

Definition 10 We define $c_2Emin_2E_3D_3E$ to be $\lambda P \in 2.\lambda Q \in 2.inj_o (p P \Rightarrow p Q)$ of type ι .

Definition 11 We define $c_2Ebool_2E_2F_5C$ to be $(\lambda V0t1 \in 2.(\lambda V1t2 \in 2.(ap (c_2Ebool_2E_21 2) (\lambda V2t \in 2)))$
Let $c_2Epair_2EABS_prod : \iota \Rightarrow \iota \Rightarrow \iota$ be given. Assume the following.

$$\begin{aligned} \forall A_27a.nonempty A_27a \Rightarrow \forall A_27b.nonempty A_27b \Rightarrow c_2Epair_2EABS_prod \\ A_27a A_27b \in ((ty_2Epair_2Eprod A_27a A_27b)^{(2^{A_27b})^{A_27a}}) \end{aligned} \quad (4)$$

Definition 12 We define $c_2Epair_2E_2C$ to be $\lambda A_27a : \iota.\lambda A_27b : \iota.\lambda V0x \in A_27a.\lambda V1y \in A_27b.(ap (c_2Epair_2EABS_prod$

Definition 13 We define $c_2Epair_2ECURRY$ to be $\lambda A_27a : \iota.\lambda A_27b : \iota.\lambda A_27c : \iota.\lambda V0f \in (A_27c^{(ty_2Epair_2EABS_prod$

Definition 14 We define $c_2Estate_transformer_2EUNIT$ to be $\lambda A_27a : \iota.\lambda A_27b : \iota.\lambda V0x \in A_27b.(\lambda V1s \in 2)$

Assume the following.

$$True \quad (5)$$

Assume the following.

$$\forall A_27a.nonempty A_27a \Rightarrow (\forall V0t \in 2.((\forall V1x \in A_27a.(p V0t)) \Leftrightarrow (p V0t))) \quad (6)$$

Assume the following.

$$\forall A_27a.nonempty A_27a \Rightarrow (\forall V0x \in A_27a.((V0x = V0x) \Leftrightarrow True)) \quad (7)$$

Assume the following.

$$\begin{aligned} \forall A_27a.nonempty A_27a \Rightarrow \forall A_27b.nonempty A_27b \Rightarrow (\\ \forall V0f \in (A_27b^{A_27a}).(\forall V1g \in (A_27b^{A_27a}).((V0f = \\ V1g) \Leftrightarrow (\forall V2x \in A_27a.((ap V0f V2x) = (ap V1g V2x)))))) \end{aligned} \quad (8)$$

Assume the following.

$$\begin{aligned} \forall A_27a.nonempty A_27a \Rightarrow \forall A_27b.nonempty A_27b \Rightarrow \forall A_27c. \\ nonempty A_27c \Rightarrow (\forall V0f \in (A_27b^{A_27a}).(\forall V1g \in (A_27a^{A_27c}). \\ (\forall V2x \in A_27c.((ap (ap (ap (c_2Ecombin_2Eo A_27c A_27b A_27a) \\ V0f) V1g) V2x) = (ap V0f (ap V1g V2x)))))) \end{aligned} \quad (9)$$

Assume the following.

$$\forall A_27a.nonempty A_27a \Rightarrow (\forall V0x \in A_27a.((ap (c_2Ecombin_2EI A_27a) V0x) = V0x)) \quad (10)$$

Assume the following.

$$\begin{aligned}
& \forall A_{.27a}.nonempty\ A_{.27a} \Rightarrow \forall A_{.27b}.nonempty\ A_{.27b} \Rightarrow \forall A_{.27c}. \\
& nonempty\ A_{.27c} \Rightarrow (\forall V0f \in (A_{.27c}^{(ty_2Epair_2Eprod\ A_{.27a}\ A_{.27b})}), \\
& ((ap\ (c_2Epair_2EUNCURRY\ A_{.27a}\ A_{.27b}\ A_{.27c})\ (ap\ (c_2Epair_2ECURRY \\
& A_{.27a}\ A_{.27b}\ A_{.27c})\ V0f)) = V0f))
\end{aligned} \tag{11}$$

Assume the following.

$$\begin{aligned}
& \forall A_{.27a}.nonempty\ A_{.27a} \Rightarrow \forall A_{.27b}.nonempty\ A_{.27b} \Rightarrow (\\
& (c_2Estate_transformer_2EUNIT\ A_{.27b}\ A_{.27a}) = (ap\ (c_2Epair_2ECURRY \\
& A_{.27a}\ A_{.27b}\ (ty_2Epair_2Eprod\ A_{.27a}\ A_{.27b}))\ (c_2Ecombin_2EI\ (\\
& ty_2Epair_2Eprod\ A_{.27a}\ A_{.27b}))))
\end{aligned} \tag{12}$$

Theorem 1

$$\begin{aligned}
& \forall A_{.27a}.nonempty\ A_{.27a} \Rightarrow \forall A_{.27b}.nonempty\ A_{.27b} \Rightarrow (\\
& (ap\ (c_2Estate_transformer_2EEXT\ A_{.27b}\ A_{.27b}\ A_{.27a})\ (c_2Estate_transformer_2EUNIT \\
& A_{.27a}\ A_{.27b})) = (c_2Ecombin_2EI\ ((ty_2Epair_2Eprod\ A_{.27b}\ A_{.27a})^{A_{.27a}}))
\end{aligned}$$