$	$\forall$		
	$\mid$	$\uparrow$		
	$\mid$	$\downarrow$		
	$\mid$	$\rightarrow$		
	$\mid$	$\leftrightarrow$		
	$\mid$	$\in$		
	$\mid$	$\notin$		
	$\mid$	$\cdot$		
	$\mid$	$\vdash$		
	$\mid$	$\leqslant$		
	$\mid$	$\geqslant$		
	$\mid$	$\simeq$		
	$\mid$	$\cup$		
	$\mid$	$\cap$		
	$\mid$	$\setminus$		
	$\mid$	$\subseteq$		
	$\mid$	$\mapsto$		
	$\mid$	$\stackrel{u}{\simeq}$		
	$\mid$	$\stackrel{a}{\simeq}$		
	$\mid$	$\varnothing$		

| $\circ$
| $\Rightarrow$
| $\models$
| $\dashv$
| $\neq$
| $\equiv_n$
| $\vee$
| $\Downarrow$
| $:\geqslant$
| $:\simeq$

formula ::=
| *judgement*
| $formula_1 \quad .. \quad formula_n$
| $\mu : vars_1 \leftrightarrow vars_2$
| μ **is bijective**
| $\widehat{\sigma}$ **is functional**
| $\widehat{\sigma}_1 \in \widehat{\sigma}_2$
| $\widehat{\sigma}_1 \subseteq \widehat{\sigma}_2$
| $vars_1 \subseteq vars_2$
| $vars_1 = vars_2$
| $vars$ **is fresh**
| $\alpha^- \notin vars$
| $\alpha^+ \notin vars$
| $\alpha^- \in vars$
| $\alpha^+ \in vars$
| $\widehat{\alpha}^+ \in vars$
| $\widehat{\alpha}^- \in vars$
| $\widehat{\alpha}^- \in \Theta$
| $\widehat{\alpha}^+ \in \Theta$
| if any other rule is not applicable
| $\vec{\alpha}_1 = \vec{\alpha}_2$
| $e_1 = e_2$
| $N = M$
| $N \neq M$
| $P \neq Q$

A ::=
| $\Gamma; \Theta \models N \leqslant M \dashv \widehat{\sigma}$ — Negative subtyping
| $\Gamma; \Theta \models P \geqslant Q \dashv \widehat{\sigma}$ — Positive supertyping

AU ::=
| $\Gamma \models P_1 \overset{a}{\simeq} P_2 \dashv (\Xi, Q, \widehat{\tau}_1, \widehat{\tau}_2)$
| $\Gamma \models N_1 \overset{a}{\simeq} N_2 \dashv (\Xi, M, \widehat{\tau}_1, \widehat{\tau}_2)$

E1 ::=
| $N \simeq_1^D M$ — Negative multi-quantified type equivalence
| $P \simeq_1^D Q$ — Positive multi-quantified type equivalence
| $P \simeq Q$

$D1$	$::=$		
	$\mid$	$\Gamma \vdash N \simeq_1^{\leqslant} M$	Negative equivalence on MQ types
	$\mid$	$\Gamma \vdash P \simeq_1^{\leqslant} Q$	Positive equivalence on MQ types
	$\mid$	$\Gamma \vdash N \leqslant_1 M$	Negative subtyping
	$\mid$	$\Gamma \vdash P \geqslant_1 Q$	Positive supertyping
	$\mid$	$\Gamma_2 \vdash \sigma_1 \simeq_1^{\leqslant} \sigma_2 : \Gamma_1$	Equivalence of substitutions
$D0$	$::=$		
	$\mid$	$\Gamma \vdash N \simeq_0^{\leqslant} M$	Negative equivalence
	$\mid$	$\Gamma \vdash P \simeq_0^{\leqslant} Q$	Positive equivalence
	$\mid$	$\Gamma \vdash N \leqslant_0 M$	Negative subtyping
	$\mid$	$\Gamma \vdash P \geqslant_0 Q$	Positive supertyping
EQ	$::=$		
	$\mid$	$N = M$	Negative type equality (alpha-equivalence)
	$\mid$	$P = Q$	Positive type equuality (alphha-equivalence)
	$\mid$	$P = Q$	
$LUBF$	$::=$		
	$\mid$	$P_1 \vee P_2 === Q$	
	$\mid$	$\mathbf{ord}\ vars\ \mathbf{in}\ P === \vec{\alpha}$	
	$\mid$	$\mathbf{ord}\ vars\ \mathbf{in}\ N === \vec{\alpha}$	
	$\mid$	$\mathbf{ord}\ vars\ \mathbf{in}\ P === \vec{\alpha}$	
	$\mid$	$\mathbf{ord}\ vars\ \mathbf{in}\ N === \vec{\alpha}$	
	$\mid$	$\mathbf{nf}\,(N') === N$	
	$\mid$	$\mathbf{nf}\,(P') === P$	
	$\mid$	$\mathbf{nf}\,(N') === N$	
	$\mid$	$\mathbf{nf}\,(P') === P$	
	$\mid$	$\mathbf{nf}\,(\vec{N}') === \vec{N}$	
	$\mid$	$\mathbf{nf}\,(\vec{P}') === \vec{P}$	
	$\mid$	$\mathbf{nf}\,(\sigma') === \sigma$	
	$\mid$	$\mathbf{nf}\,(\mu') === \mu$	
	$\mid$	$\mathbf{nf}\,(\widehat{\sigma}') === \widehat{\sigma}$	
	$\mid$	$\sigma'\rvert_{vars}$	
	$\mid$	$\widehat{\sigma}'\rvert_{vars}$	
	$\mid$	$\widehat{\tau}'\rvert_{vars}$	
	$\mid$	$\Xi'\rvert_{vars}$	
	$\mid$	$e_1\ \&\ e_2$	
	$\mid$	$\widehat{\sigma}_1\ \&\ \widehat{\sigma}_2$	
	$\mid$	$\widehat{\tau}_1\ \&\ \widehat{\tau}_2$	
	$\mid$	$\mathbf{dom}\,(\widehat{\sigma}) === vars$	
	$\mid$	$\mathbf{dom}\,(\widehat{\tau}) === vars$	
	$\mid$	$\mathbf{dom}\,(\Theta) === vars$	
LUB	$::=$		
	$\mid$	$\Gamma \vDash P_1 \vee P_2 = Q$	Least Upper Bound (Least Common Supertype)
	$\mid$	$\mathbf{upgrade}\,\Gamma \vdash P\ \mathbf{to}\ \Delta = Q$	
Nrm	$::=$		
	$\mid$	$\mathbf{nf}\,(N) = M$	

