

thm_2EquantHeuristics_2ELIST__LENGTH__0
(TMG4YTmWQmYpyCfa4QUs5LK4U5JD8AuSmRD)

October 26, 2020

Let $ty_2Enum_2Enum : \iota$ be given. Assume the following.

$$nonempty\ ty_2Enum_2Enum \quad (1)$$

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 $c_2Ebool_2E_2T$ 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 $\lambda A.\lambda 27a : \iota.(\lambda V0P \in (2^{A-27a}).(ap (ap (c_2Emin_2E_3D (2^{A-27a}))$

Definition 4 We define $c_2Ebool_2E_2F$ 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 $\lambda P \in 2.\lambda Q \in 2.inj_o (p \Rightarrow q)$ of type ι .

Definition 6 We define $c_2Ebool_2E_2F_5C$ to be $(\lambda V0t \in 2.(ap (ap c_2Emin_2E_3D_3D_3E V0t) c_2Ebool_2E_2F$

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 $c_2Enum_2EREP_num : \iota$ be given. Assume the following.

$$c_2Enum_2EREP_num \in (\omega^{ty_2Enum_2Enum}) \quad (2)$$

Let $c_2Enum_2ESUC_REP : \iota$ be given. Assume the following.

$$c_2Enum_2ESUC_REP \in (\omega^{\omega}) \quad (3)$$

Let $c_2Enum_2EABS_num : \iota$ be given. Assume the following.

$$c_2Enum_2EABS_num \in (ty_2Enum_2Enum^{\omega}) \quad (4)$$

Definition 8 We define c_2Enum_2ESUC to be $\lambda V0m \in ty_2Enum_2Enum.(ap c_2Enum_2EABS_num (c_2Enum_2ESUC_REP m))$

Definition 9 We define $c_2Emin_2E_40$ to be $\lambda A.\lambda P \in 2^A.if (\exists x \in A.p (ap P x)) \text{ then } (the (\lambda x.x \in A \wedge P x))$ of type $\iota \Rightarrow \iota$.

Definition 10 We define $c_Ebool_2E_3F$ to be $\lambda A_27a : \iota. (\lambda V0P \in (2^{A_27a}). (ap V0P (ap (c_Emin_2E_40$

Definition 11 We define $c_Eprim_rec_2E_3C$ to be $\lambda V0m \in ty_2Enum_2Enum. \lambda V1n \in ty_2Enum_2Enum$

Definition 12 We define $c_Ebool_2E_5C_2F$ to be $(\lambda V0t1 \in 2. (\lambda V1t2 \in 2. (ap (c_Ebool_2E_21 2) (\lambda V2t \in$

Definition 13 We define $c_Earithmetic_2E_3C_3D$ to be $\lambda V0m \in ty_2Enum_2Enum. \lambda V1n \in ty_2Enum_2Enum$

Let $c_2Enum_2EZERO_REP : \iota$ be given. Assume the following.

$$c_2Enum_2EZERO_REP \in \omega \tag{5}$$

Definition 14 We define c_2Enum_2E0 to be $(ap c_2Enum_2EABS_num c_2Enum_2EZERO_REP)$.

Definition 15 We define $c_Earithmetic_2E_3E$ to be $\lambda V0m \in ty_2Enum_2Enum. \lambda V1n \in ty_2Enum_2Enum$

Definition 16 We define $c_Earithmetic_2E_3E_3D$ to be $\lambda V0m \in ty_2Enum_2Enum. \lambda V1n \in ty_2Enum_2Enum$

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

$$\forall A0. nonempty A0 \Rightarrow nonempty (ty_2Elist_2Elist A0) \tag{6}$$

Let $c_2Elist_2ENIL : \iota \Rightarrow \iota$ be given. Assume the following.

$$\forall A_27a. nonempty A_27a \Rightarrow c_2Elist_2ENIL A_27a \in (ty_2Elist_2Elist A_27a) \tag{7}$$

Definition 17 We define $c_Earithmetic_2EZERO$ to be c_2Enum_2E0 .

Let $c_2Earithmetic_2E_2B : \iota$ be given. Assume the following.

$$c_2Earithmetic_2E_2B \in ((ty_2Enum_2Enum^{ty_2Enum_2Enum})^{ty_2Enum_2Enum}) \tag{8}$$

Definition 18 We define $c_Earithmetic_2EBIT1$ to be $\lambda V0n \in ty_2Enum_2Enum. (ap (ap c_2Earithmetic$

Definition 19 We define $c_Earithmetic_2ENUMERAL$ to be $\lambda V0x \in ty_2Enum_2Enum. V0x$.

