

Logiweb codex of ijcar

Up Help

ijcar, $[* \overset{\circ}{=} *]$, RootVisible(*), A, R, C, T, L, {*}, $\bar{*}$, a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z, $\langle * \equiv * \mid * := * \rangle$, $\langle * \equiv^0 * \mid * := * \rangle$, $\langle * \equiv^1 * \mid * := * \rangle$, $\langle * \equiv^* * \mid * := * \rangle$, Ded(*, *), Ded₀(*, *), Ded₁(*, *, *), Ded₂(*, *, *), Ded₃(*, *, *, *), Ded₄(*, *, *, *), Ded₄^{*}(*, *, *, *), Ded₅(*, *, *), Ded₆(*, *, *, *), Ded₆^{*}(*, *, *, *), Ded₇(*), Ded₈(*, *), Ded₈^{*}(*, *), S, Neg, MP, Gen, Ded, S1, S2, S3, S4, S5, S6, S7, S8, S9, Repetition, A1', A2', A4', A5', Prop 3.2a, Prop 3.2b, Prop 3.2c, Prop 3.2d, Prop 3.2e₁, Prop 3.2e₂, Prop 3.2e, Prop 3.2f₁, Prop 3.2f₂, Prop 3.2f, Prop 3.2g₁, Prop 3.2g₂, Prop 3.2g, Prop 3.2h₁, Prop 3.2h₂, Prop 3.2h, Block₁(*, *, *), Block₂(*), *_{hide}, MacroIndent(*), *', * = *, * ≠ *, *^{var}, *#⁰*, *#¹*, *#*^{*}, ∃*:*, ∀*:*, ∇_{obj}*:*, * ⇒ *, * ⇔ *, *#*, * ⊇ *, Π*:*, Begin*:*, End*:*, Last block line* ≫ *;*, Arbitrary ≫ *;*, * | *, →, * \ *,

ijcar

[ijcar ^{prio} →

Preassociative

[ijcar], [ijcar base], [bracket * end bracket], [big bracket * end bracket], [\$ * \$], [flush left [*]], [x], [y], [z], [[* ▷ *]], [[* → *]], [pyk], [tex], [name], [prio], [*], [T], [if(*, *, *)], [[* ⇒ *]], [val], [claim], [⊥], [f(*)], [(*)¹], [F], [0], [1], [2], [3], [4], [5], [6], [7], [8], [9], [a], [b], [c], [d], [e], [f], [g], [h], [i], [j], [k], [l], [m], [n], [o], [p], [q], [r], [s], [t], [u], [v], [w], [(*)^M], [If(*, *, *)], [array{*} * end array], [l], [c], [r], [empty], [(* | * := *)], [M(*)], [U~(*)], [U(*)], [U^M(*)], [apply(*, *)], [apply₁(*, *)], [identifier(*)], [identifier₁(*, *)], [array-plus(*, *)], [array-remove(*, *, *)], [array-put(*, *, *, *)], [array-add(*, *, *, *, *)], [bit(*, *)], [bit₁(*, *)], [rack], ["vector"], ["bibliography"], ["dictionary"], ["body"], ["codex"], ["expansion"], ["code"], ["cache"], ["diagnose"], ["pyk"], ["tex"], ["texname"], ["value"], ["message"], ["macro"], ["definition"], ["unpack"], ["claim"], ["priority"], ["lambda"], ["apply"], ["true"], ["if"], ["quote"], ["proclaim"], ["define"], ["introduce"], ["hide"], ["pre"], ["post"], [E(*, *, *)], [E₂(*, *, *, *, *)], [E₃(*, *, *, *, *)], [E₄(*, *, *, *, *)], [lookup(*, *, *)], [abstract(*, *, *, *)], [[*]], [M(*, *, *)], [M₂(*, *, *, *)], [M^{*}(*, *, *)], [macro], [s₀], [zip(*, *)], [assoc₁(*, *, *)], [(*)^P], [self], [[* ≐ *]], [[* ≐ *]], [[* ≐ *]], [[* _{pyk} ≐ *]], [[* _{tex} ≐ *]], [[* _{name} ≐ *]], [Priority table[*]], [M₁~], [M₂~(*)], [M₃~(*)], [M₄~(*, *, *, *)], [M(*, *, *)], [Q(*, *, *)], [Q₂~(*, *, *)], [Q₃~(*, *, *, *)], [Q^{*}~(*, *, *)], [(*)], [(*)], [display(*)], [statement(*)], [[*]'], [[*]'], [aspect(*, *)], [aspect(*, *, *)], [(*)], [tuple₁(*)], [tuple₂(*)], [let₂(*, *)], [let₁(*, *)],