	|	$\mathbf{nf}\,(P) = Q$	
	|	$\mathbf{nf}\,(\boxed{N}) = \boxed{M}$	
	|	$\mathbf{nf}\,(\boxed{P}) = \boxed{Q}$	
Order	::=		
	|	$\mathbf{ord}\; vars\; \mathbf{in}\; N = \vec{\alpha}$	
	|	$\mathbf{ord}\; vars\; \mathbf{in}\; P = \vec{\alpha}$	
	|	$\mathbf{ord}\; vars\; \mathbf{in}\; \boxed{N} = \vec{\alpha}$	
	|	$\mathbf{ord}\; vars\; \mathbf{in}\; \boxed{P} = \vec{\alpha}$	
SM	::=		
	|	$\Gamma \vdash e_1 \;\&\; e_2 = e_3$	Unification Solution Entry Merge
	|	$\Theta \vdash \widehat{\sigma}_1 \& \widehat{\sigma}_2 = \widehat{\sigma}_3$	Merge unification solutions
SImp	::=		
	|	$\Gamma \vdash e_1 \Rightarrow e_2$	Weakening of unification solution entries
	|	$\Theta \vdash \widehat{\sigma}_1 \Rightarrow \widehat{\sigma}_2$	Weakening of unification solutions
	|	$\Gamma \vdash e_1 \simeq e_2$	
	|	$\Theta \vdash \widehat{\sigma}_1 \simeq \widehat{\sigma}_2$	
U	::=		
	|	$\Gamma; \Theta \models \boxed{N} \overset{u}{\simeq} M \dashv \widehat{\sigma}$	Negative unification
	|	$\Gamma; \Theta \models \boxed{P} \overset{u}{\simeq} Q \dashv \widehat{\sigma}$	Positive unification
WF	::=		
	|	$\Gamma \vdash N$	Negative type well-formedness
	|	$\Gamma \vdash P$	Positive type well-formedness
	|	$\Gamma \vdash N$	Negative type well-formedness
	|	$\Gamma \vdash P$	Positive type well-formedness
	|	$\Gamma \vdash \vec{N}$	Negative type list well-formedness
	|	$\Gamma \vdash \vec{P}$	Positive type list well-formedness
	|	$\Gamma; \Theta \vdash \boxed{N}$	Negative unification type well-formedness
	|	$\Gamma; \Theta \vdash \boxed{P}$	Positive unifiication type well-formedness
	|	$\Gamma; \Xi \vdash \boxed{N}$	Negative anti-unification type well-formedness
	|	$\Gamma; \Xi \vdash \boxed{P}$	Positive anti-unification type well-formedness
	|	$\Gamma; \Xi_2 \vdash \widehat{\tau} : \Xi_1$	Antiunification substitution well-formedness
	|	$\widehat{\sigma} : \Theta$	Unification substitution well-formedness
	|	$\Gamma \vdash^{\supseteq} \Theta$	Unification context well-formedness
	|	$\Gamma_1 \vdash \sigma : \Gamma_2$	Substitution well-formedness
	|	$\Gamma \vdash e$	Unification solution entry well-formedness
judgement	::=		
	|	*A*	
	|	*AU*	
	|	*E1*	
	|	*D1*	
	|	*D0*	
	|	*EQ*	
	|	*LUB*	

	$\mid$	Nrm
	$\mid$	$Order$
	$\mid$	SM
	$\mid$	$SImp$
	$\mid$	U
	$\mid$	WF
$user\_syntax$	$::=$	
	$\mid$	α
	$\mid$	n
	$\mid$	n
	$\mid$	α^{+}
	$\mid$	α^{-}
	$\mid$	$\alpha^{\pm}$
	$\mid$	σ
	$\mid$	e
	$\mid$	$\widehat{\sigma}$
	$\mid$	$\widehat{\tau}$
	$\mid$	P
	$\mid$	N
	$\mid$	$\overrightarrow{\alpha^{+}}$
	$\mid$	$\overrightarrow{\alpha^{-}}$
	$\mid$	$\overrightarrow{\alpha^{\pm}}$
	$\mid$	P
	$\mid$	N
	$\mid$	$\vec{P}$
	$\mid$	$\vec{N}$
	$\mid$	Γ
	$\mid$	Θ
	$\mid$	Ξ
	$\mid$	$\vec{\alpha}$
	$\mid$	$vars$
	$\mid$	μ
	$\mid$	$\widehat{\alpha}^{\pm}$
	$\mid$	$\widehat{\alpha}^{+}$
	$\mid$	$\widehat{\alpha}^{-}$
	$\mid$	$\overrightarrow{\widetilde{\alpha^{+}}}$
	$\mid$	$\overrightarrow{\widehat{\alpha^{-}}}$
	$\mid$	P
	$\mid$	N
	$\mid$	$auSol$
	$\mid$	$terminals$
	$\mid$	$formula$

