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Abduction Prover in Isabelle(/HOL)

Yutaka Nagashima (the Czech Academy of Sciences) Daniel Sebastian Goc x/twitter: YutakangE ✓ high-level talk



United Reasoning Visit: https://youtu.be/rXU-IJxP_GI

LIVE DEMO (We will come back at the end.)











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RESEARCH-ARTICLE

PaMpeR: proof method recommendation system for Isabelle/HOL

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Publication: ASE 2018: Proceedings of the 33rd ACM/IEEE International Conference on Automated Software Engineering • September 2018 • Pages 362-372 • https://doi.org/10.1145/3238147.3238210

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ASE 2018: Proceedings of the 33rd ACM/IEEE... PaMpeR: proof method recommendation... Pages 362-372 Next —

ABSTRACT

Deciding which sub-tool to use interactive theorem prover (ITF a <U>p</U>roof <U>m</U>eth proof state, PaMpeR</pre provides qualitative explanation generates these recommendation transferring experienced users PaMpeR correctly especially when it comes to spe

Faster Smarter Proof by Induction in Isabelle/HOL Yutaka Nagashima

Proceedings of the Thirtieth International Joint Conference on Artificial Intelligence



IJCAI 2021

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Main Track. Pages 1981-1988. https://doi.org/10.24963/ijcai.2021/273

← Previous ABSTRACT References

Index Terms Comments



References

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(subgoal → goal) subgoal goal tactic application





Aim: to find a path from the root to the node representing proof completion.



Node = Subgoals or Auxiliary Lemma

Aim: to find a portion of the graph that represents a proof of the original goal.

LIVE DEMO (We're almost at the end of this talk.)

