

thm\_2Eiterate\_2EITERATE\_IMAGE\_NONZERO  
(TMZsfcVPeAV74iL7q9sDxErsNpubQ6gghgb)

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**Definition 1** We define `c_2Emin_2E_3D` to be  $\lambda A. \lambda x \in A. \lambda y \in A. \text{inj\_o } (x = y)$   
of type  $\iota \Rightarrow \iota$ .

**Definition 2** We define `c_2Ebool_2E_2T` to be  $(\text{ap } (\text{ap } (\text{c\_2Emin\_2E\_3D } (2^2)) (\lambda V0x \in 2.V0x)) (\lambda V1x \in 2.V1x))$

**Definition 3** We define `c_2Ebool_2E_21` to be  $\lambda A. 27a : \iota. (\lambda V0P \in (2^{A-27a}). (\text{ap } (\text{ap } (\text{c\_2Emin\_2E\_3D } (2^{A-27a})) (\lambda V1x \in 2.V1x)) (\lambda V2x \in 2.V2x)))$

**Definition 4** We define `c_2Ecombin_2E_o` to be  $\lambda A. 27a : \iota. \lambda A. 27b : \iota. \lambda A. 27c : \iota. \lambda V0f \in (A. 27b^{A-27c}). \lambda V1g \in (A. 27c^{A-27b}). (\text{ap } (\text{ap } (\text{c\_2Emin\_2E\_3D } (2^{A-27a})) (\lambda V2x \in 2.V2x)) (\lambda V3x \in 2.V3x))$

**Definition 5** We define `c_2Ecombin_2E_K` to be  $\lambda A. 27a : \iota. \lambda A. 27b : \iota. (\lambda V0x \in A. 27a. (\lambda V1y \in A. 27b. V0x))$

**Definition 6** We define `c_2Ecombin_2E_S` to be  $\lambda A. 27a : \iota. \lambda A. 27b : \iota. \lambda A. 27c : \iota. (\lambda V0f \in ((A. 27c^{A-27b})^{A-27a}). (\text{ap } (\text{ap } (\text{c\_2Emin\_2E\_3D } (2^{A-27a})) (\lambda V1x \in 2.V1x)) (\lambda V2x \in 2.V2x)))$

**Definition 7** We define `c_2Ecombin_2E_I` to be  $\lambda A. 27a : \iota. (\text{ap } (\text{ap } (\text{c\_2Ecombin\_2E_S } A. 27a (A. 27a^{A-27a})) (\lambda V1x \in 2.V1x)) (\lambda V2x \in 2.V2x))$

**Definition 8** We define `c_2Ebool_2E_2F` to be  $(\text{ap } (\text{c\_2Ebool\_2E\_21 } 2) (\lambda V0t \in 2.V0t))$ .

**Definition 9** We define `c_2Emin_2E_3D_3D_3E` to be  $\lambda P \in 2. \lambda Q \in 2. \text{inj\_o } (p \Rightarrow q)$   
of type  $\iota$ .

**Definition 10** We define `c_2Ebool_2E_2F_5C` to be  $(\lambda V0t1 \in 2. (\lambda V1t2 \in 2. (\text{ap } (\text{c\_2Ebool\_2E\_21 } 2) (\lambda V2t \in 2.V2t)) (\lambda V3t \in 2.V3t)))$

**Definition 11** We define `c_2Emin_2E_40` to be  $\lambda A. \lambda P \in 2^A. \text{if } (\exists x \in A. p (\text{ap } P x)) \text{ then } (\text{the } (\lambda x. x \in A. \lambda y. y \in A. \text{ap } P x))$   
of type  $\iota \Rightarrow \iota$ .

**Definition 12** We define `c_2Ebool_2E_COND` to be  $\lambda A. 27a : \iota. (\lambda V0t \in 2. (\lambda V1t1 \in A. 27a. (\lambda V2t2 \in A. 27a. (\text{ap } (\text{c\_2Emin\_2E_40 } (2^{A-27a})) (\lambda V3t \in 2.V3t)) (\lambda V4t \in 2.V4t))))$

**Definition 13** We define `c_2Eiterate_2E_neutral` to be  $\lambda A. 27a : \iota. \lambda V0op \in ((A. 27a^{A-27a})^{A-27a}). (\text{ap } (\text{c\_2Emin\_2E_40 } (2^{A-27a})) (\lambda V1x \in 2.V1x))$

**Definition 14** We define `c_2Ebool_2E_7E` to be  $(\lambda V0t \in 2. (\text{ap } (\text{ap } (\text{c\_2Emin\_2E_3D_3D_3E } V0t) (\lambda V1x \in 2.V1x)) (\lambda V2x \in 2.V2x)))$