$[[* \stackrel{\text{claim}}{=} *]], [\text{checker}], [\text{check}(*, *)], [\text{check}_2(*, *, *)], [\text{check}_3(*, *, *)],$
 $[\text{check}^*(*, *)], [\text{check}_2^*(*, *, *)], [[*]'], [[*]^-], [[*]^\circ], [\text{msg}], [[* \stackrel{\text{msg}}{=} *]], [<\text{stmt}>],$
 $[\text{stmt}], [[* \stackrel{\text{stmt}}{=} *]], [\text{HeadNil}'], [\text{HeadPair}'], [\text{Transitivity}'], [\perp], [\text{Contra}'], [\text{T}_E],$
 $[\text{L}_1], [\underline{*}], [\text{A}], [\text{B}], [\text{C}], [\text{D}], [\text{E}], [\text{F}], [\text{G}], [\text{H}], [\text{I}], [\text{J}], [\text{K}], [\text{L}], [\text{M}], [\text{N}], [\text{O}], [\text{P}], [\text{Q}],$
 $[\text{R}], [\text{S}], [\text{T}], [\text{U}], [\text{V}], [\text{W}], [\text{X}], [\text{Y}], [\text{Z}], [[* | * := *]], [[* * | * := *]], [\emptyset], [\text{Remainder}],$
 $[[*]^\vee], [\text{intro}(*, *, *, *)], [\text{intro}_2(*, *, *)], [\text{error}(*, *)], [\text{error}_2(*, *)], [\text{proof}(*, *, *)],$
 $[\text{proof}_2(*, *)], [\text{S}(*, *)], [\text{S}^1(*, *)], [\text{S}^\triangleright(*, *)], [\text{S}_1^\triangleright(*, *, *)], [\text{S}^E(*, *)], [\text{S}_1^E(*, *, *)],$
 $[\text{S}^+(*, *)], [\text{S}_1^+(*, *, *)], [\text{S}^-(*, *)], [\text{S}_1^-(*, *, *)], [\text{S}^*(*, *)], [\text{S}_1^*(*, *, *)],$
 $[\text{S}_2^*(*, *, *, *)], [\text{S}^\oplus(*, *)], [\text{S}_1^\oplus(*, *, *)], [\text{S}^+(*, *)], [\text{S}_1^+(*, *, *, *)], [\text{S}^{\#}(*, *)],$
 $[\text{S}_1^{\#}(*, *, *, *)], [\text{S}^{\text{i.e.}}(*, *)], [\text{S}_1^{\text{i.e.}}(*, *, *, *)], [\text{S}_2^{\text{i.e.}}(*, *, *, *, *)], [\text{S}^\nabla(*, *)],$
 $[\text{S}_1^\nabla(*, *, *, *)], [\text{S}^{\text{i}}(*, *)], [\text{S}_1^{\text{i}}(*, *, *)], [\text{S}_2^{\text{i}}(*, *, *, *)], [\text{T}(*)], [\text{claims}(*, *, *)],$
 $[\text{claims}_2(*, *, *)], [<\text{proof}>], [\text{proof}], [[\text{Lemma} * : *]], [[\text{Proof of} * : *]],$
 $[[* \text{ lemma} * : *]], [[* \text{ antilemma} * : *]], [[* \text{ rule} * : *]], [[* \text{ antirule} * : *]],$
 $[\text{verifier}], [\mathcal{V}_1(*)], [\mathcal{V}_2(*, *)], [\mathcal{V}_3(*, *, *, *)], [\mathcal{V}_4(*, *)], [\mathcal{V}_5(*, *, *, *)], [\mathcal{V}_6(*, *, *, *)],$
 $[\mathcal{V}_7(*, *, *, *)], [\text{Cut}(*, *)], [\text{Head}_\oplus(*)], [\text{Tail}_\oplus(*)], [\text{rule}_1(*, *)], [\text{rule}(*, *)],$
 $[\text{Rule tactic}], [\text{Plus}(*, *)], [[\text{Theory} *]], [\text{theory}_2(*, *)], [\text{theory}_3(*, *)],$
 $[\text{theory}_4(*, *, *)], [\text{HeadNil}''], [\text{HeadPair}''], [\text{Transitivity}''], [\text{Contra}''], [\text{HeadNil}],$
 $[\text{HeadPair}], [\text{Transitivity}], [\text{Contra}], [\text{T}_E], [\text{ragged right}],$
