

thm_2Einfree_2Eis__tree__strongind
(TMWAdM499uvVpbcG1VSyePHEWcjxaMzntLc)

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Definition 1 We define $c_2Emin_2E_3D$ to be $\lambda A.\lambda x \in A.\lambda y \in A.inj_o (x = y)$ of type $\iota \Rightarrow \iota$.

Definition 2 We define c_2Ebool_2ET to be $(ap (ap (c_2Emin_2E_3D (2^2)) (\lambda V0x \in 2.V0x)) (\lambda V1x \in 2.V1x))$

Definition 3 We define $c_2Ebool_2E_21$ to be $\lambda A_27a : \iota.(\lambda V0P \in (2^{A_27a}).(ap (ap (c_2Emin_2E_3D (2^{A_27a}))$

Definition 4 We define c_2Ebool_2EF to be $(ap (c_2Ebool_2E_21 2) (\lambda V0t \in 2.V0t))$.

Definition 5 We define $c_2Emin_2E_3D_3D_3E$ to be $\lambda P \in 2.\lambda Q \in 2.inj_o (p P \Rightarrow p Q)$ of type ι .

Definition 6 We define $c_2Ebool_2E_7E$ to be $(\lambda V0t \in 2.(ap (ap c_2Emin_2E_3D_3D_3E V0t) c_2Ebool_2EF$

Let $ty_2Elist_2Elist : \iota \Rightarrow \iota$ be given. Assume the following.

$$\forall A0.nonempty A0 \Rightarrow nonempty (ty_2Elist_2Elist A0) \quad (1)$$

Let $c_2Elist_2ETL : \iota \Rightarrow \iota$ be given. Assume the following.

$$\forall A_27a.nonempty A_27a \Rightarrow c_2Elist_2ETL A_27a \in ((ty_2Elist_2Elist A_27a)^{(ty_2Elist_2Elist A_27a)}) \quad (2)$$

Let $c_2Elist_2EHD : \iota \Rightarrow \iota$ be given. Assume the following.

$$\forall A_27a.nonempty A_27a \Rightarrow c_2Elist_2EHD A_27a \in (A_27a)^{(ty_2Elist_2Elist A_27a)} \quad (3)$$

Definition 7 We define $c_2Ebool_2E_2F_5C$ to be $(\lambda V0t1 \in 2.(\lambda V1t2 \in 2.(ap (c_2Ebool_2E_21 2) (\lambda V2t \in 2.V2t))$

Let $ty_2Esum_2Esum : \iota \Rightarrow \iota \Rightarrow \iota$ be given. Assume the following.

$$\forall A0.nonempty A0 \Rightarrow \forall A1.nonempty A1 \Rightarrow nonempty (ty_2Esum_2Esum A0 A1) \quad (4)$$

Let $c_2Esum_2EABS_sum : \iota \Rightarrow \iota \Rightarrow \iota$ be given. Assume the following.

$$\forall A_27a.nonempty A_27a \Rightarrow \forall A_27b.nonempty A_27b \Rightarrow c_2Esum_2EABS_sum A_27a A_27b \in ((ty_2Esum_2Esum A_27a A_27b)^{((2^{A_27b})^{A_27a})^2}) \quad (5)$$

Definition 8 We define c_2Esum_2EINR to be $\lambda A_27a : \iota.\lambda A_27b : \iota.\lambda V0e \in A_27b.(ap (c_2Esum_2EABS$
Let $c_2Elist_2ENIL : \iota \Rightarrow \iota$ be given. Assume the following.

$$\forall A_27a.nonempty A_27a \Rightarrow c_2Elist_2ENIL A_27a \in (ty_2Elist_2Elist A_27a) \quad (6)$$

Definition 9 We define c_2Emin_2E40 to be $\lambda A.\lambda P \in 2^A$. **if** $(\exists x \in A.p (ap P x))$ **then** (the $(\lambda x.x \in A \wedge p$
of type $\iota \Rightarrow \iota$).

Definition 10 We define c_2Ebool_2ECOND to be $\lambda A_27a : \iota.(\lambda V0t \in 2.(\lambda V1t1 \in A_27a.(\lambda V2t2 \in A_27a.($

Definition 11 We define c_2Esum_2EINL to be $\lambda A_27a : \iota.\lambda A_27b : \iota.\lambda V0e \in A_27a.(ap (c_2Esum_2EABS$

Definition 12 We define c_2Ebool_2E3F to be $\lambda A_27a : \iota.(\lambda V0P \in (2^{A_27a}).(ap V0P (ap (c_2Emin_2E40$

Definition 13 We define $c_2Ebool_2E5C_2E2F$ to be $(\lambda V0t1 \in 2.(\lambda V1t2 \in 2.(ap (c_2Ebool_2E21 2) (\lambda V2t \in$

Definition 14 We define $c_2Einfree_2Eis_tree$ to be $\lambda A_27a : \iota.\lambda A_27b : \iota.\lambda A_27d : \iota.(\lambda V0a0 \in ((ty_2Esum$
Assume the following.

$$True \quad (7)$$

Assume the following.