**Definition 15** We define `c_2Ebool_2E_IN` to be  $\lambda A. 27a : \iota. (\lambda V0x \in A. 27a. (\lambda V1f \in (2^{A-27a}). (\text{ap } V1f V0x)))$

Let  $ty\_2Epair\_2Eprod : \iota \Rightarrow \iota \Rightarrow \iota$  be given. Assume the following.

$$\forall A0.nonempty\ A0 \Rightarrow \forall A1.nonempty\ A1 \Rightarrow nonempty\ (ty\_2Epair\_2Eprod\ A0\ A1) \quad (1)$$

Let  $c\_2Epair\_2EABS\_prod : \iota \Rightarrow \iota \Rightarrow \iota$  be given. Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow \forall A\_27b.nonempty\ A\_27b \Rightarrow c\_2Epair\_2EABS\_prod\ A\_27a\ A\_27b \in ((ty\_2Epair\_2Eprod\ A\_27a\ A\_27b)^{(2^{A\_27b})^{A\_27a}}) \quad (2)$$

**Definition 16** We define  $c\_2Epair\_2E\_2C$  to be  $\lambda A\_27a : \iota.\lambda A\_27b : \iota.\lambda V0x \in A\_27a.\lambda V1y \in A\_27b.(ap\ (c\_2E$

Let  $c\_2Epred\_set\_2EGSPEC : \iota \Rightarrow \iota \Rightarrow \iota$  be given. Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow \forall A\_27b.nonempty\ A\_27b \Rightarrow c\_2Epred\_set\_2EGSPEC\ A\_27a\ A\_27b \in ((2^{A\_27a})^{(ty\_2Epair\_2Eprod\ A\_27a\ 2)^{A\_27b}}) \quad (3)$$

**Definition 17** We define  $c\_2Eiterate\_2Esupport$  to be  $\lambda A\_27a : \iota.\lambda A\_27b : \iota.\lambda V0op \in ((A\_27b^{A\_27b})^{A\_27a}).\lambda V$

**Definition 18** We define  $c\_2Ebool\_2E\_5C\_2F$  to be  $(\lambda V0t1 \in 2.(\lambda V1t2 \in 2.(ap\ (c\_2Ebool\_2E\_21\ 2)\ (\lambda V2t \in$

**Definition 19** We define  $c\_2Epred\_set\_2EINSERT$  to be  $\lambda A\_27a : \iota.\lambda V0x \in A\_27a.\lambda V1s \in (2^{A\_27a}).(ap\ (c\_2E$

**Definition 20** We define  $c\_2Epred\_set\_2EEMPTY$  to be  $\lambda A\_27a : \iota.(\lambda V0x \in A\_27a.c\_2Ebool\_2EF)$ .

**Definition 21** We define  $c\_2Epred\_set\_2EFINITE$  to be  $\lambda A\_27a : \iota.\lambda V0s \in (2^{A\_27a}).(ap\ (c\_2Ebool\_2E\_21\ 2)$

**Definition 22** We define  $c\_2Eiterate\_2EITSET$  to be  $\lambda A\_27a : \iota.\lambda A\_27b : \iota.\lambda V0f \in ((A\_27a^{A\_27a})^{A\_27b}).\lambda V$

**Definition 23** We define  $c\_2Eiterate\_2Eiterate$  to be  $\lambda A\_27a : \iota.\lambda A\_27b : \iota.\lambda V0op \in ((A\_27b^{A\_27b})^{A\_27a}).\lambda V$

**Definition 24** We define  $c\_2Eiterate\_2Emonoidal$  to be  $\lambda A\_27a : \iota.\lambda V0op \in ((A\_27a^{A\_27a})^{A\_27a}).(ap\ (ap\ c\_2E$

**Definition 25** We define  $c\_2Ebool\_2E\_3F$  to be  $\lambda A\_27a : \iota.(\lambda V0P \in (2^{A\_27a}).(ap\ V0P\ (ap\ (c\_2Emin\_2E\_40$

**Definition 26** We define  $c\_2Epred\_set\_2EIMAGE$  to be  $\lambda A\_27a : \iota.\lambda A\_27b : \iota.\lambda V0f \in (A\_27b^{A\_27a}).\lambda V1s \in$

Assume the following.

$$True \quad (4)$$

Assume the following.

$$(\forall V0t1 \in 2.(\forall V1t2 \in 2.(((p\ V0t1) \Rightarrow (p\ V1t2)) \Rightarrow (((p\ V1t2) \Rightarrow (p\ V0t1)) \Rightarrow ((p\ V0t1) \Leftrightarrow (p\ V1t2)))))) \quad (5)$$

Assume the following.