 $[\text{ragged right expansion}], [\text{parm}(*, *, *)], [\text{parm}^*(*, *, *)], [\text{inst}(*, *)],$
 $[\text{inst}^*(*, *)], [\text{occur}(*, *, *)], [\text{occur}^*(*, *, *)], [\text{unify}(* = *, *)], [\text{unify}^*(* = *, *)],$
 $[\text{unify}_2(* = *, *)], [\text{L}_a], [\text{L}_b], [\text{L}_c], [\text{L}_d], [\text{L}_e], [\text{L}_f], [\text{L}_g], [\text{L}_h], [\text{L}_i], [\text{L}_j], [\text{L}_k], [\text{L}_l], [\text{L}_m],$
 $[\text{L}_n], [\text{L}_o], [\text{L}_p], [\text{L}_q], [\text{L}_r], [\text{L}_s], [\text{L}_t], [\text{L}_u], [\text{L}_v], [\text{L}_w], [\text{L}_x], [\text{L}_y], [\text{L}_z], [\text{L}_A], [\text{L}_B], [\text{L}_C],$
 $[\text{L}_D], [\text{L}_E], [\text{L}_F], [\text{L}_G], [\text{L}_H], [\text{L}_I], [\text{L}_J], [\text{L}_K], [\text{L}_L], [\text{L}_M], [\text{L}_N], [\text{L}_O], [\text{L}_P], [\text{L}_Q], [\text{L}_R],$
 $[\text{L}_S], [\text{L}_T], [\text{L}_U], [\text{L}_V], [\text{L}_W], [\text{L}_X], [\text{L}_Y], [\text{L}_Z], [\text{L}_?], [\text{Reflexivity}], [\text{Reflexivity}_1],$
 $[\text{Commutativity}], [\text{Commutativity}_1], [<\text{tactic}>], [\text{tactic}], [[* \stackrel{\text{tactic}}{=} *]], [\mathcal{P}(*, *, *)],$
 $[\mathcal{P}^*(*, *, *)], [\text{p}_0], [\text{conclude}_1(*, *)], [\text{conclude}_2(*, *, *)], [\text{conclude}_3(*, *, *, *)],$
 $[\text{conclude}_4(*, *)], [[* \overset{\circ}{=} *]], [\text{RootVisible}(*)], [\text{A}], [\text{R}], [\text{C}], [\text{T}], [\text{L}], [\{*\}], [\bar{*}], [a], [b],$
 $[c], [d], [e], [f], [g], [h], [i], [j], [k], [l], [m], [n], [o], [p], [q], [r], [s], [t], [u], [v], [w], [x],$
 $[y], [z], [*\equiv * | * := *], [*\equiv^0 * | * := *], [*\equiv^1 * | * := *], [*\equiv^* * | * := *],$
 $[\text{Ded}(*, *)], [\text{Ded}_0(*, *)], [\text{Ded}_1(*, *, *)], [\text{Ded}_2(*, *, *)], [\text{Ded}_3(*, *, *, *)],$
 $[\text{Ded}_4(*, *, *, *)], [\text{Ded}_4^{\dagger}(*, *, *, *)], [\text{Ded}_5(*, *, *)], [\text{Ded}_6(*, *, *, *)],$
 $[\text{Ded}_6^{\dagger}(*, *, *, *)], [\text{Ded}_7(*, *)], [\text{Ded}_8(*, *)], [\text{Ded}_8^{\dagger}(*, *)], [\text{S}], [\text{Neg}], [\text{MP}], [\text{Gen}],$
 $[\text{Ded}], [\text{S1}], [\text{S2}], [\text{S3}], [\text{S4}], [\text{S5}], [\text{S6}], [\text{S7}], [\text{S8}], [\text{S9}], [\text{Repetition}], [\text{A1}'], [\text{A2}'], [\text{A4}'],$
 $[\text{A5}'], [\text{Prop 3.2a}], [\text{Prop 3.2b}], [\text{Prop 3.2c}], [\text{Prop 3.2d}], [\text{Prop 3.2e}_1], [\text{Prop 3.2e}_2],$
 $[\text{Prop 3.2e}], [\text{Prop 3.2f}_1], [\text{Prop 3.2f}_2], [\text{Prop 3.2f}], [\text{Prop 3.2g}_1], [\text{Prop 3.2g}_2],$
 $[\text{Prop 3.2g}], [\text{Prop 3.2h}_1], [\text{Prop 3.2h}_2], [\text{Prop 3.2h}], [\text{Block}_1(*, *, *)], [\text{Block}_2(*, *)];$

