1 Syntax

1.1 Source Syntax

Types	T	$::=$	$\alpha \mid \top \mid \tau_1 \to \tau_2 \mid \forall\alpha.\,\tau \mid \tau_1 \,\&\, \tau_2 \mid \{\mathsf{l}{:}\tau\}$
Expressions	E	$::=$	$x \mid \top \mid \lambda(x{:}\tau).\,e \mid e_1\ e_2 \mid \Lambda\alpha.\,e \mid e\ \tau \mid e_1,,e_2 \mid \{\mathsf{l} = e\} \mid e.\mathsf{l} \mid e \setminus \mathsf{l}$
		$\mid$	$\mathtt{sig}\ s[\overline{\alpha}]\ \mathtt{where}\ \overline{\mathsf{l} : \tau}\ \mathtt{in}\ e$
		$\mid$	$\mathtt{sig}\ s_1[\overline{\alpha_1}]\ \mathtt{extends}\ \overline{s_2[\overline{\alpha}]}\ \mathtt{where}\ \overline{\mathsf{l} : \tau}\ \mathtt{in}\ e$
		$\mid$	$\mathtt{algebra}\ x\ \mathtt{implements}\ \overline{s[\overline{\tau}]}\ \mathtt{where}\ \overline{\mathsf{l}@(\mathsf{l}_1\ \overline{x_1}) = e_1}\ \mathtt{in}\ e$
		$\mid$	$\mathtt{algebra}\ x\ \mathtt{extends}\ \overline{x_0}\ \mathtt{implements}\ \overline{s[\overline{\tau}]}\ \mathtt{where}\ \overline{\mathsf{l}@(\mathsf{l}_1\ \overline{x_1}) = e_1}\ \mathtt{in}\ e$
		$\mid$	$\mathtt{data}\ d\ \mathtt{from}\ s[\overline{\alpha}].\alpha_0\ \mathtt{in}\ e$
Contexts	Γ	$::=$	$\epsilon \mid \Gamma, \alpha \mid \Gamma, x{:}\tau \mid \Gamma, s[\overline{\alpha}] \to \overline{\mathsf{l} : \tau}$
Labels	l		(fields)
	s		(interfaces)
	d		(datatypes)
Syntactic sugars	$\circ$	$::=$	$s[\alpha_0]$
	$\bullet$	$::=$	$[\overline{\alpha_0}/\overline{\alpha}]\{\overline{\mathsf{l} : \tau}\}$

1.2 Target Syntax

Types	T	$::=$	$\alpha \mid \top \mid \tau_1 \to \tau_2 \mid \forall\alpha.\,\tau \mid \tau_1 \,\&\, \tau_2 \mid \{\mathsf{l}{:}\tau\}$
Expressions	E	$::=$	$x \mid \top \mid \lambda(x{:}\tau).\,e \mid e_1\ e_2 \mid \Lambda\alpha.\,e \mid e\ \tau \mid e_1,,e_2 \mid \{\mathsf{l} = e\} \mid e.\mathsf{l} \mid e \setminus \mathsf{l}$
Contexts	Γ	$::=$	$\epsilon \mid \Gamma, \alpha \mid \Gamma, x{:}\tau$
Labels	l		
Syntactic sugars	$\circ$	$::=$	$\mathtt{let}\ x : \tau = e_1\ \mathtt{in}\ e_2$
	$\bullet$	$::=$	$(\lambda(x{:}\tau).\,e_2)\ e_1$

2 Translation

$$\boxed{\Gamma \vdash e : \tau \Rightarrow \mathsf{E}} \qquad \frac{\Gamma, s[\overline{\alpha}] \to \overline{\mathsf{l} : \tau} \vdash\ e\ :\ \tau_*\ \Rightarrow\ \mathsf{E}}{\Gamma\ \vdash\ \mathtt{sig}\ s[\overline{\alpha}]\ \mathtt{where}\ \overline{\mathsf{l} : \tau}\ \mathtt{in}\ e\ :\ \tau_*\ \Rightarrow\ \mathtt{let}\ merge_s : \ldots = \ldots\ \mathtt{in}\ \mathsf{E}}$$

$$\frac{\overline{\Gamma \vdash s_2[\overline{\alpha_2}]} \qquad \Gamma, s_1[\overline{\alpha_1}] \to \mathbf{U}_{\varnothing}[\overline{\alpha}/\overline{\alpha_2}]\Gamma(s_2)\ \mathbf{U}_{\leftarrow}\overline{\mathsf{l} : \tau} \vdash\ e\ :\ \tau_*\ \Rightarrow\ \mathsf{E}}{\Gamma\ \vdash\ \mathtt{sig}\ s_1[\overline{\alpha_1}]\ \mathtt{extends}\ \overline{s_2[\overline{\alpha}]}\ \mathtt{where}\ \overline{\mathsf{l} : \tau}\ \mathtt{in}\ e\ :\ \tau_*\ \Rightarrow\ \mathtt{let}\ merge_{s_1} : \ldots = \ldots\ \mathtt{in}\ \mathsf{E}}$$

$$\frac{\Gamma, \ldots \vdash\ e\ :\ \tau_*\ \Rightarrow\ \mathsf{E} \qquad \overline{\Gamma, \ldots \vdash\ e_1\ :\ \tau_1\ \Rightarrow\ \mathsf{E}_1} \qquad \overline{\Gamma \vdash s[\overline{\alpha}] \to \overline{\mathsf{l}_s : \tau_s}}}{\Gamma\ \vdash\ \mathtt{algebra}\ x\ \mathtt{implements}\ \overline{s[\overline{\tau}]}\ \mathtt{where}\ \overline{\mathsf{l}@(\mathsf{l}_1\ \overline{x_1}) = e_1}\ \mathtt{in}\ e\ :\ \tau_*\ \Rightarrow\ \ldots}$$