$\boxed{\Gamma;\,\Theta \models N \leqslant M \dashv \widehat{\sigma}}$ Negative subtyping

$$\frac{}{\Gamma;\,\Theta \models \alpha^{-} \leqslant \alpha^{-} \dashv \cdot}\quad \text{ANV}\textsc{ar}$$

$$\frac{\Gamma;\Theta \models \mathbf{nf}\,(P) \stackrel{u}{\simeq} \mathbf{nf}\,(Q) \dashv \widehat{\sigma}}{\Gamma;\,\Theta \models {\uparrow}P \leqslant {\uparrow}Q \dashv \widehat{\sigma}}\quad \text{AS}\textsc{hift}\text{U}$$

$$\frac{\Gamma;\, \Theta \vDash P \geqslant Q \dashv \widehat{\sigma}_1 \quad \Gamma;\, \Theta \vDash N \leqslant M \dashv \widehat{\sigma}_2}{\Gamma;\, \Theta \vDash P \to N \leqslant Q \to M \dashv \widehat{\sigma}_1 \,\&\, \widehat{\sigma}_2}\ \textsc{AArrow}$$

$$\frac{\Gamma, \overrightarrow{\beta^+};\, \Theta, \overrightarrow{\widehat{\alpha}^+\{\Gamma, \overrightarrow{\beta^+}\}} \vDash [\overrightarrow{\widehat{\alpha}^+}/\overrightarrow{\alpha^+}]N \leqslant M \dashv \widehat{\sigma}}{\Gamma;\, \Theta \vDash \forall\overrightarrow{\alpha^+}.N \leqslant \forall\overrightarrow{\beta^+}.M \dashv \widehat{\sigma}\backslash\overrightarrow{\widehat{\alpha}^+}}\ \textsc{AForall}$$

$\boxed{\Gamma;\, \Theta \vDash P \geqslant Q \dashv \widehat{\sigma}}$ Positive supertyping

$$\frac{}{\Gamma;\, \Theta \vDash \alpha^+ \geqslant \alpha^+ \dashv \cdot}\ \textsc{APVar}$$

$$\frac{\Gamma; \Theta \vDash \mathbf{nf}\,(N) \overset{u}{\simeq} \mathbf{nf}\,(M) \dashv \widehat{\sigma}}{\Gamma;\, \Theta \vDash {\downarrow}N \geqslant {\downarrow}M \dashv \widehat{\sigma}}\ \textsc{AShiftD}$$

$$\frac{\Gamma, \overrightarrow{\beta^-};\, \Theta, \overrightarrow{\widehat{\alpha}^-\{\Gamma, \overrightarrow{\beta^-}\}} \vDash [\overrightarrow{\widehat{\alpha}^-}/\overrightarrow{\alpha^-}]P \geqslant Q \dashv \widehat{\sigma}}{\Gamma;\, \Theta \vDash \exists\overrightarrow{\alpha^-}.P \geqslant \exists\overrightarrow{\beta^-}.Q \dashv \widehat{\sigma}\backslash\overrightarrow{\widehat{\alpha}^-}}\ \textsc{AExists}$$

$$\frac{\widehat{\alpha}^+\{\Delta\} \in \Theta \quad \mathbf{upgrade}\,\Gamma \vdash P\,\mathbf{to}\,\Delta = Q}{\Gamma;\, \Theta \vDash \widehat{\alpha}^+ \geqslant P \dashv (\widehat{\alpha}^+ :\geqslant Q)}\ \textsc{APUVar}$$

$\boxed{\Gamma \vDash P_1 \overset{a}{\simeq} P_2 \dashv (\Xi, Q, \widehat{\tau}_1, \widehat{\tau}_2)}$

$$\frac{}{\Gamma \vDash \alpha^+ \overset{a}{\simeq} \alpha^+ \dashv (\cdot, \alpha^+, \cdot, \cdot)}\ \textsc{AUPVar}$$

$$\frac{\Gamma \vDash N_1 \overset{a}{\simeq} N_2 \dashv (\Xi, M, \widehat{\tau}_1, \widehat{\tau}_2)}{\Gamma \vDash {\downarrow}N_1 \overset{a}{\simeq} {\downarrow}N_2 \dashv (\Xi, {\downarrow}M, \widehat{\tau}_1, \widehat{\tau}_2)}\ \textsc{AUShiftD}$$

$$\frac{\overrightarrow{\alpha^-} \cap \Gamma = \varnothing \quad \Gamma \vDash P_1 \overset{a}{\simeq} P_2 \dashv (\Xi, Q, \widehat{\tau}_1, \widehat{\tau}_2)}{\Gamma \vDash \exists\overrightarrow{\alpha^-}.P_1 \overset{a}{\simeq} \exists\overrightarrow{\alpha^-}.P_2 \dashv (\Xi, \exists\overrightarrow{\alpha^-}.Q, \widehat{\tau}_1, \widehat{\tau}_2)}\ \textsc{AUExists}$$