Preassociative

$[[* \{*\}], [* / \text{indexintro}(*, *, *, *)], [* / \text{intro}(*, *, *)], [* / \text{bothintro}(*, *, *, *, *)],$
 $[* / \text{nameintro}(*, *, *, *)], [*'], [[* | *]], [[* \rightarrow *]], [[* \Rightarrow *]], [*0], [*1], [0b], [*-color(*)],$
 $[*-color^*(*)], [*^H], [*^T], [*^U], [*^h], [*^t], [*^s], [*^c], [*^d], [*^a], [*^C], [*^M], [*^B], [*^T], [*^i],$
 $[*^d], [*^R], [*^0], [*^1], [*^2], [*^3], [*^4], [*^5], [*^6], [*^7], [*^8], [*^9], [*^E], [*^V], [*^C], [*^C^*],$
 $[*_{\text{hide}}];$

Preassociative

$[" * "], [], [(*)^t], [\text{string}(*, *) + *], [\text{string}(*, *) ++ *], [$
 $*, [*], [! *], [\' *], [\# *], [\$ *], [\% *], [\& *], [\' *], [(*), (*)], [**], [+ *], [*], [- *], [*], [/ *],$

[0*], [1*], [2*], [3*], [4*], [5*], [6*], [7*], [8*], [9*], [:*], [; *], [<*], [= *], [>*], [?*],
 [@*], [A*], [B*], [C*], [D*], [E*], [F*], [G*], [H*], [I*], [J*], [K*], [L*], [M*], [N*],
 [O*], [P*], [Q*], [R*], [S*], [T*], [U*], [V*], [W*], [X*], [Y*], [Z*], [[*], [*], [^*],
 [*], [^*], [a*], [b*], [c*], [d*], [e*], [f*], [g*], [h*], [i*], [j*], [k*], [l*], [m*], [n*], [o*],
 [p*], [q*], [r*], [s*], [t*], [u*], [v*], [w*], [x*], [y*], [z*], [{*}, [}*], [~*],
 [**Preassociative** *; *], [**Postassociative** *; *], [[*], *], [priority * end],
 [newline *], [macro newline *], [MacroIndent(*)];

Preassociative

[* ' *], [* ' *];

Preassociative

[*'];

Preassociative

[* · *], [* · 0 *];

Preassociative

[* + *], [* + 0 *], [* + 1 *], [* - *], [* - 0 *], [* - 1 *];

Preassociative

[* ∪ { * }], [* ∪ *], [* \ { * }];

Postassociative

[* ∴ *], [* ∴ *], [* ∴ ∴ *], [* + 2 * *], [* ∴ ∴ *], [* + 2 * *];

Postassociative

[* , *];

Preassociative

[* $\stackrel{B}{\approx}$ *], [* $\stackrel{D}{\approx}$ *], [* $\stackrel{C}{\approx}$ *], [* $\stackrel{P}{\approx}$ *], [* \approx *], [* = *], [* \dashv *], [* $\overset{t}{=}$ *], [* $\overset{t^*}{=}$ *], [* $\overset{r}{=}$ *],

[* \in_t *], [* \subseteq_T *], [* $\overset{T}{=}$ *], [* $\overset{s}{=}$ *], [* free in *], [* free in * *], [* free for * in *],

[* free for * in *], [* \in_c *], [* < *], [* < ' *], [* \leq' *], [* = *], [* \neq *], [* var],

[* $\#^0$ *], [* $\#^1$ *], [* $\#^*$ *];

Preassociative

[¬*];

Preassociative

[* \wedge *], [* $\ddot{\wedge}$ *], [* $\tilde{\wedge}$ *], [* \wedge_c *];

Preassociative

[* \vee *], [* \parallel *], [* $\ddot{\vee}$ *];

Preassociative

[\exists *: *], [\forall *: *], [\forall_{obj} *: *];

Postassociative

[* $\dot{\Rightarrow}$ *], [* \Rightarrow *], [* \Leftrightarrow *];

Postassociative

[* : *], [* spy *], [*! *];

Preassociative

[* $\left\{ \begin{array}{c} * \\ * \end{array} \right.$];

Preassociative

[λ * . *], [Λ * . *], [Λ *], [**if** * **then** * **else** *], [**let** * = * **in** *], [**let** * $\dot{=}$ * **in** *];

Preassociative

[*#*];

Preassociative

[*^I], [*[▷]], [*^V], [*⁺], [*⁻], [*^{*}];

Preassociative

[* @ *], [* ▷ *], [* ▷ *], [* ≫ *], [* ▷ *];

Postassociative

[* ⊢ *], [* ⊢ *], [* i.e. *];

Preassociative

[∀*: *], [∏*: *];

Postassociative

[* ⊕ *];

Postassociative

[*; *];

Preassociative

[* proves *];

Preassociative

[* **proof of** * : *], [Line * : * ≫ *; *], [Last line * ≫ * □],
 [Line * : Premise ≫ *; *], [Line * : Side-condition ≫ *; *], [Arbitrary ≫ *; *],
 [Local ≫ * = *; *], [Begin *; * : End; *], [Last block line * ≫ *;],
 [Arbitrary ≫ *; *];

Postassociative

[* | *];

Postassociative

[* then *], [* [*]*];

Preassociative

[*&*], [→];

Preassociative

[* \\ *], [* \\ *];

[ijcar ^{pyk} → “ijcar”]

[* ^o = *]

[[x ^o = y] ^{macro} → λt.λs.λc.λ $\tilde{\mathcal{M}}_4$ (t, s, c, [[[x ^o = y] ≐ [(x)^P ^{macro} → y]]]])

[[x ^o = y] ^{tex} → “

[#1/tex name/tex.