$$(\forall V0t \in 2.(False \Rightarrow (p\ V0t))) \quad (6)$$

Assume the following.

$$(\forall V0t \in 2.((p V0t) \vee (\neg(p V0t)))) \quad (7)$$

Assume the following.

$$\forall A\_27a.nonempty \ A\_27a \Rightarrow (\forall V0t \in 2.((\forall V1x \in A\_27a.(p V0t)) \Leftrightarrow (p V0t))) \quad (8)$$

Assume the following.

$$(\forall V0t1 \in 2.(\forall V1t2 \in 2.(\forall V2t3 \in 2.(((p V0t1) \wedge (p V1t2) \wedge (p V2t3)) \Leftrightarrow (((p V0t1) \wedge (p V1t2)) \wedge (p V2t3)))))) \quad (9)$$

Assume the following.

$$(\forall V0t \in 2.(((p V0t) \Rightarrow False) \Rightarrow (\neg(p V0t)))) \quad (10)$$

Assume the following.

$$(\forall V0t \in 2.((\neg(p V0t)) \Rightarrow ((p V0t) \Rightarrow False))) \quad (11)$$

Assume the following.

$$(\forall V0t \in 2.(((True \wedge (p V0t)) \Leftrightarrow (p V0t)) \wedge (((p V0t) \wedge True) \Leftrightarrow (p V0t)) \wedge (((False \wedge (p V0t)) \Leftrightarrow False) \wedge (((p V0t) \wedge False) \Leftrightarrow False) \wedge (((p V0t) \wedge (p V0t)) \Leftrightarrow (p V0t)))))) \quad (12)$$

Assume the following.

$$(\forall V0t \in 2.(((True \vee (p V0t)) \Leftrightarrow True) \wedge (((p V0t) \vee True) \Leftrightarrow True) \wedge (((False \vee (p V0t)) \Leftrightarrow (p V0t)) \wedge (((p V0t) \vee False) \Leftrightarrow (p V0t)) \wedge (((p V0t) \vee (p V0t)) \Leftrightarrow (p V0t)))))) \quad (13)$$

Assume the following.

$$(\forall V0t \in 2.(((True \Rightarrow (p V0t)) \Leftrightarrow (p V0t)) \wedge (((p V0t) \Rightarrow True) \Leftrightarrow True) \wedge (((False \Rightarrow (p V0t)) \Leftrightarrow True) \wedge (((p V0t) \Rightarrow (p V0t)) \Leftrightarrow True) \wedge (((p V0t) \Rightarrow False) \Leftrightarrow (\neg(p V0t)))))) \quad (14)$$

Assume the following.

$$((\forall V0t \in 2.((\neg(\neg(p V0t))) \Leftrightarrow (p V0t))) \wedge (((\neg True) \Leftrightarrow False) \wedge ((\neg False) \Leftrightarrow True))) \quad (15)$$

Assume the following.

$$\forall A\_27a.nonempty \ A\_27a \Rightarrow (\forall V0x \in A\_27a.((V0x = V0x) \Leftrightarrow True)) \quad (16)$$

Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow (\forall V0x \in A\_27a. (\forall V1y \in A\_27a. ((V0x = V1y) \Leftrightarrow (V1y = V0x)))) \quad (17)$$

Assume the following.

$$(\forall V0t \in 2. (((True \Leftrightarrow (p\ V0t)) \Leftrightarrow (p\ V0t)) \wedge (((p\ V0t) \Leftrightarrow True) \Leftrightarrow (p\ V0t)) \wedge (((False \Leftrightarrow (p\ V0t)) \Leftrightarrow \neg(p\ V0t)) \wedge (((p\ V0t) \Leftrightarrow False) \Leftrightarrow \neg(p\ V0t)))))) \quad (18)$$

Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow (\forall V0t1 \in A\_27a. (\forall V1t2 \in A\_27a. (((ap\ (ap\ (ap\ (c\_2Ebool\_2ECOND\ A\_27a)\ c\_2Ebool\_2ET)\ V0t1)\ V1t2) = V0t1) \wedge ((ap\ (ap\ (ap\ (c\_2Ebool\_2ECOND\ A\_27a)\ c\_2Ebool\_2EF)\ V0t1)\ V1t2) = V1t2)))) \quad (19)$$

Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow (\forall V0P \in (2^{A\_27a}). (\neg(\forall V1x \in A\_27a. (p\ (ap\ V0P\ V1x)))) \Leftrightarrow (\exists V2x \in A\_27a. (\neg(p\ (ap\ V0P\ V2x)))))) \quad (20)$$

Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow (\forall V0P \in (2^{A\_27a}). (\forall V1Q \in (2^{A\_27a}). ((\forall V2x \in A\_27a. ((p\ (ap\ V0P\ V2x)) \wedge (p\ (ap\ V1Q\ V2x)))) \Leftrightarrow ((\forall V3x \in A\_27a. (p\ (ap\ V0P\ V3x))) \wedge (\forall V4x \in A\_27a. (p\ (ap\ V1Q\ V4x))))))) \quad (21)$$

Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow (\forall V0P \in 2. (\forall V1Q \in (2^{A\_27a}). ((\forall V2x \in A\_27a. (p\ (ap\ V1Q\ V2x)))) \Leftrightarrow (\forall V3x \in A\_27a. ((p\ V0P) \wedge (p\ (ap\ V1Q\ V3x)))))) \quad (22)$$

Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow (\forall V0P \in (2^{A\_27a}). (\forall V1Q \in 2. ((\exists V2x \in A\_27a. (p\ (ap\ V0P\ V2x))) \vee (p\ V1Q)) \Leftrightarrow (\exists V3x \in A\_27a. ((p\ (ap\ V0P\ V3x)) \vee (p\ V1Q)))))) \quad (23)$$

Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow (\forall V0P \in (2^{A\_27a}). (\forall V1Q \in 2. ((\exists V2x \in A\_27a. ((p\ (ap\ V0P\ V2x)) \wedge (p\ V1Q))) \Leftrightarrow ((\exists V3x \in A\_27a. (p\ (ap\ V0P\ V3x)) \wedge (p\ V1Q)))))) \quad (24)$$

Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow (\forall V0P \in 2. (\forall V1Q \in (2^{A\_27a}). ((\exists V2x \in A\_27a. ((p\ V0P) \wedge (p\ (ap\ V1Q\ V2x)))) \Leftrightarrow ((p\ V0P) \wedge (\exists V3x \in A\_27a. (p\ (ap\ V1Q\ V3x)))))) \quad (25)$$

Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow (\forall V0P \in 2. (\forall V1Q \in (2^{A\_27a}). ((\forall V2x \in A\_27a. ((p\ V0P) \vee (p\ (ap\ V1Q\ V2x)))) \Leftrightarrow ((p\ V0P) \vee (\forall V3x \in A\_27a. (p\ (ap\ V1Q\ V3x))))))) \quad (26)$$

Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow (\forall V0P \in 2. (\forall V1Q \in (2^{A\_27a}). ((\forall V2x \in A\_27a. ((p\ V0P) \Rightarrow (p\ (ap\ V1Q\ V2x)))) \Leftrightarrow ((p\ V0P) \Rightarrow (\forall V3x \in A\_27a. (p\ (ap\ V1Q\ V3x))))))) \quad (27)$$

Assume the following.

$$(\forall V0A \in 2. (\forall V1B \in 2. (\forall V2C \in 2. (((p\ V0A) \vee (p\ V1B) \vee (p\ V2C)) \Leftrightarrow (((p\ V0A) \vee (p\ V1B)) \vee (p\ V2C)))))) \quad (28)$$

Assume the following.

$$(\forall V0A \in 2. (\forall V1B \in 2. (((p\ V0A) \vee (p\ V1B)) \Leftrightarrow ((p\ V1B) \vee (p\ V0A)))) \quad (29)$$

Assume the following.

$$(\forall V0A \in 2. (\forall V1B \in 2. (((\neg((p\ V0A) \wedge (p\ V1B))) \Leftrightarrow ((\neg(p\ V0A) \vee \neg(p\ V1B)))) \wedge ((\neg((p\ V0A) \vee (p\ V1B))) \Leftrightarrow ((\neg(p\ V0A) \wedge \neg(p\ V1B)))))) \quad (30)$$

Assume the following.

$$(\forall V0t1 \in 2. (\forall V1t2 \in 2. (\forall V2t3 \in 2. (((p\ V0t1) \Rightarrow ((p\ V1t2) \Rightarrow (p\ V2t3))) \Leftrightarrow (((p\ V0t1) \wedge (p\ V1t2)) \Rightarrow (p\ V2t3)))))) \quad (31)$$

Assume the following.

$$\forall V0x \in 2. (\forall V1x\_27 \in 2. (\forall V2y \in 2. (\forall V3y\_27 \in 2. (((((p\ V0x) \Leftrightarrow (p\ V1x\_27)) \wedge ((p\ V1x\_27) \Rightarrow ((p\ V2y) \Leftrightarrow (p\ V3y\_27)))) \Rightarrow (((p\ V0x) \Rightarrow (p\ V2y)) \Leftrightarrow ((p\ V1x\_27) \Rightarrow (p\ V3y\_27)))))) \quad (32)$$

Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow (\forall V0P \in 2. (\forall V1Q \in 2. (\forall V2x \in A\_27a. (\forall V3x\_27 \in A\_27a. (\forall V4y \in A\_27a. (\forall V5y\_27 \in A\_27a. (((((p\ V0P) \Leftrightarrow (p\ V1Q)) \wedge (((p\ V1Q) \Rightarrow (V2x = V3x\_27)) \wedge ((\neg(p\ V1Q)) \Rightarrow (V4y = V5y\_27)))) \Rightarrow ((ap\ (ap\ (ap\ (c.2Ebool\_2ECOND\ A\_27a)\ V0P)\ V2x)\ V4y) = (ap\ (ap\ (ap\ (c.2Ebool\_2ECOND\ A\_27a)\ V1Q)\ V3x\_27)\ V5y\_27)))))) \quad (33)$$

Assume the following.

$$\forall A\_27a.nonempty\ A\_27a \Rightarrow \forall A\_27b.nonempty\ A\_27b \Rightarrow \forall A\_27c.nonempty\ A\_27c \Rightarrow (\forall V0f \in (A\_27b^{A\_27a}). (\forall V1g \in (A\_27a^{A\_27c}). (\forall V2x \in A\_27c. ((ap\ (ap\ (ap\ (c.2Ecombin\_2Eo\ A\_27c\ A\_27b\ A\_27a)\ V0f)\ V1g)\ V2x) = (ap\ V0f\ (ap\ V1g\ V2x)))))) \quad (34)$$

Assume the following.

$$\forall A_{.27a}. \text{nonempty } A_{.27a} \Rightarrow (\forall V0x \in A_{.27a}. ((\text{ap } (\text{c\_2Ecombin\_2EI } A_{.27a}) V0x) = V0x)) \quad (35)$$

Assume the following.

$$\begin{aligned} & \forall A_{.27a}. \text{nonempty } A_{.27a} \Rightarrow (\forall V0op \in ((A_{.27a}^{A_{.27a}})^{A_{.27a}}). \\ & ((p (\text{ap } (\text{c\_2Eiterate\_2Emonoidal } A_{.27a}) V0op)) \Rightarrow ((\forall V1a \in \\ & A_{.27a}. ((\text{ap } (\text{ap } V0op (\text{ap } (\text{c\_2Eiterate\_2Eneutral } A_{.27a}) V0op)) V1a) = \\ & V1a)) \wedge ((\forall V2a \in A_{.27a}. ((\text{ap } (\text{ap } V0op V2a) (\text{ap } (\text{c\_2Eiterate\_2Eneutral } \\ & A_{.27a}) V0op)) = V2a)) \wedge ((\forall V3a \in A_{.27a}. (\forall V4b \in A_{.27a}. \\ & ((\text{ap } (\text{ap } V0op V3a) V4b) = (\text{ap } (\text{ap } V0op V4b) V3a)))))) \wedge ((\forall V5a \in \\ & A_{.27a}. (\forall V6b \in A_{.27a}. (\forall V7c \in A_{.27a}. ((\text{ap } (\text{ap } V0op (\text{ap } \\ & (\text{ap } V0op V5a) V6b)) V7c) = (\text{ap } (\text{ap } V0op V5a) (\text{ap } (\text{ap } V0op V6b) V7c)))))) \wedge \\ & ((\forall V8a \in A_{.27a}. (\forall V9b \in A_{.27a}. (\forall V10c \in A_{.27a}. \\ & ((\text{ap } (\text{ap } V0op V8a) (\text{ap } (\text{ap } V0op V9b) V10c)) = (\text{ap } (\text{ap } V0op V9b) (\text{ap } (\text{ap } \\ & V0op V8a) V10c)))))))))) \end{aligned} \quad (36)$$

Assume the following.