B TIP_prop	L06.thy (~/Workplace/Prod/Prod/)	Proof state Vuto update Update Search:
- 31 "t	2 (S z2) z = S (t2 z2 z)"	▼ 100% ~ .
32		theorem
5 ○ 33 prov	e property v :	original goal 7579816:
34 "($(\text{length}(\text{rev}(x \mid y \mid z))) = (t2 (\text{length} \mid y) ((\text{length} \mid z)))^n$	length (rev (x ?var 0.0 ?var 1.0)) =
35		t2 (length ?var 0.0) (length ?var 1.0)
36	a abduced lowma tactic 14045256. Wyar 0 - t2 yar 0 7	
30 an		
2 39 ab	hty (simpart) done	
40 41] emm	a abduced lemma tartic 14045358. "(Λ_a t2 var 0 a = t2 a var 0) \rightarrow S (t2 var 1 var 0) = t2 var 1 (S var 0)"	
41 Cenin	u added_ctem_cterte_t+0+555. (A. 2 va_5 u = 2 u +0 -0) $\rightarrow 5$ (2 va_1 va_5) = 2 va_1 (5 va_5)	
42 ap	have the second s	
45		
45 Lemm	a abduced lemma commutativity 7642214: "t2 var 0 var 1 = t2 var 1 var 0"	
46 ap	ply (induct "var 0" arbitrary : var 1)	
47 ap	plv (simp all)	
48 ap	plv (simp add : abduced lemma tactic 14045356)	
49 US	ing abduced lemma tactic 14045358 apply force done	
50		
51 Lemm	a abduced lemma tactic 13498028: "length var θ = length (x var θ nil2)"	
52 ap	ply (induct "var 0")	
- 53 ap	ply (simp all) done	
54		
\$ 55 Lemm	a abduced lemma remove assumption 47001480: "S (length (x var θ var 1)) = length (x var θ (cons2 var 2 var 1))"	
56 ap	ply (induct "var θ" arbitrary : var 1)	
- 57 ap	ply (simp all) done	
58		
\$ 59 Lemm	a abduced_lemma_tactic_13498034:	
- 60 " (🔿	a. length (x var_ θ a) = length (x a var_ θ)) \Rightarrow S (length (x var_1 var_ θ)) = length (x var_1 (cons2 var_ θ))"	
61 ap	ply (simp add : abduced_lemma_remove_assumption_47001480) done	
62		
63 Lemm	a abduced_lemma_composite_commutativity_7642270: "length (x var_0 var_1) = length (x var_0 var_0)"	
64 ap	<pre>ply (induct "var_0" arbitrary : var_1)</pre>	
65 ap	<pre>ply (simp_all)</pre>	
66 US	ing abduced lemma tactic_13498028 apply blast	
67 ap	<pre>ply (simp add : abduced_lemma_tactic_13498034) done</pre>	
68		
69 lemm	a abduced_lemma_tactic_13293202: "length (rev var_0) = length var_0 \Longrightarrow length (x (rev var_0) (cons2 var_1 nil2)) = S (length var_0)"	
70 ap	ply (metis TIP_prop_06.length.simps (2) TIP_prop_06.x.simps (1) TIP_prop_06.x.simps (2)	
- 71	abduced_lemma_composite_commutativity_7642270) done	
72		
0 73 lemm	a abduced_lemma_generalisation_then_extension_7642332: "length (rev var_0) = length var_0"	
74 ap	<pre>ply (induct "var_0")</pre>	
75 ap	ply (simp_all)	
- 76 ap	ply (simp add : abduced_lemma_tactic_13293202) <u>done</u>	
77		
♦ 78 Lemm	a abduced_lemma_identity_7579838: "x var_0 nil2 = var_0"	
79 ap	<pre>ply (induct "var_0")</pre>	
- 80 ap	ply (simp_all) done	
81		
82 Lemm	a abduced Lemma_generalisation_then_extension_1//45958: "length (rev (x var 0 nll2)) = length var 0"	
83 ap	ply (simp add : abduced_lemma_generalisation_then_extension_/642332 abduced_lemma_identity_/5/9838)	
- 84 do	ine de la constante de la const	
85		
86 Lemm 86 Lemm	a about the Lemma tactic 332/4940: $(A. \text{ tength } (\text{rev}(x a \text{ var} G)) = 12 (\text{ tength } var, G) (\text{tength } a)) \implies$	
- 87 teng	$(1) (rev (x Var_1 (collsz Var_2 Var_0))) = 5 ((z (tength Var_1)))$	
88 ap	pty (metis iP_prop_00.length.simps (2) iP_prop_00.x.simps (2) abduced_lemma_composite_commutativity_042220 abduced_lemma_generalisation_then_extension_042332)	
- 89 00	ine and a second s	
90	r should law a conversion of 7647396 . Then the (vary (vary 0 vary 1)) - the (law the vary 0).	
91 Lemm	a abulcui centra generalize by reinalize $y_1 = reinalize y_1 = reinalize y_1$	
92 ap	pty (induct val 1 abtraly ; val 0)	
93 ap	pty (samp_att) mult (simp_att), abdured lemma generalization then extension 17745958)	
94 ap	<pre>plu (simp add : abduced lemma tractic 2322404)</pre>	
95 ap	hey (simp add : abdaced_temma_tatit_33224940)	
96 00	lie de la constante de la const	
9/	a original doal 7570816; "length (rev (x var θ var 1)) - +2 (length var 1)"	
90	no organic_gouc_forsource tengen (rev (x voi_v voi_v) = te (tengen voi_v) (tengen voi_v) (tengen voi_v) (tengen voi_v) (tengen voi	Ŧ
99 ap	<pre>pry (simp dod . abduced_temma_commatativity_/v42214 abduced_temma_generative_by_reliamining_/v42200 ;</pre>	1