\stackrel{\circ}{=}#2.

]”]

[[x ^o = y] ^{pyk} → “general macro define * as * end define”]

RootVisible(*)

[RootVisible(x) $\xrightarrow{\text{name}}$ “
RootVisible(#1.
)”]

[RootVisible(x) $\xrightarrow{\text{tex}}$ “#1/tex name/tex.”]

[RootVisible(x) $\xrightarrow{\text{pyk}}$ “make root visible * end visible”]

A

[A $\xrightarrow{\text{tex}}$ “
A”]

[A $\xrightarrow{\text{pyk}}$ “ijcar example axiom”]

R

[R $\xrightarrow{\text{tex}}$ “
R”]

[R $\xrightarrow{\text{pyk}}$ “ijcar example rule”]

C

[C $\xrightarrow{\text{tex}}$ “
C”]

[C $\xrightarrow{\text{pyk}}$ “ijcar example contradiction”]

T

[T $\xrightarrow{\text{tex}}$ “
T”]

[T $\xrightarrow{\text{pyk}}$ “ijcar example theory”]

L

[L $\xrightarrow{\text{tex}}$ “
L”]

[L $\xrightarrow{\text{pyk}}$ “ijcar example lemma”]

{*}

[{x} $\xrightarrow{\text{tex}}$ “
\{#1.
\}”]

[{x} $\xrightarrow{\text{pyk}}$ “set * end set”]

$\bar{*}$

[\bar{x} $\xrightarrow{\text{tex}}$ “\overline{\#1.}”]

[\bar{x} $\xrightarrow{\text{pyk}}$ “object var * end var”]

a

[*a* $\xrightarrow{\text{macro}}$ $\lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[a \doteq \bar{a}]])$]

[*a* $\xrightarrow{\text{tex}}$ “
\mathit{a}”]

[*a* $\xrightarrow{\text{pyk}}$ “object a”]

b

[*b* $\xrightarrow{\text{macro}}$ $\lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[b \doteq \bar{b}]])$]

[*b* $\xrightarrow{\text{tex}}$ “
\mathit{b}”]

[*b* $\xrightarrow{\text{pyk}}$ “object b”]

c

[*c* $\xrightarrow{\text{macro}}$ $\lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[c \doteq \bar{c}]])$]

[$c \xrightarrow{\text{tex}}$ “
 $\backslash\mathit{c}$ ”]

[$c \xrightarrow{\text{pyk}}$ “object c ”]

d

[$d \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[d \doteq \bar{d}]])$]

[$d \xrightarrow{\text{tex}}$ “
 $\backslash\mathit{d}$ ”]

[$d \xrightarrow{\text{pyk}}$ “object d ”]

e

[$e \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[e \doteq \bar{e}]])$]

[$e \xrightarrow{\text{tex}}$ “
 $\backslash\mathit{e}$ ”]

[$e \xrightarrow{\text{pyk}}$ “object e ”]

f

[$f \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[f \doteq \bar{f}]])$]

[$f \xrightarrow{\text{tex}}$ “
 $\backslash\mathit{f}$ ”]

[$f \xrightarrow{\text{pyk}}$ “object f ”]

g

[$g \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[g \doteq \bar{g}]])$]

[$g \xrightarrow{\text{tex}}$ “
 $\backslash\mathit{g}$ ”]

[$g \xrightarrow{\text{pyk}}$ “object g ”]

h

[$h \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[h \doteq \bar{h}]])$]

[$h \xrightarrow{\text{tex}}$ “
`\mathit{h}`”]

[$h \xrightarrow{\text{pyk}}$ “object h”]

i

[$i \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[i \doteq \bar{i}]])$]

[$i \xrightarrow{\text{tex}}$ “
`\mathit{i}`”]

[$i \xrightarrow{\text{pyk}}$ “object i”]

j

[$j \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[j \doteq \bar{j}]])$]

[$j \xrightarrow{\text{tex}}$ “
`\mathit{j}`”]

[$j \xrightarrow{\text{pyk}}$ “object j”]

k

[$k \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[k \doteq \bar{k}]])$]

[$k \xrightarrow{\text{tex}}$ “
`\mathit{k}`”]

[$k \xrightarrow{\text{pyk}}$ “object k”]

l

[$l \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[l \doteq \bar{l}]])$]

[$l \xrightarrow{\text{tex}}$ “
`\mathit{l}`”]

[$l \xrightarrow{\text{pyk}}$ “object l”]

m

[$m \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[m \doteq \bar{m}]])$]

[$m \xrightarrow{\text{tex}} \text{“}\backslash\text{mathit}\{m\}\text{”}$]

[$m \xrightarrow{\text{pyk}} \text{“object } m\text{”}$]

n

[$n \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[n \doteq \bar{n}]])$]

