Quick Look

Wojciech Kołowski

Old rules

$$\frac{\Gamma, x : A \vdash e \Leftarrow H \Rightarrow B}{\Gamma \vdash \lambda x.\, e \Leftarrow A \to H \Rightarrow A \to B} \text{Abs}$$

$$\frac{\Gamma \vdash f \Leftarrow \mathbf{?} \to H \Rightarrow A \to B \quad \Gamma \vdash a \Leftarrow A \Rightarrow A}{\Gamma \vdash f\, a \Leftarrow H \Rightarrow B} \text{App}$$

$$\frac{\Gamma \vdash a \Leftarrow \mathbf{?} \Rightarrow A \quad \Gamma \vdash f \Leftarrow A \to H \Rightarrow A \to B}{\Gamma \vdash f\, a \Leftarrow H \Rightarrow B} \text{AltApp}$$

What is hard in each approach

Easy for the original rule APP, but hard for the alternative ALTAPP: $f\ e_1$, $f\ e_1\ e_2$, etc.

Easy for the alternative rule ALTAPP, but hard for the original one APP: $(\lambda x.\ e)\ y$, $(\lambda x.\ e)\ y\ z$

Hard for both: case $(\lambda a.\ e_1)\ (\lambda b.\ e_2)\ x$

Quick Look at the argument

$$\frac{(x : A) \in \Gamma}{\Gamma \vdash x \Rightarrow A} \text{QL-ARG-VAR}$$

$$\overline{\Gamma \vdash (e : H) \Rightarrow H} \text{QL-ARG-ANNOT}$$

$$\overline{\Gamma \vdash \texttt{unit} \Rightarrow \mathbf{1}} \text{QL-ARG-UNIT}$$

$$\frac{e \neq x \quad e \neq (e' : H') \quad e \neq \texttt{unit}}{\Gamma \vdash e \Rightarrow \texttt{?}} \text{QL-ARG-FAIL}$$

Quick Look at the argument – the rule

$$\frac{\Gamma \vdash a \Rightarrow H_A \quad \Gamma \vdash f \Leftarrow H_A \rightarrow H_B \Rightarrow A \rightarrow B \quad \Gamma \vdash a \Leftarrow A \Rightarrow A}{\Gamma \vdash f \; a \Leftarrow H_B \Rightarrow B} \text{App-QL-Ar}$$

Quick Look at the function

TODO

Quick Look at the function – the rule

$$\frac{\Gamma \vdash f \Rightarrow H_A \to H'_B \quad \begin{array}{c} \Gamma \vdash a \Leftarrow H_A \Rightarrow A \\ \Gamma \vdash f \Leftarrow A \to H_B \sqcup H'_B \Rightarrow A \to B \end{array}}{\Gamma \vdash f \ a \Leftarrow H_B \Rightarrow B} \text{QL-Fun}$$

Quick Look with a hint

$$\frac{(x : A) \in \Gamma \quad H \sqsubseteq A}{\Gamma \vdash x \Leftarrow H \Rightarrow A} \text{QL-VAR}$$

$$\frac{}{\Gamma \vdash (e : H_1) \Leftarrow H_2 \Rightarrow H_1 \sqcup H_2} \text{QL-ANNOT}$$

$$\frac{e \neq x \quad e \neq (e' : H')}{\Gamma \vdash e \Leftarrow H \Rightarrow H} \text{QL-FAIL}$$

Quick Look with a hint – the rule

$$\frac{\Gamma \vdash f \Leftarrow\; ? \rightarrow H \Rightarrow H_A \rightarrow H_B \qquad \begin{array}{c} \Gamma \vdash a \Leftarrow H_A \Rightarrow A \\ \Gamma \vdash f \Leftarrow A \rightarrow H_B \Rightarrow A \rightarrow B \end{array}}{\Gamma \vdash f\; a \Leftarrow H \Rightarrow B} \text{QL-App}$$

TODO

$$\frac{\Gamma \vdash e_2 \Leftarrow \textbf{?} \Rightarrow H_2 \quad \Gamma \vdash e_1 \Leftarrow H \Rightarrow f \; ; \; \overline{e} \; ; \; H'}{\Gamma \vdash e_1 \; e_2 \Leftarrow H \Rightarrow f \; ; \; \overline{e} \; ; \; H'} \text{QLD-App}$$

$$\frac{(x : A) \in \Gamma \quad H \sqsubseteq A}{\Gamma \vdash x \Leftarrow H \Rightarrow A \; ; \; ;} \text{QLD-Var}$$

$$\frac{}{\Gamma \vdash (e : H_1) \Leftarrow H_2 \Rightarrow H_1 \sqcup H_2} \text{QL-Annot}$$

$$\frac{e \neq x \quad e \neq (e' : H')}{\Gamma \vdash e \Leftarrow H \Rightarrow H} \text{QL-Fail}$$

$$\frac{\Gamma \vdash e_1 \; e_2 \Leftarrow H \Rightarrow f \; ; \; \overline{e} \; ; \; H'}{\Gamma \vdash e_1 \; e_2 \Leftarrow H \Rightarrow B}$$