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TIP_prop_06.thy (~/Workplace/Prod/Prod/)		✓ ✓ ✓ Proof state ✓ Auto update Update Search:
31 "t2 (S z2) z = S (t2 z2 z)"		▼ 100% ∨
34 saprove property0 :		theorem
34 "((length (rev (x y z))) = (t2 (length y) (length z)))"		original_goal_7579816:
35		length (rev (x ?var_0.0 ?var_1.0)) =
$_{100000}$ abduced lower testic 14045256. Were $0 = \pm 2$ yer 0.7		
a) caning abutce_temma_tacttrates555. Val_0 = t2 Val_0 2		
39 apply (simp_all) done		
	1 (0	
41 Lemma aboutced_Lemma_tactic_14045358; $"(/)a$, t2 var_0 a = t2 a var_0) \implies 5 (t2 var_1 var_0) = t2 v about (induct "var 1" "var 0" rule : TIP prop 06 t2 induct)	ar_1 (S var_0)"	
a apply (simp all) done		
44		
<pre>45\Lemma abduced_lemma_commutativity_7642214: "t2 var_0 var_1 = t2 var_1 var_0"</pre>		
apply (induct var_0 arbitrary: var_1)		
<pre>48 apply (simp add : abduced_lemma_tactic_14045356)</pre>	$mma \rightarrow poall = HIIIIIa$	
49 using abduced_lemma_tactic_14045358 apply force done		
50 51 Jemma abduced Jemma tactic 13408028: "Jenoth var A = Jenoth (v var A nil2)"		noduchonon
52 apply (induct "var 0")		
53 apply (simp_all) done		
54		
55 Lemma abouced_Lemma_remove_assumption_4/001480; "5 (Length (x Var_0 Var_1)) = Length (x Var_0 (cor 56 _apply (induct "var 0" arbitrary : var 1)	sz var_z var_i)"	
s7 apply (simp all) done	goal	
58	5001	
$\frac{59}{20} = \frac{1}{20} + \frac{1}{20}$		
a apply (sim ad ; abduced lemma remove assumption 47001480) done		
62		
63 Lemma abduced_lemma_composite_commutativity_7642270: "length (x var_0 var_1) = length (x var_1 var 63 Lemma abduced_lemma_composite_commutativity_7642270: "length (x var_0 var_1) = length (x var_1 var 64 Lemma abduced_lemma_composite_commutativity_7642270: "length (x var_0 var_1) = length (x var_1 v	_0) "	
64 apply (induct "Var_0" arbitrary : Var_1)		
6 using abduced lemma tactic 13498028 apply blast		
67 apply (simp add : abduced_lemma_tactic_13498034) done		
$\frac{66}{10000000000000000000000000000000000$	(and unt 1 nill) = C (length unt 0)	
apply (metis TIP prop 06.length.simps (2) TIP prop 06.x.simps (1) TIP prop 06.x.simps (2)	$(cons_2 var_1 nic_2) = 5 (cengch var_0)$	
71 abduced_lemma_composite_commutativity_7642270) done	$h = \sigma \circ 1 \rightarrow \sigma \circ 1$ sub- $\sigma \circ 2$	
⁷²	D - SOM \rightarrow S	tactic
73 Lemma abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_/642332: "Length (rev Var_0) = Length (a_0" - abduced_Lemma generalisation_then_extension_rev (a_0" - abduced_Lemma generalisation_then_extension_rev (abduced_Lemma generalisation_then_extension_rev		
s apply (simp all)		
76 apply (simp add : abduced_lemma_tactic_13293202) done		
77 zalemma obduced lemma identity 7570920, "v yor 0 pilo - yor 0"		annlication
ra comma a volte (induct "var 0")		αρρητατιστι
apply (simp_all) done	GOO	
az cenima abouted_temima_generalisation_then_extension_1//45958: "length (rev (x var_0 nil2)) = length as apply (simp add : abduced lemma generalisation then extension 7642332 abduced lemma identity 75	79838	
done		
85		
<pre>86 Lemma abduced_lemma_tactic_33224946: "(Λa. length (rev (x a var_0)) = t2 (length var_0) (length a relength (rev (x var_1 (cons2 var_2 var_0))) = S (t2 (length var_0) (length var_1))"</pre>	$)) \Rightarrow$	
apply (metis TIP prop 06.length.simps (2) TIP prop 06.x.simps (2) abduced lemma composite (ommutativity 7642270 abduced lemma generalisation then extension 7642332)	
as done		
98	1) (length yes 0)	
<pre>gitemma abduced_temma_generalise_by_renaming_/042286: "length (rev (x var_0 var_1))" = t2 (length val gz apply (induct "var 1" arbitrary : var 0)</pre>) (tength var_0)"	
<pre>93 apply (simp_all)</pre>		
<pre>94 apply (simp add : abduced_lemma_generalisation_then_extension_17745958)</pre>		
<pre>95 apply (simp add : abduced_lemma_tactic_33224946) acd dama</pre>		
90 UVIC 97		
<pre>gellemma original_goal_7579816: "length (rev (x var_0 var_1)) = t2 (length var_0) (length var_1)"</pre>		
apply (simp add : abduced_lemma_commutativity_7642214 abduced_lemma_generalise_by_renaming_7642	286)	I