[$n \xrightarrow{\text{tex}} \text{“}\backslash\text{mathit}\{n\}\text{”}$]

[$n \xrightarrow{\text{pyk}} \text{“object } n\text{”}$]

o

[$o \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[o \doteq \bar{o}]])$]

[$o \xrightarrow{\text{tex}} \text{“}\backslash\text{mathit}\{o\}\text{”}$]

[$o \xrightarrow{\text{pyk}} \text{“object } o\text{”}$]

p

[$p \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[p \doteq \bar{p}]])$]

[$p \xrightarrow{\text{tex}} \text{“}\backslash\text{mathit}\{p\}\text{”}$]

[$p \xrightarrow{\text{pyk}} \text{“object } p\text{”}$]

q

[$q \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[q \doteq \bar{q}]])$]

[$q \xrightarrow{\text{tex}} \text{“}\backslash\text{mathit}\{q\}\text{”}$]

[$q \xrightarrow{\text{pyk}} \text{“object } q\text{”}$]

r

$[r \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[r \doteq \bar{r}]])]$

$[r \xrightarrow{\text{tex}} \text{"}\backslash\text{mathit}\{r\}\text{"}]$

$[r \xrightarrow{\text{pyk}} \text{"object r"}]$

s

$[s \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[s \doteq \bar{s}]])]$

$[s \xrightarrow{\text{tex}} \text{"}\backslash\text{mathit}\{s\}\text{"}]$

$[s \xrightarrow{\text{pyk}} \text{"object s"}]$

t

$[t \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[t \doteq \bar{t}]])]$

$[t \xrightarrow{\text{tex}} \text{"}\backslash\text{mathit}\{t\}\text{"}]$

$[t \xrightarrow{\text{pyk}} \text{"object t"}]$

u

$[u \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[u \doteq \bar{u}]])]$

$[u \xrightarrow{\text{tex}} \text{"}\backslash\text{mathit}\{u\}\text{"}]$

$[u \xrightarrow{\text{pyk}} \text{"object u"}]$

v

$[v \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[v \doteq \bar{v}]])]$

$[v \xrightarrow{\text{tex}} \text{"}\backslash\text{mathit}\{v\}\text{"}]$

$[v \xrightarrow{\text{pyk}} \text{"object v"}]$

w

$[w \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[w \doteq \bar{w}]])]$

$[w \xrightarrow{\text{tex}} “$
 $\backslash\text{mathit}\{w\}”]$

$[w \xrightarrow{\text{pyk}} “\text{object } w”]$

x

$[x \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[x \doteq \bar{x}]])]$

$[x \xrightarrow{\text{tex}} “$
 $\backslash\text{mathit}\{x\}”]$

$[x \xrightarrow{\text{pyk}} “\text{object } x”]$

y

$[y \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[y \doteq \bar{y}]])]$

$[y \xrightarrow{\text{tex}} “$
 $\backslash\text{mathit}\{y\}”]$

$[y \xrightarrow{\text{pyk}} “\text{object } y”]$

z

$[z \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[z \doteq \bar{z}]])]$

$[z \xrightarrow{\text{tex}} “$
 $\backslash\text{mathit}\{z\}”]$

$[z \xrightarrow{\text{pyk}} “\text{object } z”]$

$\langle * \equiv * \mid * := * \rangle$

$[\langle a \equiv b \mid x := t \rangle \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[\langle a \equiv b \mid x := t \rangle \doteq \langle [a] \equiv^0 [b] \mid [x] := [t] \rangle]])]$

$[\langle x \equiv y \mid z := u \rangle \xrightarrow{\text{tex}} “$
 $\backslash\text{langle } \#1.$

$\{\backslash\text{equiv}\} \#2.$

$\mid \#3.$

{:=} #4.
\rangle ”]

[⟨x≡y|z:=u⟩^{pyk} “sub * is * where * is * end sub”]

⟨*≡⁰* | * :=*⟩

[⟨a≡⁰b|x:=t⟩^{val} λc. [x^{var} ∧ ⟨a≡¹b|x:=t⟩]]

[⟨x≡⁰y|z:=u⟩^{tex} “

\rangle #1.

{\equiv}^0 #2.

| #3.

{:=} #4.

\rangle ”]

[⟨x≡⁰y|z:=u⟩^{pyk} “sub zero * is * where * is * end sub”]

⟨*≡¹* | * :=*⟩

[⟨a≡¹b|x:=t⟩^{val} a! [x! [t!

If(If(b^r [∀_{obj}u:v], b¹^t x, F), a^t b,

If(b^{var} ∧ [b^t x], a^t t, If([

a]^r b, ⟨a^t≡*b^t|x:=t⟩, F))]]]

[⟨x≡¹y|z:=u⟩^{tex} “

\rangle #1.

