Lista 8

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1	2	3	4
+	+	+	+

1.

$$\begin{aligned}
\texttt{BT}\ \beta &= \forall\alpha.\,(\beta \to \alpha \to \alpha \to \alpha) \to \alpha \to \alpha \\
\texttt{Node} &= \Lambda\beta.\,\lambda x^{\beta}.\,\lambda l^{\texttt{BT}\ \beta}.\,\lambda r^{\texttt{BT}\ \beta}.\,\Lambda\alpha.\,\lambda n^{\beta\to\alpha\to\alpha\to\alpha}.\,\lambda t^{\alpha}.\,n\ x\ (l\ \alpha\ n\ t)\ (r\ \alpha\ n\ t) \\
\texttt{Tip} &= \Lambda\beta.\,\Lambda\alpha.\,\lambda n^{\beta\to\alpha\to\alpha\to\alpha}.\,\lambda t^{\alpha}.\,t \\
\texttt{_BTit} &= \Lambda\beta.\,\lambda b^{\texttt{BT}\ \beta}.\,\Lambda\alpha.\,\lambda n^{\beta\to\alpha\to\alpha\to\alpha}.\,\lambda t^{\alpha}.\,b\ \alpha\ n\ t
\end{aligned}$$

$$\begin{aligned}
\texttt{_BTit}\ \beta\ (\texttt{Node}\ \beta\ x\ l\ r)\ \alpha\ n\ t &\to^{*} n\ x\ (\texttt{_BTit}\ \beta\ l\ \alpha\ n\ t)\ (\texttt{_BTit}\ \beta\ r\ \alpha\ n\ t) \\
\texttt{_BTit}\ \beta\ \texttt{Tip}\ \alpha\ n\ t &\to^{*} t
\end{aligned}$$

4.

$$\dfrac{\dfrac{\dfrac{}{\Gamma, \forall\alpha.\,\varphi[\alpha] \to \gamma \vdash \forall\alpha.\,\varphi[\alpha] \to \gamma}\,Ax}{\Gamma, \forall\alpha.\,\varphi[\alpha] \to \gamma \vdash \varphi[\alpha := \sigma] \to \gamma}\,\forall E \quad \dfrac{\Gamma \vdash \varphi[\alpha := \sigma]}{\Gamma, \forall\alpha.\,\varphi[\alpha] \to \gamma \vdash \varphi[\alpha := \sigma]}\,W}{\dfrac{\dfrac{\Gamma, \forall\alpha.\,\varphi[\alpha] \to \gamma \vdash \gamma}{\Gamma \vdash (\forall\alpha.\,\varphi[\alpha] \to \gamma) \to \gamma}\,\to I}{\Gamma \vdash \forall\gamma.\,(\forall\alpha.\,\varphi[\alpha] \to \gamma) \to \gamma}\,\forall I}\,\to E$$

$$\dfrac{\dfrac{\Gamma_1 \vdash \forall\gamma.\,(\forall\alpha.\,\varphi[\alpha] \to \gamma) \to \gamma}{\Gamma_1 \vdash (\forall\alpha.\,\varphi[\alpha] \to \psi) \to \psi}\,\forall E \quad \dfrac{\dfrac{\Gamma_2, \varphi[\alpha] \vdash \psi}{\Gamma_2 \vdash \varphi[\alpha] \to \psi}\,\to I}{\Gamma_2 \vdash \forall\alpha.\,\varphi[\alpha] \to \psi}\,\forall I}{\Gamma_1, \Gamma_2 \vdash \psi}\,\to E$$