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т	1P_prop_06.thy (~/Workplace/Prod/Prod/)	✓ Proof state ✓ Auto update Update Sea
3	1 "t2 (S z2) z = S (t2 z2 z)"	✓ L00%
3	2 aprove property0 :	theorem
3	("((length (rev (x y z))) = (t2 (length y) (length z)))"	original_goal_7579816:
3!	s and the second se	length (rev (x ?var_0.0 ?var_1.0)) =
3	6 Jeama abduced lemma tactic 14045356. "Var θ = t2 var θ 7"	
3	apply (induct "var 0")	
3	apply (simp_all) done	
4		
4	$\begin{bmatrix} \text{Lemma abudged} (\text{Lemma fractice}, 14943536; (Aa, 12 val_0) \Rightarrow 5 (12 val_0) \Rightarrow 5 (12 val_1) val_0) = 12 val_1 (5 val_0) \\ = applv (induct "var 1" "var 0" rule : TIP prop 66, t2 induct)$	
4	apply (simp_all) done	
4		
4	apply (induct "var 0" achitrary: var 1)	
4	apply (simp all)	
4	a apply (simp add : abduced lemma tactic 14045356)	
4	g Using abduced_Lemma_tactic_14045338 apply force done	
5	lemma abduced Lemma tactic 13498028: "length var 0 = length (x var 0 nil2)"	nonc
5	2 apply (induct "var_0")	וכווס
5	a apply (simp_all) done	
5	s Jemma abduced lemma remove assumption 47001480: "S (length (x var θ var 1)) = length (x var θ (cons2 var 2 var 1))"	
5	apply (induct "var 0" arbitrary : var_1)	
5	apply (simp_all) done	
5	olemma abduced lemma tactic 13498034;	
6	$((A_a, length(x var_0 a) = length(x a var_0)) \implies S(length(x var_1 var_0)) = length(x var_1 (cons2 var_2 var_0))$	
6	apply (simp add : abduced_lemma_remove_assumption_47001480) done	
6	lemma abduced lemma composite commutativity 7642270: "length (x var 0 var 1) = length (x var 1 var 0)"	
6	a apply (induct "var 0" arbitrary : var 1)	
6	s apply (simp_all)	
6	6 Using abouted_temma_tactit_13496026 apply blast	
6		
6	<pre>elemma abduced lemma_tactic_13293202: "length (rev var_0) = length var_0 ⇒ length (x (rev var_0) (cons2 var_1 nil2)) = 5 (length var_0)"</pre>	
7	a abduyed lemma composite commutativity (7642276) done	
7	2 3 3 3 3 3 3 3 3 3 3	nnlata_hacad
7	slemma_abduced_lemma_generalisation_then_extension_7642332: "length (rev va_0) = length; va_0	ווטומנכ־טמזכט
7	4 apply (induct "var 0") apply (cinn all)	
7	<pre>apply(simp_add : abduced lemma tactic_13293202) done</pre>	
7		nnacturing
7	Slemma abduced Lemma identity /5/9838: "x var@ nil2 = var@"	unjeetunng
8	apply (sinp all) done	
8		
8	2 Lemma abduced Lemma generalisation then extension 17745958: "Length (rev (x var 0 nil2)) = length var 0"	
8	a approv (simp add : abdded_temma_generatisation_then_extension_7042552 abdded_temma_tdentity_575555)	
8	s	
8	$[\text{lemma abduced lemma tactic 33224946: "(Aa. length (rev (x a var \theta)) = t2 (length var \theta) (length a)) \Rightarrow$	
8	a_{a} apply (rev (x var_1 (const var_2 var_0)) - 5 ((z (length var_1))) = 5 ((z (length var_1	
8	9 done	
9	0	
9	apply (induct "var1" arbitrary: var 0)	
9	apply (simp_all)	
9	<pre>4 apply (simp add : abduced_lemma_generalisation_then_extension_17745958)</pre>	
9	s apply (simp add : abduced_temma_tactic_33224946)	
9		
9	alemma original_goal_7579816: "length (rev (x var_0 var_1)) = t2 (length var_0) (length var_1)"	r
9	<pre>g apply (simp add : abduced_lemma_commutativity_7642214 abduced_lemma_generalise_by_renaming_7642286) a done</pre>	