$$\begin{aligned} & \forall A_{.27a}. \text{nonempty } A_{.27a} \Rightarrow \forall A_{.27b}. \text{nonempty } A_{.27b} \Rightarrow ( \\ & \forall V0op \in ((A_{.27a}^{A_{.27a}})^{A_{.27a}}). ((p (\text{ap } (\text{c\_2Eiterate\_2Emonoidal } \\ & A_{.27a}) V0op)) \Rightarrow ((\forall V1f \in (A_{.27a}^{A_{.27b}}). ((\text{ap } (\text{ap } (\text{ap } (\text{c\_2Eiterate\_2Eiterate } \\ & A_{.27b} A_{.27a}) V0op) (\text{c\_2Epred\_set\_2EEMPTY } A_{.27b})) V1f) = (\text{ap } (\text{c\_2Eiterate\_2Eneutral } \\ & A_{.27a}) V0op))) \wedge (\forall V2f \in (A_{.27a}^{A_{.27b}}). (\forall V3x \in A_{.27b}. \\ & (\forall V4s \in (2^{A_{.27b}}). ((p (\text{ap } (\text{c\_2Epred\_set\_2EFINITE } A_{.27b}) \\ & V4s)) \Rightarrow ((\text{ap } (\text{ap } (\text{ap } (\text{c\_2Eiterate\_2Eiterate } A_{.27b} A_{.27a}) V0op) ( \\ & \text{ap } (\text{ap } (\text{c\_2Epred\_set\_2EINSERT } A_{.27b}) V3x) V4s)) V2f) = (\text{ap } (\text{ap } ( \\ & \text{ap } (\text{c\_2Ebool\_2ECOND } A_{.27a}) (\text{ap } (\text{ap } (\text{c\_2Ebool\_2EIN } A_{.27b}) V3x) V4s)) \\ & (\text{ap } (\text{ap } (\text{ap } (\text{c\_2Eiterate\_2Eiterate } A_{.27b} A_{.27a}) V0op) V4s) V2f)) \\ & (\text{ap } (\text{ap } V0op (\text{ap } V2f V3x)) (\text{ap } (\text{ap } (\text{ap } (\text{c\_2Eiterate\_2Eiterate } A_{.27b} \\ & A_{.27a}) V0op) V4s) V2f)))))))))) \end{aligned} \quad (37)$$

Assume the following.

$$\begin{aligned} & \forall A_{.27a}. \text{nonempty } A_{.27a} \Rightarrow (\forall V0x \in A_{.27a}. (\forall V1y \in \\ & A_{.27a}. (\forall V2s \in (2^{A_{.27a}}). ((p (\text{ap } (\text{ap } (\text{c\_2Ebool\_2EIN } A_{.27a}) \\ & V0x) (\text{ap } (\text{ap } (\text{c\_2Epred\_set\_2EINSERT } A_{.27a}) V1y) V2s))) \Leftrightarrow ((V0x = \\ & V1y) \vee (p (\text{ap } (\text{ap } (\text{c\_2Ebool\_2EIN } A_{.27a}) V0x) V2s)))))) \end{aligned} \quad (38)$$

Assume the following.

$$\begin{aligned} & \forall A_{.27a}. \text{nonempty } A_{.27a} \Rightarrow \forall A_{.27b}. \text{nonempty } A_{.27b} \Rightarrow ( \\ & \forall V0y \in A_{.27b}. (\forall V1s \in (2^{A_{.27a}}). (\forall V2f \in (A_{.27b}^{A_{.27a}}). \\ & ((p (\text{ap } (\text{ap } (\text{ap } (\text{c\_2Ebool\_2EIN } A_{.27b}) V0y) (\text{ap } (\text{ap } (\text{c\_2Epred\_set\_2EIMAGE } \\ & A_{.27a} A_{.27b}) V2f) V1s))) \Leftrightarrow (\exists V3x \in A_{.27a}. ((V0y = (\text{ap } V2f V3x)) \wedge \\ & (p (\text{ap } (\text{ap } (\text{c\_2Ebool\_2EIN } A_{.27a}) V3x) V1s)))))) \end{aligned} \quad (39)$$

Assume the following.

$$\begin{aligned} & \forall A\_27a.nonempty\ A\_27a \Rightarrow \forall A\_27b.nonempty\ A\_27b \Rightarrow ( \\ & \quad \forall V0f \in (A\_27b^{A\_27a}).((ap\ (ap\ (c\_2Epred\_set\_2EIMAGE\ A\_27a \\ & \quad A\_27b)\ V0f)\ (c\_2Epred\_set\_2EEMPTY\ A\_27a)) = (c\_2Epred\_set\_2EEMPTY \\ & \quad A\_27b))) \end{aligned} \quad (40)$$

Assume the following.

$$\begin{aligned} & \forall A\_27a.nonempty\ A\_27a \Rightarrow \forall A\_27b.nonempty\ A\_27b \Rightarrow ( \\ & \quad \forall V0f \in (A\_27b^{A\_27a}).(\forall V1x \in A\_27a.(\forall V2s \in ( \\ & \quad 2^{A\_27a}).((ap\ (ap\ (c\_2Epred\_set\_2EIMAGE\ A\_27a\ A\_27b)\ V0f)\ (ap \\ & \quad (ap\ (c\_2Epred\_set\_2EINSERT\ A\_27a)\ V1x)\ V2s)) = (ap\ (ap\ (c\_2Epred\_set\_2EINSERT \\ & \quad A\_27b)\ (ap\ V0f\ V1x))\ (ap\ (ap\ (c\_2Epred\_set\_2EIMAGE\ A\_27a\ A\_27b) \\ & \quad V0f)\ V2s)))))) \end{aligned} \quad (41)$$