$\boxed{\Gamma \vDash N_1 \overset{a}{\simeq} N_2 \dashv (\Xi, M, \widehat{\tau}_1, \widehat{\tau}_2)}$

$$\frac{}{\Gamma \vDash \alpha^- \overset{a}{\simeq} \alpha^- \dashv (\cdot, \alpha^-, \cdot, \cdot)}\ \textsc{AUNVar}$$

$$\frac{\Gamma \vDash P_1 \overset{a}{\simeq} P_2 \dashv (\Xi, Q, \widehat{\tau}_1, \widehat{\tau}_2)}{\Gamma \vDash {\uparrow}P_1 \overset{a}{\simeq} {\uparrow}P_2 \dashv (\Xi, {\uparrow}Q, \widehat{\tau}_1, \widehat{\tau}_2)}\ \textsc{AUShiftU}$$

$$\frac{\overrightarrow{\alpha^+} \cap \Gamma = \varnothing \quad \Gamma \vDash N_1 \overset{a}{\simeq} N_2 \dashv (\Xi, M, \widehat{\tau}_1, \widehat{\tau}_2)}{\Gamma \vDash \forall\overrightarrow{\alpha^+}.N_1 \overset{a}{\simeq} \forall\overrightarrow{\alpha^+}.N_2 \dashv (\Xi, \forall\overrightarrow{\alpha^+}.M, \widehat{\tau}_1, \widehat{\tau}_2)}\ \textsc{AUForall}$$

$$\frac{\Gamma \vDash P_1 \overset{a}{\simeq} P_2 \dashv (\Xi_1, Q, \widehat{\tau}_1, \widehat{\tau}_2) \quad \Gamma \vDash N_1 \overset{a}{\simeq} N_2 \dashv (\Xi_2, M, \widehat{\tau}_1', \widehat{\tau}_2')}{\Gamma \vDash P_1 \to N_1 \overset{a}{\simeq} P_2 \to N_2 \dashv (\Xi_1 \cup \Xi_2, Q \to M, \widehat{\tau}_1 \,\&\, \widehat{\tau}_1', \widehat{\tau}_2 \,\&\, \widehat{\tau}_2')}\ \textsc{AUArrow}$$

$$\frac{\text{if any other rule is not applicable} \quad \Gamma \vdash N \quad \Gamma \vdash M}{\Gamma \vDash N \overset{a}{\simeq} M \dashv (\widehat{\alpha}^-_{\{N,M\}}, \widehat{\alpha}^-_{\{N,M\}}, (\widehat{\alpha}^-_{\{N,M\}} :\approx N), (\widehat{\alpha}^-_{\{N,M\}} :\approx M))}\ \textsc{AUAU}$$

$\boxed{N \simeq_1^D M}$ Negative multi-quantified type equivalence

$$\frac{}{\alpha^- \simeq_1^D \alpha^-}\ \textsc{E1NVar}$$

$$\frac{P \simeq_1^D Q}{{\uparrow}P \simeq_1^D {\uparrow}Q}\ \textsc{E1ShiftU}$$

$$\frac{P \simeq_1^D Q \quad N \simeq_1^D M}{P \to N \simeq_1^D Q \to M} \quad \text{E1Arrow}$$

$$\frac{\overrightarrow{\alpha^+} \cap \mathbf{fv}\, M = \varnothing \quad \mu : (\overrightarrow{\beta^+} \cap \mathbf{fv}\, M) \leftrightarrow (\overrightarrow{\alpha^+} \cap \mathbf{fv}\, N) \quad N \simeq_1^D [\mu]M}{\forall\overrightarrow{\alpha^+}.N \simeq_1^D \forall\overrightarrow{\beta^+}.M} \quad \text{E1Forall}$$

$\boxed{P \simeq_1^D Q}$ Positive multi-quantified type equivalence

$$\frac{}{\alpha^+ \simeq_1^D \alpha^+} \quad \text{E1PVar}$$

$$\frac{N \simeq_1^D M}{\downarrow N \simeq_1^D \downarrow M} \quad \text{E1ShiftD}$$

$$\frac{\overrightarrow{\alpha^-} \cap \mathbf{fv}\, Q = \varnothing \quad \mu : (\overrightarrow{\beta^-} \cap \mathbf{fv}\, Q) \leftrightarrow (\overrightarrow{\alpha^-} \cap \mathbf{fv}\, P) \quad P \simeq_1^D [\mu]Q}{\exists\overrightarrow{\alpha^-}.P \simeq_1^D \exists\overrightarrow{\beta^-}.Q} \quad \text{E1Exists}$$

$\boxed{P \simeq Q}$

$\boxed{\Gamma \vdash N \simeq_1^{\leqslant} M}$ Negative equivalence on MQ types

$$\frac{\Gamma \vdash N \leqslant_1 M \quad \Gamma \vdash M \leqslant_1 N}{\Gamma \vdash N \simeq_1^{\leqslant} M} \quad \text{D1NDef}$$

$\boxed{\Gamma \vdash P \simeq_1^{\leqslant} Q}$ Positive equivalence on MQ types

$$\frac{\Gamma \vdash P \geqslant_1 Q \quad \Gamma \vdash Q \geqslant_1 P}{\Gamma \vdash P \simeq_1^{\leqslant} Q} \quad \text{D1PDef}$$