$$(\forall V0t1 \in 2.(\forall V1t2 \in 2.(((p V0t1) \Rightarrow (p V1t2)) \Rightarrow (((p V1t2) \Rightarrow (p V0t1)) \Rightarrow ((p V0t1) \Leftrightarrow (p V1t2)))))) \quad (8)$$

Assume the following.

$$(\forall V0t \in 2.(((True \Rightarrow (p V0t)) \Leftrightarrow (p V0t)) \wedge (((p V0t) \Rightarrow True) \Leftrightarrow True) \wedge (((False \Rightarrow (p V0t)) \Leftrightarrow True) \wedge (((p V0t) \Rightarrow (p V0t)) \Leftrightarrow True) \wedge ((p V0t) \Rightarrow False) \Leftrightarrow (\neg (p V0t)))))) \quad (9)$$

Assume the following.

$$(\forall V0x \in 2.(\forall V1y \in 2.(\forall V2z \in 2.(\forall V3w \in 2.(((p V0x) \Rightarrow (p V1y)) \wedge ((p V2z) \Rightarrow (p V3w))) \Rightarrow (((p V0x) \wedge (p V2z)) \Rightarrow ((p V1y) \wedge (p V3w)))))) \quad (10)$$

Assume the following.

$$(\forall V0x \in 2.(\forall V1y \in 2.(\forall V2z \in 2.(\forall V3w \in 2.(((p V0x) \Rightarrow (p V1y)) \wedge ((p V2z) \Rightarrow (p V3w))) \Rightarrow (((p V0x) \vee (p V2z)) \Rightarrow ((p V1y) \vee (p V3w)))))) \quad (11)$$

Assume the following.

$$\forall A_27a.nonempty A_27a \Rightarrow (\forall V0P \in (2^{A_27a}).(\forall V1Q \in (2^{A_27a}).((\forall V2x \in A_27a.((p (ap V0P V2x)) \Rightarrow (p (ap V1Q V2x)))) \Rightarrow ((\forall V3x \in A_27a.(p (ap V0P V3x))) \Rightarrow (\forall V4x \in A_27a.(p (ap V1Q V4x)))))) \quad (12)$$

Assume the following.

$$\begin{aligned}
& \forall A_27a.nonempty\ A_27a \Rightarrow (\forall V0P \in (2^{A_27a}).(\forall V1Q \in \\
& (2^{A_27a}).((\forall V2x \in A_27a.((p\ (ap\ V0P\ V2x)) \Rightarrow (p\ (ap\ V1Q\ V2x)))) \Rightarrow \\
& ((\exists V3x \in A_27a.(p\ (ap\ V0P\ V3x))) \Rightarrow (\exists V4x \in A_27a.(p\ (\\
& \quad ap\ V1Q\ V4x))))))))) \tag{13}
\end{aligned}$$

Theorem 1

$$\begin{aligned}
& \forall A_27a.nonempty\ A_27a \Rightarrow \forall A_27b.nonempty\ A_27b \Rightarrow \forall A_27d. \\
& nonempty\ A_27d \Rightarrow (\forall V0is_tree_27 \in (2^{((ty_2Esum_2Esum\ A_27a\ A_27b)^{(ty_2Elist_2Elist\ A_27d)}))}), \\
& (((\forall V1a \in A_27a.(p\ (ap\ V0is_tree_27\ (\lambda V2p \in (ty_2Elist_2Elist \\
& \quad A_27d).(ap\ (c_2Esum_2EINL\ A_27a\ A_27b)\ V1a)))))) \wedge (\forall V3f \in \\
& ((ty_2Esum_2Esum\ A_27a\ A_27b)^{(ty_2Elist_2Elist\ A_27d)}_{A_27d}). \\
& (\forall V4b \in A_27b.((\forall V5d \in A_27d.((p\ (ap\ (c_2Einfree_2Eis_tree \\
& \quad A_27a\ A_27b\ A_27d)\ (ap\ V3f\ V5d))) \wedge (p\ (ap\ V0is_tree_27\ (ap\ V3f\ V5d)))))) \Rightarrow \\
& (p\ (ap\ V0is_tree_27\ (\lambda V6p \in (ty_2Elist_2Elist\ A_27d).(ap\ (\\
& \quad ap\ (ap\ (c_2Ebool_2ECOND\ (ty_2Esum_2Esum\ A_27a\ A_27b))\ (ap\ (ap\ (\\
& \quad c_2Emin_2E_3D\ (ty_2Elist_2Elist\ A_27d))\ V6p)\ (c_2Elist_2ENIL \\
& \quad A_27d))))\ (ap\ (c_2Esum_2EINR\ A_27a\ A_27b)\ V4b))\ (ap\ (ap\ V3f\ (ap\ (c_2Elist_2EHD \\
& \quad A_27d)\ V6p))\ (ap\ (c_2Elist_2ETL\ A_27d)\ V6p)))))) \Rightarrow (\forall V7a0 \in \\
& ((ty_2Esum_2Esum\ A_27a\ A_27b)^{(ty_2Elist_2Elist\ A_27d)}).(p \\
& (ap\ (c_2Einfree_2Eis_tree\ A_27a\ A_27b\ A_27d)\ V7a0)) \Rightarrow (p\ (ap\ V0is_tree_27 \\
& \quad V7a0))))))
\end{aligned}$$