Assume the following.

$$\begin{aligned} & \forall A\_27a.nonempty\ A\_27a \Rightarrow (\forall V0P \in (2^{(2^{A\_27a})}).(( \\ & \quad (p\ (ap\ V0P\ (c\_2Epred\_set\_2EEMPTY\ A\_27a))) \wedge (\forall V1s \in (2^{A\_27a}). \\ & \quad ((p\ (ap\ (c\_2Epred\_set\_2EFINITE\ A\_27a)\ V1s)) \wedge (p\ (ap\ V0P\ V1s)))) \Rightarrow \\ & \quad (\forall V2e \in A\_27a.((\neg(p\ (ap\ (ap\ (c\_2Ebool\_2EIN\ A\_27a)\ V2e)\ V1s))) \Rightarrow \\ & \quad (p\ (ap\ V0P\ (ap\ (ap\ (c\_2Epred\_set\_2EINSERT\ A\_27a)\ V2e)\ V1s)))))) \Rightarrow \\ & \quad (\forall V3s \in (2^{A\_27a}).((p\ (ap\ (c\_2Epred\_set\_2EFINITE\ A\_27a) \\ & \quad V3s)) \Rightarrow (p\ (ap\ V0P\ V3s)))))) \end{aligned} \quad (42)$$

Assume the following.

$$\begin{aligned} & \forall A\_27a.nonempty\ A\_27a \Rightarrow \forall A\_27b.nonempty\ A\_27b \Rightarrow ( \\ & \quad \forall V0s \in (2^{A\_27a}).((p\ (ap\ (c\_2Epred\_set\_2EFINITE\ A\_27a) \\ & \quad V0s)) \Rightarrow (\forall V1f \in (A\_27b^{A\_27a}).(p\ (ap\ (c\_2Epred\_set\_2EFINITE \\ & \quad A\_27b)\ (ap\ (ap\ (c\_2Epred\_set\_2EIMAGE\ A\_27a\ A\_27b)\ V1f)\ V0s)))))) \end{aligned} \quad (43)$$

Assume the following.

$$(\forall V0t \in 2.((\neg(\neg(p\ V0t))) \Leftrightarrow (p\ V0t))) \quad (44)$$

Assume the following.

$$(\forall V0A \in 2.((p\ V0A) \Rightarrow ((\neg(p\ V0A)) \Rightarrow False))) \quad (45)$$

Assume the following.

$$\begin{aligned} & (\forall V0A \in 2.(\forall V1B \in 2.(((\neg((p\ V0A) \vee (p\ V1B))) \Rightarrow False) \Leftrightarrow \\ & \quad ((p\ V0A) \Rightarrow False) \Rightarrow ((\neg(p\ V1B)) \Rightarrow False)))) \end{aligned} \quad (46)$$

Assume the following.

$$\begin{aligned} & (\forall V0A \in 2.(\forall V1B \in 2.(((\neg(\neg((p\ V0A) \vee (p\ V1B))) \Rightarrow False) \Leftrightarrow \\ & \quad ((p\ V0A) \Rightarrow ((\neg(p\ V1B)) \Rightarrow False)))))) \end{aligned} \quad (47)$$

Assume the following.

$$(\forall V0A \in 2.((\neg(p V0A)) \Rightarrow False) \Rightarrow ((p V0A) \Rightarrow False) \Rightarrow False)) \quad (48)$$

Assume the following.

$$\begin{aligned} & (\forall V0p \in 2.(\forall V1q \in 2.(\forall V2r \in 2.(((p V0p) \Leftrightarrow ( \\ & (p V1q) \Leftrightarrow (p V2r))) \Leftrightarrow (((p V0p) \vee ((p V1q) \vee (p V2r))) \wedge (((p V0p) \vee (\neg( \\ & p V2r)) \vee (\neg(p V1q)))) \wedge (((p V1q) \vee ((\neg(p V2r)) \vee (\neg(p V0p)))) \wedge ((p V2r) \vee \\ & ((\neg(p V1q)) \vee (\neg(p V0p)))))))))) \end{aligned} \quad (49)$$

Assume the following.

$$\begin{aligned} & (\forall V0p \in 2.(\forall V1q \in 2.(\forall V2r \in 2.(((p V0p) \Leftrightarrow ( \\ & (p V1q) \wedge (p V2r))) \Leftrightarrow (((p V0p) \vee (\neg(p V1q)) \vee (\neg(p V2r)))) \wedge (((p V1q) \vee \\ & (\neg(p V0p))) \wedge ((p V2r) \vee (\neg(p V0p)))))) \end{aligned} \quad (50)$$