$\boxed{\Gamma \vdash N \leqslant_1 M}$ Negative subtyping

$$\frac{}{\Gamma \vdash \alpha^- \leqslant_1 \alpha^-} \quad \text{D1NVar}$$

$$\frac{\texttt{<<multiple parses>>}}{\Gamma \vdash \uparrow P \leqslant_1 \uparrow Q} \quad \text{D1ShiftU}$$

$$\frac{\Gamma \vdash P \geqslant_1 Q \quad \Gamma \vdash N \leqslant_1 M}{\Gamma \vdash P \to N \leqslant_1 Q \to M} \quad \text{D1Arrow}$$

$$\frac{\mathbf{fv}\, N \cap \overrightarrow{\beta^+} = \varnothing \quad \Gamma, \overrightarrow{\beta^+} \vdash P_i \quad \Gamma, \overrightarrow{\beta^+} \vdash [\overrightarrow{P}/\overrightarrow{\alpha^+}]N \leqslant_1 M}{\Gamma \vdash \forall\overrightarrow{\alpha^+}.N \leqslant_1 \forall\overrightarrow{\beta^+}.M} \quad \text{D1Forall}$$

$\boxed{\Gamma \vdash P \geqslant_1 Q}$ Positive supertyping

$$\frac{}{\Gamma \vdash \alpha^+ \geqslant_1 \alpha^+} \quad \text{D1PVar}$$

$$\frac{\texttt{<<multiple parses>>}}{\Gamma \vdash \downarrow N \geqslant_1 \downarrow M} \quad \text{D1ShiftD}$$

$$\frac{\mathbf{fv}\, P \cap \overrightarrow{\beta^-} = \varnothing \quad \Gamma, \overrightarrow{\beta^-} \vdash N_i \quad \Gamma, \overrightarrow{\beta^-} \vdash [\overrightarrow{N}/\overrightarrow{\alpha^-}]P \geqslant_1 Q}{\Gamma \vdash \exists\overrightarrow{\alpha^-}.P \geqslant_1 \exists\overrightarrow{\beta^-}.Q} \quad \text{D1Exists}$$

$\boxed{\Gamma_2 \vdash \sigma_1 \simeq_1^{\leqslant} \sigma_2 : \Gamma_1}$ Equivalence of substitutions

$\boxed{\Gamma \vdash N \simeq_0^{\leqslant} M}$ Negative equivalence

$$\frac{\Gamma \vdash N \leqslant_0 M \quad \Gamma \vdash M \leqslant_0 N}{\Gamma \vdash N \simeq_0^{\leqslant} M} \quad \text{D0NDef}$$

$\boxed{\Gamma \vdash P \simeq_0^{\leqslant} Q}$ Positive equivalence

$$\frac{\Gamma \vdash P \geqslant_0 Q \quad \Gamma \vdash Q \geqslant_0 P}{\Gamma \vdash P \simeq_0^{\leqslant} Q} \quad \text{D0PDef}$$

$\boxed{\Gamma \vdash N \leqslant_0 M}$ Negative subtyping

$$\frac{}{\Gamma \vdash \alpha^- \leqslant_0 \alpha^-} \quad \text{D0NVar}$$

$$\frac{\Gamma \vdash P \simeq_0^{\leqslant} Q}{\Gamma \vdash \uparrow P \leqslant_0 \uparrow Q} \quad \text{D0ShiftU}$$

$$\frac{\Gamma \vdash P \quad \Gamma \vdash [P/\alpha^+]N \leqslant_0 M \quad M \neq \forall \beta^+.M'}{\Gamma \vdash \forall \alpha^+.N \leqslant_0 M} \quad \text{D0ForallL}$$

$$\frac{\Gamma, \alpha^+ \vdash N \leqslant_0 M}{\Gamma \vdash N \leqslant_0 \forall \alpha^+.M} \quad \text{D0ForallR}$$

$$\frac{\Gamma \vdash P \geqslant_0 Q \quad \Gamma \vdash N \leqslant_0 M}{\Gamma \vdash P \to N \leqslant_0 Q \to M} \quad \text{D0Arrow}$$

$\boxed{\Gamma \vdash P \geqslant_0 Q}$ Positive supertyping

$$\frac{}{\Gamma \vdash \alpha^+ \geqslant_0 \alpha^+} \quad \text{D0PVar}$$

$$\frac{\Gamma \vdash N \simeq_0^{\leqslant} M}{\Gamma \vdash \downarrow N \geqslant_0 \downarrow M} \quad \text{D0ShiftD}$$

$$\frac{\Gamma \vdash N \quad \Gamma \vdash [N/\alpha^-]P \geqslant_0 Q \quad Q \neq \exists \alpha^-.Q'}{\Gamma \vdash \exists \alpha^-.P \geqslant_0 Q} \quad \text{D0ExistsL}$$

$$\frac{\Gamma, \alpha^- \vdash P \geqslant_0 Q}{\Gamma \vdash P \geqslant_0 \exists \alpha^-.Q} \quad \text{D0ExistsR}$$

$\boxed{N = M}$ Negative type equality (alpha-equivalence)

$\boxed{P = Q}$ Positive type equuality (alphha-equivalence)