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File Edit Search Markers Folding View Utilities Macros Plugins Help 🖻 🖻 i 🖪 🥵 i 📬 🖾 🖾 🖓 i 🔍 i 🔍 i 📣 i 🙆 i 📣 👘 TIP prop 06.thy (~/Workplace/Prod/Prod/ Proof state Auto update Update Search: 1 | "t2 (S z2) z = S (t2 z2 z)"- 100% theorem 33 prove propertv0 : original goal 7579816: "((length (rev (x y z))) = (t2 (length y) (length z)))" length (rev (x ?var 0.0 ?var 1.0)) = t2 (length ?var_0.0) (length ?var_1.0) a7 lemma abduced lemma tactic 14045356: "var 0 = t2 var 0 Z" apply (induct "var 0") apply (simp all) done 41 Lemma abduced lemma tactic 14045358: "(A. t2 var 0 a = t2 a var 0) \implies S (t2 var 1 var 0) = t2 var 1 (S var 0)" 42 apply (induct "var 1" "var 0" rule : TIP prop 06.t2.induct) apply (simp all) done 45 lemma abduced lemma commutativity 7642214: "t2 var 0 var 1 = t2 var 1 var 0" apply (induct "var 0" arbitrary : var 1) $(\text{lemma} \rightarrow \text{goal})$ lemma apply (simp all) apply (simp add : abduced lemma tactic 14045356) using abduced lemma tactic 14045358 apply force done modus ponens 1lemma abduced_lemma_tactic_13498028: "length var_0 = length (x var 0 nil2)" apply (induct "var 0") apply (simp all) done Lemma abduced lemma remove assumption 47001480: "S (length (x var 0 var 1)) = length (x var 0 (cons2 var 2 var 1))" goal apply (induct "var 0" arbitrary : var 1) apply (simp all) done 59 **Lemma** abduced lemma tactic 13498034: 0"(Aa. length (x var_0 a) = length (x a var_0)) \implies S (length (x var_1 var_0)) = length (x var_1 (cons2 var_2 var_0))" apply (simp add : abduced lemma remove assumption 47001480) done $_{63}$ lemma abduced lemma composite commutativity 7642270: "length (x var 0 var 1) = length (x var 1 var 0)" apply (induct "var 0" arbitrary : var 1) apply (simp all) using abduced_lemma_tactic_13498028 apply blast apply (simp add : abduced lemma tactic 13498034) done $_{69}$ lemma abduced lemma tactic 13293202: "length (rev var θ) = length var $\theta \implies$ length (x (rev var θ) (cons2 var 1 nil2)) = S (length var θ)" apply (metis TIP prop 06.length.simps (2) TIP_prop_06.x.simps (1) TIP_prop_06.x.simps (2) conjecture mutation-based abduced lemma composite commutativity 7642270) done n_{ie} cture \rightarrow goal) Lemma abduced lemma generalisation then extension 7642332: apply (induct "var 0") apply (simp all) apply (simp add : abduced_lemma_tactic_13293202) done conjecturing 78 lemma abduced lemma identity 7579838: "x var 0 nil2 = var 0" apply (induct "var 0") goal apply (simp all) done lemma abduced lemma generalisation then extension 17745958: "length (rev (x var 0 nil2)) = length var 0" apply (simp add : abduced lemma generalisation then extension 7642332 abduced lemma identity 7579838) done $_{86}$ lemma abduced_lemma_tactic_33224946: "($(Aa. length (rev (x a var_0)) = t2 (length var_0) (length a)) \implies$ $1 = 37 \left[\text{length (rev (x var 1 (cons2 var 2 var 0))} \right] = S (t2 (length var 0) (length var 1))"$ apply (metis TIP prop 06.length.simps (2) TIP prop 06.x.simps (2) abduced lemma composite commutativity 7642270 abduced lemma generalisation then extension 7642332) done 1 lemma abduced lemma generalise by renaming 7642286: "length (rev (x var 0 var 1)) = t2 (length var 1) (length var 0)" apply (induct "var 1" arbitrary : var 0) apply (simp all) apply (simp add : abduced_lemma_generalisation_then_extension 17745958) apply (simp add : abduced lemma tactic 33224946) done $_{98}$ Lemma original goal 7579816: "length (rev (x var 0 var 1)) = t2 (length var 0) (length var 1)" 99 apply (simp add : abduced lemma commutativity 7642214 abduced lemma generalise by renaming 7642286)