Assume the following.

$$\begin{aligned} & (\forall V0p \in 2.(\forall V1q \in 2.(\forall V2r \in 2.(((p V0p) \Leftrightarrow ( \\ & (p V1q) \vee (p V2r))) \Leftrightarrow (((p V0p) \vee (\neg(p V1q))) \wedge (((p V0p) \vee (\neg(p V2r))) \wedge \\ & ((p V1q) \vee ((p V2r) \vee (\neg(p V0p)))))))) \end{aligned} \quad (51)$$

Assume the following.

$$\begin{aligned} & (\forall V0p \in 2.(\forall V1q \in 2.(\forall V2r \in 2.(((p V0p) \Leftrightarrow ( \\ & (p V1q) \Rightarrow (p V2r))) \Leftrightarrow (((p V0p) \vee (p V1q)) \wedge (((p V0p) \vee (\neg(p V2r))) \wedge (( \\ & \neg(p V1q)) \vee ((p V2r) \vee (\neg(p V0p)))))))) \end{aligned} \quad (52)$$

Assume the following.

$$\begin{aligned} & (\forall V0p \in 2.(\forall V1q \in 2.(((p V0p) \Leftrightarrow (\neg(p V1q))) \Leftrightarrow (((p V0p) \vee \\ & (p V1q)) \wedge ((\neg(p V1q)) \vee (\neg(p V0p)))))) \end{aligned} \quad (53)$$

Assume the following.

$$(\forall V0p \in 2.(\forall V1q \in 2.((\neg((p V0p) \Rightarrow (p V1q))) \Rightarrow (p V0p))) \quad (54)$$

Assume the following.

$$(\forall V0p \in 2.(\forall V1q \in 2.((\neg((p V0p) \Rightarrow (p V1q))) \Rightarrow (\neg(p V1q)))) \quad (55)$$

Assume the following.

$$(\forall V0p \in 2.(\forall V1q \in 2.((\neg((p V0p) \vee (p V1q))) \Rightarrow (\neg(p V0p)))) \quad (56)$$

Assume the following.

$$(\forall V0p \in 2.(\forall V1q \in 2.((\neg((p V0p) \vee (p V1q))) \Rightarrow (\neg(p V1q)))) \quad (57)$$

Assume the following.

$$(\forall V0p \in 2.((\neg(\neg(p V0p))) \Rightarrow (p V0p))) \quad (58)$$



**Theorem 1**

$$\begin{aligned} & \forall A\_27a.nonempty\ A\_27a \Rightarrow \forall A\_27b.nonempty\ A\_27b \Rightarrow \forall A\_27c. \\ nonempty\ A\_27c & \Rightarrow (\forall V0op \in ((A\_27c^{A\_27c})^{A\_27c}).((p\ (ap\ (c\_2Eiterate\_2Emonoidal \\ & A\_27c)\ V0op)) \Rightarrow (\forall V1g \in (A\_27c^{A\_27b}).(\forall V2f \in (A\_27b^{A\_27a}). \\ & (\forall V3s \in (2^{A\_27a}).(((p\ (ap\ (c\_2Epred\_set\_2EFINITE\ A\_27a) \\ & V3s)) \wedge (\forall V4x \in A\_27a.(\forall V5y \in A\_27a.(((p\ (ap\ (ap\ (c\_2Ebool\_2EIN \\ & A\_27a)\ V4x)\ V3s)) \wedge ((p\ (ap\ (ap\ (c\_2Ebool\_2EIN\ A\_27a)\ V5y)\ V3s)) \wedge \\ & ((\neg(V4x = V5y)) \wedge ((ap\ V2f\ V4x) = (ap\ V2f\ V5y)))))) \Rightarrow ((ap\ V1g\ (ap\ V2f\ V4x)) = \\ & (ap\ (c\_2Eiterate\_2Eneutral\ A\_27c)\ V0op)))))) \Rightarrow ((ap\ (ap\ (ap\ (c\_2Eiterate\_2Eiterate \\ & A\_27b\ A\_27c)\ V0op)\ (ap\ (ap\ (c\_2Epred\_set\_2EIMAGE\ A\_27a\ A\_27b) \\ & V2f)\ V3s))\ V1g) = (ap\ (ap\ (ap\ (c\_2Eiterate\_2Eiterate\ A\_27a\ A\_27c) \\ & V0op)\ V3s)\ (ap\ (ap\ (c\_2Ecombin\_2Eo\ A\_27a\ A\_27c\ A\_27b)\ V1g)\ V2f)))))))))) \end{aligned}$$