$\boxed{P = Q}$

$\boxed{P_1 \vee P_2}$

$\boxed{\mathbf{ord}\, vars\, \mathbf{in}\, P}$

$\boxed{\mathbf{ord}\, vars\, \mathbf{in}\, N}$

$\boxed{\mathbf{ord}\, vars\, \mathbf{in}\, P}$

$\boxed{\mathbf{ord}\, vars\, \mathbf{in}\, N}$

$\boxed{\mathbf{nf}\,(N')}$

$\boxed{\mathbf{nf}\,(P')}$

$\boxed{\mathbf{nf}\,(N')}$

$\boxed{\mathbf{nf}\,(P')}$

$\boxed{\mathbf{nf}\,(\overrightarrow{N}')}$

$\boxed{\mathbf{nf}\,(\overrightarrow{P}')}$

$\boxed{\mathbf{nf}\,(\sigma')}$

$\boxed{\mathbf{nf}\,(\mu')}$

$\boxed{\mathbf{nf}\,(\widehat{\sigma}')}$

$\boxed{\sigma'|_{vars}}$

$\boxed{\widehat{\sigma}'|_{vars}}$

$\boxed{\widehat{\tau}'|_{vars}}$

$\boxed{\Xi'|_{vars}}$

$\boxed{e_1 \ \& \ e_2}$

$\boxed{\widehat{\sigma}_1 \ \& \ \widehat{\sigma}_2}$

$\boxed{\widehat{\tau}_1 \ \& \ \widehat{\tau}_2}$

$\boxed{\mathbf{dom}\,(\widehat{\sigma})}$

$\boxed{\mathbf{dom}\,(\widehat{\tau})}$

$\boxed{\mathbf{dom}\,(\Theta)}$

$\boxed{\Gamma \vDash P_1 \vee P_2 = Q}$ Least Upper Bound (Least Common Supertype)

$$\frac{}{\Gamma \vDash \alpha^+ \vee \alpha^+ = \alpha^+} \quad \text{LUBVar}$$

$$\frac{\Gamma, \cdot \vDash \mathbf{nf}\,(\downarrow N) \overset{a}{\simeq} \mathbf{nf}\,(\downarrow M) \dashv (\Xi, P, \widehat{\tau}_1, \widehat{\tau}_2)}{\Gamma \vDash \downarrow N \vee \downarrow M = \exists \overrightarrow{\alpha^-}.[\overrightarrow{\alpha^-}/\Xi]\,P} \quad \text{LUBShift}$$

$$\frac{\Gamma, \overrightarrow{\alpha^-}, \overrightarrow{\beta^-} \vDash P_1 \vee P_2 = Q}{\Gamma \vDash \exists \overrightarrow{\alpha^-}.P_1 \vee \exists \overrightarrow{\beta^-}.P_2 = Q} \quad \text{LUBExists}$$

$\boxed{\mathbf{upgrade}\,\Gamma \vdash P\,\mathbf{to}\,\Delta = Q}$

$$\frac{\Gamma = \Delta, \overrightarrow{\alpha^\pm} \quad \overrightarrow{\beta^\pm}\,\textbf{is fresh} \quad \overrightarrow{\gamma^\pm}\,\textbf{is fresh} \quad \Delta, \overrightarrow{\beta^\pm}, \overrightarrow{\gamma^\pm} \vDash [\overrightarrow{\beta^\pm}/\overrightarrow{\alpha^\pm}]P \vee [\overrightarrow{\gamma^\pm}/\overrightarrow{\alpha^\pm}]P = Q}{\mathbf{upgrade}\,\Gamma \vdash P\,\mathbf{to}\,\Delta = Q} \quad \text{LUBUpgrade}$$

$\boxed{\mathbf{nf}\,(N) = M}$

$$\frac{}{\mathbf{nf}\,(\alpha^-) = \alpha^-} \quad \text{NrmNVar}$$

$$\frac{\texttt{<<multiple parses>>}}{\mathbf{nf}\,(\uparrow P) = \uparrow Q} \quad \text{NrmShiftU}$$

$$\frac{\texttt{<<multiple parses>>}}{\mathbf{nf}\,(P \to N) = Q \to M} \quad \text{NrmArrow}$$

$$\frac{\texttt{<<multiple parses>>}}{\mathbf{nf}\,(\forall \overrightarrow{\alpha^+}.N) = \forall \overrightarrow{\alpha^+}'.N'} \quad \text{NrmForall}$$

$\boxed{\mathbf{nf}\,(P) = Q}$

$$\frac{}{\mathbf{nf}\,(\alpha^+) = \alpha^+} \quad \text{NrmPVar}$$

$$\frac{\texttt{<<multiple parses>>}}{\mathbf{nf}\,(\downarrow N) = \downarrow M} \quad \text{NrmShiftD}$$

$$\frac{\texttt{<<multiple parses>>}}{\mathbf{nf}\,(\exists \overrightarrow{\alpha^-}.P) = \exists \overrightarrow{\alpha^-}'.P'} \quad \text{NrmExists}$$

$\boxed{\mathbf{nf}\,(N) = M}$

$$\frac{}{\mathbf{nf}\,(\widehat{\alpha}^-) = \widehat{\alpha}^-}\ \textsc{NrmNUVar}$$

$\boxed{\mathbf{nf}\,(P) = Q}$

$$\frac{}{\mathbf{nf}\,(\widehat{\alpha}^+) = \widehat{\alpha}^+}\ \textsc{NrmPUVar}$$