{\equiv}^1 #2.

| #3.

{:=} #4.

\rangle ”]

[⟨x≡¹y|z:=u⟩^{pyk} “sub one * is * where * is * end sub”]

⟨*≡* | * :=*⟩

[⟨a≡*b|x:=t⟩^{val} b! [x! [t!If(a, T, If(⟨a^h≡¹b^h|x:=t⟩, ⟨a^t≡*b^t|x:=t⟩, F))]]]

[⟨x≡*y|z:=u⟩^{tex} “

\rangle #1.

{\equiv}^* #2.

| #3.

{:=} #4.
\rangle ”]

[<x≡*y|z:=u> $\xrightarrow{\text{pyk}}$ “sub star * is * where * is * end sub”]

Ded(*, *)

[Ded(p, c) $\xrightarrow{\text{macro}}$ $\lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, \llbracket \text{Ded}(p, c) \doteq \lambda x. \text{Ded}_0(\llbracket p \rrbracket, \llbracket c \rrbracket) \rrbracket \rrbracket)$]

[Ded(x, y) $\xrightarrow{\text{tex}}$ “
Ded(#1.
, #2.
)”]

[Ded(x, y) $\xrightarrow{\text{pyk}}$ “deduction * conclude * end deduction”]

Ded₀(*, *)

[Ded₀(p, c) $\xrightarrow{\text{val}}$ $c! \text{If}(\text{Ded}_8(p, T), \text{Ded}_1(\text{Ded}_7(p), c, T), F)$]

[Ded₀(x, y) $\xrightarrow{\text{tex}}$ “
Ded_0(#1.
, #2.
)”]

[Ded₀(x, y) $\xrightarrow{\text{pyk}}$ “deduction zero * conclude * end deduction”]

Ded₁(*, *, *)

[Ded₁(p, c, s) $\xrightarrow{\text{val}}$ $\text{If}(c \stackrel{r}{=} [x \vdash y], \text{Ded}_1(p, c^2, c^1 :: s), \text{Ded}_2(p, c, s))$]

[Ded₁(x, y, z) $\xrightarrow{\text{tex}}$ “
Ded_1(#1.
, #2.
, #3.
)”]

[Ded₁(x, y, z) $\xrightarrow{\text{pyk}}$ “deduction one * conclude * condition * end deduction”]

Ded₂(* , * , *)

[Ded₂(p, c, s) $\xrightarrow{\text{val}}$ [s! [[p $\stackrel{r}{\equiv}$ [x ⊢ y]] ∧ [c $\stackrel{r}{\equiv}$ [x ⇒ y]]]]
 { Ded₃(p¹, c¹, s, T) ∧ Ded₂(p², c², s)
 { Ded₄(p, c, s, Ded₆(p, c, T, T))]

[Ded₂(x, y, z) $\xrightarrow{\text{tex}}$ “

Ded_2(#1.

, #2.

, #3.

)”]

[Ded₂(x, y, z) $\xrightarrow{\text{pyk}}$ “deduction two * conclude * condition * end deduction”]

Ded₃(* , * , * , *)

[Ded₃(p, c, s, b) $\xrightarrow{\text{val}}$ If(¬ [c $\stackrel{r}{\equiv}$ [∀_{obj}x: y]] , Ded₄(p, c, s, b), If([p $\stackrel{r}{\equiv}$ [∀_{obj}x: y]] ∧
 [p¹ $\stackrel{t}{\equiv}$ [c¹]] , Ded₄(p, c, s, b), Ded₃(p, c², s, [c¹ :: [c¹]] :: b))]]

[Ded₃(x, y, z, u) $\xrightarrow{\text{tex}}$ “

Ded_3(#1.

, #2.

, #3.

, #4.

)”]

[Ded₃(x, y, z, u) $\xrightarrow{\text{pyk}}$ “deduction three * conclude * condition * bound * end deduction”]

Ded₄(* , * , * , *)

[Ded₄(p, c, s, b) $\xrightarrow{\text{val}}$ s! [b!If(p $\stackrel{r}{\equiv}$ [x̄], **lookup**(p, b, T) $\stackrel{t}{\equiv}$ c, If(¬ [p $\stackrel{r}{\equiv}$ c] , F,
 If(p $\stackrel{r}{\equiv}$ [∀_{obj}x: y] , [p¹ $\stackrel{t}{\equiv}$ [c¹]] ∧ Ded₄(p², c², s, [p¹ :: [p¹]] :: b), If(¬ [p
 p $\stackrel{r}{\equiv}$ [x]] , Ded₄^{*}(p^t, c^t, s, b), [p¹ $\stackrel{t}{\equiv}$ [c¹]] ∧ Ded₅(p, s, b)))]]

[Ded₄(x, y, z, u) $\xrightarrow{\text{tex}}$ “

Ded_4(#1.