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File Edit Search Markers Folding View Utilities Macros Plugins Help 💥 🕞 🕄 I 🖓 I 🗂 🖾 🗔 🗔 I 🔍 🔆 I 📥 I 🙆 I 👍 👘 TIP prop 06.thv (~/Workplace/Prod/Prod/) Proof state Auto update Update Search: 31 | "t2 (S z2) z = S (t2 z2 z)"100% theorem 33 prove propertv0 : original goal 7579816: "((length (rev (x y z))) = (t2 (length y) (length z)))" length (rev (x ?var 0.0 ?var 1.0)) = t2 (length ?var_0.0) (length ?var_1.0) 37 **lemma** abduced lemma tactic 14045356: "var 0 = t2 var 0 Z" apply (induct "var 0") apply (simp all) done 41 Lemma abduced lemma tactic 14045358: "(Aa. t2 var 0a = t2 a var <math>0) \implies S (t2 var 1 var 0) = t2 var 1 (S var 0)" simultaneous 42 apply (induct "var 1" "var 0" rule : TIP prop 06.t2.induct) 43 apply (simp all) done 45 Lemma abduced lemma commutativity 7642214: "t2 var 0 var 1 = t2 var 1 var 0" 46 apply (induct "var 0" arbitrary : var 1) conjecturing apply (simp all) apply (simp add : abduced_lemma_tactic 14045356) using abduced lemma tactic 14045358 apply force done s1lemma abduced_lemma_tactic_13498028: "length var_0 = length (x var_0 nil2)" apply (induct "var 0") apply (simp all) done lemma abduced lemma remove assumption 47001480: "S (length (x var 0 var 1)) = length (x var 0 (cons2 var 2 var 1))" apply (induct "var 0" arbitrary : var 1) apply (simp all) done so Lemma abduced Lemma_tactic 13498034: (A. Length (x var_0 a) = Length (x a var_0)) \Rightarrow S (Length (x var_1 var_0)) = Length (x var_1 (on 2010 Man 2010 M $_{63}$ lemma abduced lemma composite commutativity 7642270: "length (x var 0 var 1) = length (x var 1 var 0)" apply (induct "var 0" arbitrary : var 1) apply (simp all) using abduced lemma tactic 13498028 apply blast apply (simp add : abduced lemma tactic 13498034) done goa $_{69}$ lemma abduced lemma tactic 13293202: "length (rev var 0) = length var 0 \implies length (x (rev var 0) (cons2 var 1 nil2)) = S (length var 0)" apply (metis TIP prop 06.length.simps (2) TIP prop 06.x.simps (1) TIP prop 06.x.simps (2) abduced lemma composite commutativity 7642270) done 73 lemma abduced lemma generalisation then extension 7642332: "length (rev var 0) = length var 0" apply (induct "var 0") apply (simp all) apply (simp add : abduced_lemma_tactic_13293202) done 78 lemma abduced lemma identity 7579838: "x var 0 nil2 = var 0" 79 apply (induct "var 0") apply (simp all) done 82 lemma abduced lemma generalisation then extension 17745958: "length (rev (x var 0 nil2)) = length var 0" apply (simp add : abduced lemma generalisation then extension 7642332 abduced lemma identity 7579838) done 86[lemma abduced_lemma_tactic_33224946: "(\A. length (rev (x a var 0)) = t2 (length var_0) (length a)) = $1 = 37 \left[\text{length} (\text{rev} (\text{x var} 1 (\text{cons} 2 \text{ var} 2 \text{ var} 0)) \right] = S (t2 (\text{length} \text{var} 0) (\text{length} \text{var} 1))^{"}$ apply (metis TIP_prop_06.length.simps (2) TIP_prop_06.x.simps (2) abduced_lemma_composite_commutativity_7642270 abduced_lemma_generalisation_then_extension_7642332) done 91 lemma abduced lemma generalise by renaming 7642286: "length (rev (x var 0 var 1)) = t2 (length var 1) (length var 0)" apply (induct "var 1" arbitrary : var 0) apply (simp all) apply (simp add : abduced_lemma_generalisation_then_extension 17745958) apply (simp add : abduced lemma_tactic_33224946) done | 98 Lemma original goal 7579816: "length (rev (x var 0 var 1)) = t2 (length var 0) (length var 1)" apply (simp add : abduced lemma commutativity 7642214 abduced lemma generalise by renaming 7642286) 100 done

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