$\boxed{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,N = \vec{\alpha}}$

$$\frac{\alpha^- \in \mathit{vars}}{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,\alpha^- = \alpha^-}\ \textsc{ONVarIn}$$

$$\frac{\alpha^- \notin \mathit{vars}}{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,\alpha^- = \cdot}\ \textsc{ONVarNIn}$$

$$\frac{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,P = \vec{\alpha}}{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,\uparrow P = \vec{\alpha}}\ \textsc{OShiftU}$$

$$\frac{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,P = \vec{\alpha}_1 \quad \mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,N = \vec{\alpha}_2}{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,P \to N = \vec{\alpha}_1, (\vec{\alpha}_2 \backslash \vec{\alpha}_1)}\ \textsc{OArrow}$$

$$\frac{\mathit{vars} \cap \overrightarrow{\alpha^+} = \varnothing \quad \mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,N = \vec{\alpha}}{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,\forall\overrightarrow{\alpha^+}.N = \vec{\alpha}}\ \textsc{OForall}$$

$\boxed{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,P = \vec{\alpha}}$

$$\frac{\alpha^+ \in \mathit{vars}}{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,\alpha^+ = \alpha^+}\ \textsc{OPVarIn}$$

$$\frac{\alpha^+ \notin \mathit{vars}}{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,\alpha^+ = \cdot}\ \textsc{OPVarNIn}$$

$$\frac{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,N = \vec{\alpha}}{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,\downarrow N = \vec{\alpha}}\ \textsc{OShiftD}$$

$$\frac{\mathit{vars} \cap \overrightarrow{\alpha^-} = \varnothing \quad \mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,P = \vec{\alpha}}{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,\exists\overrightarrow{\alpha^-}.P = \vec{\alpha}}\ \textsc{OExists}$$

$\boxed{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,N = \vec{\alpha}}$

$$\frac{}{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,\widehat{\alpha}^- = \cdot}\ \textsc{ONUVar}$$

$\boxed{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,P = \vec{\alpha}}$

$$\frac{}{\mathbf{ord}\,\mathit{vars}\,\mathbf{in}\,\widehat{\alpha}^+ = \cdot}\ \textsc{OPUVar}$$

$\boxed{\Gamma \vdash e_1 \,\&\, e_2 = e_3}$ Unification Solution Entry Merge

$$\frac{\Gamma \vDash P_1 \vee P_2 = Q}{\Gamma \vdash (\widehat{\alpha}^+ :\geqslant P_1) \,\&\, (\widehat{\alpha}^+ :\geqslant P_2) = (\widehat{\alpha}^+ :\geqslant Q)}\ \textsc{SMESupSup}$$

$$\frac{\Gamma; \cdot \vDash P \geqslant Q \dashv \widehat{\sigma}'}{\Gamma \vdash (\widehat{\alpha}^+ :\approx P) \,\&\, (\widehat{\alpha}^+ :\geqslant Q) = (\widehat{\alpha}^+ :\approx P)}\ \textsc{SMEEqSup}$$

$$\frac{\Gamma; \cdot \vDash Q \geqslant P \dashv \widehat{\sigma}'}{\Gamma \vdash (\widehat{\alpha}^+ :\geqslant P) \,\&\, (\widehat{\alpha}^+ :\approx Q) = (\widehat{\alpha}^+ :\approx Q)}\ \textsc{SMESupEq}$$

$$\frac{\text{<<multiple parses>>}}{\Gamma \vdash (\widehat{\alpha}^+ :\approx P) \mathbin{\&} (\widehat{\alpha}^+ :\approx P') = (\widehat{\alpha}^+ :\approx P)} \quad \textsc{SMEPEqEq}$$

$$\frac{\text{<<multiple parses>>}}{\Gamma \vdash (\widehat{\alpha}^- :\approx N_1) \mathbin{\&} (\widehat{\alpha}^- :\approx N') = (\widehat{\alpha}^- :\approx N)} \quad \textsc{SMENEqEq}$$

$\boxed{\Theta \vdash \widehat{\sigma}_1 \& \widehat{\sigma}_2 = \widehat{\sigma}_3}$ Merge unification solutions

$\boxed{\Gamma \vdash e_1 \Rightarrow e_2}$ Weakening of unification solution entries

$$\frac{\Gamma \vdash P_1 \geqslant_1 P_2}{\Gamma \vdash (\widehat{\alpha}^+ :\geqslant P_1) \Rightarrow (\widehat{\alpha}^+ :\geqslant P_2)} \quad \textsc{SImpESupSup}$$

$$\frac{\Gamma \vdash P_1 \geqslant_1 P_2}{\Gamma \vdash (\widehat{\alpha}^+ :\approx P_1) \Rightarrow (\widehat{\alpha}^+ :\geqslant P_2)} \quad \textsc{SImpEEqSup}$$

$$\frac{\text{<<multiple parses>>}}{\Gamma \vdash (\widehat{\alpha}^+ :\approx P_1) \Rightarrow (\widehat{\alpha}^+ :\approx P_2)} \quad \textsc{SImpEPEqEq}$$

$$\frac{\text{<<multiple parses>>}}{\Gamma \vdash (\widehat{\alpha}^- :\approx N_1) \Rightarrow (\widehat{\alpha}^- :\approx N_2)} \quad \textsc{SImpENEqEq}$$

$\boxed{\Theta \vdash \widehat{\sigma}_1 \Rightarrow \widehat{\sigma}_2}$ Weakening of unification solutions