Let $c_2Elist_2ELENGTH : \iota \Rightarrow \iota$ be given. Assume the following.

$$\forall A_27a. nonempty A_27a \Rightarrow c_2Elist_2ELENGTH A_27a \in (ty_2Enum_2Enum^{(ty_2Elist_2Elist A_27a)}) \tag{9}$$

Assume the following.

$$\forall A_27a. nonempty A_27a \Rightarrow (\forall V0l \in (ty_2Elist_2Elist A_27a). ((ap (c_2Elist_2ELENGTH A_27a) V0l) = c_2Enum_2E0) \Leftrightarrow (V0l = (c_2Elist_2ENIL A_27a)))) \tag{10}$$

Assume the following.

$$\begin{aligned} \forall A_27a.nonempty\ A_27a \Rightarrow (\forall V0l \in (ty_2Elist_2Elist \\ A_27a).((c_2Enum_2E0 = (ap\ (c_2Elist_2ELENGTH\ A_27a)\ V0l)) \Leftrightarrow (\\ V0l = (c_2Elist_2ENIL\ A_27a)))) \end{aligned} \quad (11)$$

Assume the following.

$$\begin{aligned} \forall A_27a.nonempty\ A_27a \Rightarrow (\forall V0l \in (ty_2Elist_2Elist \\ A_27a).(((p\ (ap\ (ap\ c_2Eprim_rec_2E_3C\ (ap\ (c_2Elist_2ELENGTH \\ A_27a)\ V0l))\ (ap\ c_2Earithmetic_2ENUMERAL\ (ap\ c_2Earithmetic_2EBIT1 \\ c_2Earithmetic_2EZERO)))) \Leftrightarrow (V0l = (c_2Elist_2ENIL\ A_27a))) \wedge \\ (((p\ (ap\ (ap\ c_2Earithmetic_2E_3E\ (ap\ c_2Earithmetic_2ENUMERAL \\ (ap\ c_2Earithmetic_2EBIT1\ c_2Earithmetic_2EZERO)))\ (ap\ (c_2Elist_2ELENGTH \\ A_27a)\ V0l))) \Leftrightarrow (V0l = (c_2Elist_2ENIL\ A_27a))) \wedge ((p\ (ap\ (ap\ c_2Earithmetic_2E_3E_3D \\ c_2Enum_2E0)\ (ap\ (c_2Elist_2ELENGTH\ A_27a)\ V0l))) \Leftrightarrow (V0l = (c_2Elist_2ENIL \\ A_27a))) \wedge ((p\ (ap\ (ap\ c_2Earithmetic_2E_3C_3D\ (ap\ (c_2Elist_2ELENGTH \\ A_27a)\ V0l))\ c_2Enum_2E0)) \Leftrightarrow (V0l = (c_2Elist_2ENIL\ A_27a)))))) \end{aligned} \quad (12)$$

Theorem 1

$$\begin{aligned} \forall A_27a.nonempty\ A_27a \Rightarrow (\forall V0l \in (ty_2Elist_2Elist \\ A_27a).((((ap\ (c_2Elist_2ELENGTH\ A_27a)\ V0l) = c_2Enum_2E0) \Leftrightarrow \\ (V0l = (c_2Elist_2ENIL\ A_27a))) \wedge ((c_2Enum_2E0 = (ap\ (c_2Elist_2ELENGTH \\ A_27a)\ V0l)) \Leftrightarrow (V0l = (c_2Elist_2ENIL\ A_27a))) \wedge ((p\ (ap\ (ap\ c_2Eprim_rec_2E_3C \\ (ap\ (c_2Elist_2ELENGTH\ A_27a)\ V0l))\ (ap\ c_2Earithmetic_2ENUMERAL \\ (ap\ c_2Earithmetic_2EBIT1\ c_2Earithmetic_2EZERO)))) \Leftrightarrow (V0l = \\ (c_2Elist_2ENIL\ A_27a))) \wedge ((p\ (ap\ (ap\ c_2Earithmetic_2E_3E\ (\\ ap\ c_2Earithmetic_2ENUMERAL\ (ap\ c_2Earithmetic_2EBIT1\ c_2Earithmetic_2EZERO))) \\ (ap\ (c_2Elist_2ELENGTH\ A_27a)\ V0l))) \Leftrightarrow (V0l = (c_2Elist_2ENIL\ A_27a))) \wedge \\ (((p\ (ap\ (ap\ c_2Earithmetic_2E_3E_3D\ c_2Enum_2E0)\ (ap\ (c_2Elist_2ELENGTH \\ A_27a)\ V0l))) \Leftrightarrow (V0l = (c_2Elist_2ENIL\ A_27a))) \wedge ((p\ (ap\ (ap\ c_2Earithmetic_2E_3C_3D \\ (ap\ (c_2Elist_2ELENGTH\ A_27a)\ V0l))\ c_2Enum_2E0)) \Leftrightarrow (V0l = (c_2Elist_2ENIL \\ A_27a)))))) \end{aligned}$$