

thm_2Esorting_2EPERM_FUN_SWAP_AT_FRONT (TMQoyi4a7DGv1eDfMjMnSpJvNQpoAPYgpTg)

October 26, 2020

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 $(\lambda V0t \in 2.(ap (ap c_2Emin_2E_3D_3D_3E V0t) c_2Ebool_2EF$

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

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

Let $c_2Elist_2ECONS : \iota \Rightarrow \iota$ be given. Assume the following.

$$\forall A_27a.nonempty A_27a \Rightarrow c_2Elist_2ECONS A_27a \in (((ty_2Elist_2Elist A_27a)^{(ty_2Elist_2Elist A_27a)})^{A_27a}) \quad (2)$$

Let $c_2Elist_2EFILTER : \iota \Rightarrow \iota$ be given. Assume the following.

$$\forall A_27a.nonempty A_27a \Rightarrow c_2Elist_2EFILTER A_27a \in (((ty_2Elist_2Elist A_27a)^{(ty_2Elist_2Elist A_27a)})^{(2^{A_27a})}) \quad (3)$$

Definition 8 We define $c_2Esorting_2EPERM$ to be $\lambda A_27a : \iota.\lambda V0L1 \in (ty_2Elist_2Elist A_27a).\lambda V1L2 \in$

Assume the following.

$$True \quad (4)$$

Assume the following.

$$\forall A_27a.nonempty\ A_27a \Rightarrow (\forall V0t \in 2. ((\forall V1x \in A_27a.(p\ V0t)) \Leftrightarrow (p\ V0t))) \quad (5)$$

Assume the following.

$$\forall A_27a.nonempty\ A_27a \Rightarrow (\forall V0x \in A_27a. (\forall V1y \in A_27a. ((V0x = V1y) \Leftrightarrow (V1y = V0x)))) \quad (6)$$

Assume the following.

$$(\forall V0t \in 2. (((True \Leftrightarrow (p\ V0t)) \Leftrightarrow (p\ V0t)) \wedge (((p\ V0t) \Leftrightarrow True) \Leftrightarrow (p\ V0t)) \wedge (((False \Leftrightarrow (p\ V0t)) \Leftrightarrow (\neg(p\ V0t))) \wedge (((p\ V0t) \Leftrightarrow False) \Leftrightarrow (\neg(p\ V0t))))) \quad (7)$$

Assume the following.

$$\forall A_27a.nonempty\ A_27a \Rightarrow (\forall V0L \in (ty_2Elist_2Elist\ A_27a).(p\ (ap\ (ap\ (c_2Esorting_2EPERM\ A_27a)\ V0L)\ V0L))) \quad (8)$$

Assume the following.

$$\forall A_27a.nonempty\ A_27a \Rightarrow (\forall V0x \in A_27a. (\forall V1y \in A_27a. (\forall V2l1 \in (ty_2Elist_2Elist\ A_27a). (\forall V3l2 \in (ty_2Elist_2Elist\ A_27a). ((p\ (ap\ (ap\ (c_2Esorting_2EPERM\ A_27a)\ (ap\ (ap\ (c_2Elist_2ECONS\ A_27a)\ V0x)\ (ap\ (ap\ (c_2Elist_2ECONS\ A_27a)\ V1y)\ V2l1)))\ (ap\ (ap\ (c_2Elist_2ECONS\ A_27a)\ V1y)\ (ap\ (ap\ (c_2Elist_2ECONS\ A_27a)\ V0x)\ V3l2)))) \Leftrightarrow (p\ (ap\ (ap\ (c_2Esorting_2EPERM\ A_27a)\ V2l1)\ V3l2)))))) \quad (9)$$

Assume the following.

$$\forall A_27a.nonempty\ A_27a \Rightarrow (\forall V0x \in (ty_2Elist_2Elist\ A_27a). (\forall V1y \in (ty_2Elist_2Elist\ A_27a). ((p\ (ap\ (ap\ (c_2Esorting_2EPERM\ A_27a)\ V0x)\ V1y)) \Leftrightarrow ((ap\ (c_2Esorting_2EPERM\ A_27a)\ V0x) = (ap\ (c_2Esorting_2EPERM\ A_27a)\ V1y)))) \quad (10)$$

Theorem 1

$$\forall A_27a.nonempty\ A_27a \Rightarrow (\forall V0x \in A_27a. (\forall V1y \in A_27a. (\forall V2l \in (ty_2Elist_2Elist\ A_27a). ((ap\ (c_2Esorting_2EPERM\ A_27a)\ (ap\ (ap\ (c_2Elist_2ECONS\ A_27a)\ V0x)\ (ap\ (ap\ (c_2Elist_2ECONS\ A_27a)\ V1y)\ V2l))) = (ap\ (c_2Esorting_2EPERM\ A_27a)\ (ap\ (ap\ (c_2Elist_2ECONS\ A_27a)\ V1y)\ (ap\ (ap\ (c_2Elist_2ECONS\ A_27a)\ V0x)\ V2l)))))) \quad (11)$$