$\boxed{\Gamma \vdash e_1 \simeq e_2}$

$$\frac{\text{<<multiple parses>>}}{\Gamma \vdash (\widehat{\alpha}^+ :\geqslant P_1) \simeq (\widehat{\alpha}^+ :\geqslant P_2)} \quad \textsc{SImpEEqSupSup}$$

$$\frac{\text{<<multiple parses>>}}{\Gamma \vdash (\widehat{\alpha}^+ :\approx P_1) \simeq (\widehat{\alpha}^+ :\approx P_2)} \quad \textsc{SImpEEqPEqEq}$$

$$\frac{\text{<<multiple parses>>}}{\Gamma \vdash (\widehat{\alpha}^- :\approx N_1) \simeq (\widehat{\alpha}^- :\approx N_2)} \quad \textsc{SImpEEqNEqEq}$$

$\boxed{\Theta \vdash \widehat{\sigma}_1 \simeq \widehat{\sigma}_2}$

$\boxed{\Gamma; \Theta \models N \overset{u}{\simeq} M \dashv \widehat{\sigma}}$ Negative unification

$$\frac{}{\Gamma; \Theta \models \alpha^- \overset{u}{\simeq} \alpha^- \dashv \cdot} \quad \textsc{UNVar}$$

$$\frac{\Gamma; \Theta \models P \overset{u}{\simeq} Q \dashv \widehat{\sigma}}{\Gamma; \Theta \models \uparrow P \overset{u}{\simeq} \uparrow Q \dashv \widehat{\sigma}} \quad \textsc{UShiftU}$$

$$\frac{\Gamma; \Theta \models P \overset{u}{\simeq} Q \dashv \widehat{\sigma}_1 \quad \Gamma; \Theta \models N \overset{u}{\simeq} M \dashv \widehat{\sigma}_2}{\Gamma; \Theta \models P \to N \overset{u}{\simeq} Q \to M \dashv \widehat{\sigma}_1 \mathbin{\&} \widehat{\sigma}_2} \quad \textsc{UArrow}$$

$$\frac{\Gamma, \overrightarrow{\alpha^+}; \Theta \models N \overset{u}{\simeq} M \dashv \widehat{\sigma}}{\Gamma; \Theta \models \forall \overrightarrow{\alpha^+}. N \overset{u}{\simeq} \forall \overrightarrow{\alpha^+}. M \dashv \widehat{\sigma}} \quad \textsc{UForall}$$

$$\frac{\widehat{\alpha}^-\{\Delta\} \in \Theta \quad \Delta \vdash N}{\Gamma; \Theta \models \widehat{\alpha}^- \overset{u}{\simeq} N \dashv (\widehat{\alpha}^- :\approx N)} \quad \textsc{UNUVar}$$

$\boxed{\Gamma; \Theta \models P \overset{u}{\simeq} Q \dashv \widehat{\sigma}}$ Positive unification

$$\frac{}{\Gamma; \Theta \models \alpha^+ \overset{u}{\simeq} \alpha^+ \dashv \cdot} \quad \textsc{UPVar}$$

$$\frac{\Gamma; \Theta \models N \overset{u}{\simeq} M \dashv \widehat{\sigma}}{\Gamma; \Theta \models \downarrow N \overset{u}{\simeq} \downarrow M \dashv \widehat{\sigma}} \quad \textsc{UShiftD}$$

$$\frac{\Gamma, \overrightarrow{\alpha^-}; \Theta \models P \overset{u}{\simeq} Q \dashv \widehat{\sigma}}{\Gamma; \Theta \models \exists \overrightarrow{\alpha^-}. P \overset{u}{\simeq} \exists \overrightarrow{\alpha^-}. Q \dashv \widehat{\sigma}} \quad \text{UEXISTS}$$

$$\frac{\widehat{\alpha}^+\{\Delta\} \in \Theta \quad \Delta \vdash P}{\Gamma; \Theta \models \widehat{\alpha}^+ \overset{u}{\simeq} P \dashv (\widehat{\alpha}^+ :\approx P)} \quad \text{UPUVAR}$$

$\boxed{\Gamma \vdash N}$ Negative type well-formedness
$\boxed{\Gamma \vdash P}$ Positive type well-formedness
$\boxed{\Gamma \vdash N}$ Negative type well-formedness
$\boxed{\Gamma \vdash P}$ Positive type well-formedness
$\boxed{\Gamma \vdash \overrightarrow{N}}$ Negative type list well-formedness
$\boxed{\Gamma \vdash \overrightarrow{P}}$ Positive type list well-formedness
$\boxed{\Gamma; \Theta \vdash N}$ Negative unification type well-formedness
$\boxed{\Gamma; \Theta \vdash P}$ Positive unifiication type well-formedness
$\boxed{\Gamma; \Xi \vdash N}$ Negative anti-unification type well-formedness
$\boxed{\Gamma; \Xi \vdash P}$ Positive anti-unification type well-formedness
$\boxed{\Gamma; \Xi_2 \vdash \widehat{\tau} : \Xi_1}$ Antiunification substitution well-formedness
$\boxed{\widehat{\sigma} : \Theta}$ Unification substitution well-formedness
$\boxed{\Gamma \vdash^{\supseteq} \Theta}$ Unification context well-formedness
$\boxed{\Gamma_1 \vdash \sigma : \Gamma_2}$ Substitution well-formedness
$\boxed{\Gamma \vdash e}$ Unification solution entry well-formedness

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Definition rules:        74 good    14 bad
Definition rule clauses: 144 good    14 bad
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