, #2.

, #3.

, #4.

)”]

[Ded₄(x, y, z, u) $\xrightarrow{\text{pyk}}$ “deduction four * conclude * condition * bound * end

deduction”]

$\text{Ded}_4^*(*, *, *, *)$

$[\text{Ded}_4^*(p, c, s, b) \xrightarrow{\text{val}} c! [s! [b! \text{If}(p, T, \text{Ded}_4(p^h, c^h, s, b) \wedge \text{Ded}_4^*(p^t, c^t, s, b))]]]$

$[\text{Ded}_4^*(x, y, z, u) \xrightarrow{\text{tex}} “$

$\text{Ded}_4^*(\#1.$

, #2.

, #3.

, #4.

)”]

$[\text{Ded}_4^*(x, y, z, u) \xrightarrow{\text{pyk}} “\text{deduction four star * conclude * condition * bound * end deduction”]$

$\text{Ded}_5(*, *, *)$

$[\text{Ded}_5(p, s, b) \xrightarrow{\text{val}} p! [s! \text{If}(b, T, [[[[x] \#^0 [y]]^h :: [[[[*]]^h :: [b^{hh} :: T]] :: [[[[x]]^h :: [p :: T]] :: T]]] \in_t s] \wedge \text{Ded}_5(p, s, b^t))]]$

$[\text{Ded}_5(x, y, z) \xrightarrow{\text{tex}} “$

$\text{Ded}_5(\#1.$

, #2.

, #3.

)”]

$[\text{Ded}_5(x, y, z) \xrightarrow{\text{pyk}} “\text{deduction five * condition * bound * end deduction”]$

$\text{Ded}_6(*, *, *, *)$

$[\text{Ded}_6(p, c, e, b) \xrightarrow{\text{val}} p! [c! [b! [e! \text{If}(p \stackrel{r}{=} [\bar{x}], [p \in_t e] \left\{ \begin{array}{l} b \\ [p :: c] :: b \end{array} \right\}, \text{If}(\neg [p \stackrel{r}{=} c], T, \text{If}(p \stackrel{r}{=} [\underline{a}], b, \text{If}(p \stackrel{r}{=} [\forall_{\text{obj}} x: y], \text{Ded}_6(p^2, c^2, c^1 :: e, b), \text{Ded}_6^*(p^t, c^t, e, b)))])]]]$

$[\text{Ded}_6(p, c, e, b) \xrightarrow{\text{tex}} “$

$\text{Ded}_6(\#1.$

, #2.

, #3.

, #4.

)”]

$[\text{Ded}_6(\mathbf{p}, \mathbf{c}, \mathbf{e}, \mathbf{b}) \xrightarrow{\text{pyk}} \text{“deduction six * conclude * exception * bound * end deduction”}]$

$\text{Ded}_6^*(*, *, *, *)$

$[\text{Ded}_6^*(\mathbf{p}, \mathbf{c}, \mathbf{e}, \mathbf{b}) \xrightarrow{\text{val}} \mathbf{p}! [\mathbf{c}! [\mathbf{b}! [\mathbf{e}!\text{If}(\mathbf{p}, \mathbf{b}, \text{Ded}_6^*(\mathbf{p}^t, \mathbf{c}^t, \mathbf{e}, \text{Ded}_6(\mathbf{p}^h, \mathbf{c}^h, \mathbf{e}, \mathbf{b})))]]]]]$

$[\text{Ded}_6^*(\mathbf{p}, \mathbf{c}, \mathbf{e}, \mathbf{b}) \xrightarrow{\text{tex}} \text{“$

$\text{Ded}_6^*(\#1.$

$\#2.$

$\#3.$

$\#4.$

$\text{)”}]$

$[\text{Ded}_6^*(\mathbf{p}, \mathbf{c}, \mathbf{e}, \mathbf{b}) \xrightarrow{\text{pyk}} \text{“deduction six star * conclude * exception * bound * end deduction”}]$

$\text{Ded}_7(*)$

$[\text{Ded}_7(\mathbf{p}) \xrightarrow{\text{val}} [\mathbf{p} \stackrel{\mathbf{r}}{=} [\forall \mathbf{x}: \mathbf{y}]] \left\{ \begin{array}{l} \text{Ded}_7(\mathbf{p}^2) \\ \mathbf{p} \end{array} \right\}]$

$[\text{Ded}_7(\mathbf{p}) \xrightarrow{\text{tex}} \text{“$

$\text{Ded}_7(\#1.$

$\text{)”}]$

$[\text{Ded}_7(\mathbf{p}) \xrightarrow{\text{pyk}} \text{“deduction seven * end deduction”}]$

$\text{Ded}_8(*, *)$

$[\text{Ded}_8(\mathbf{p}, \mathbf{b}) \xrightarrow{\text{val}} \text{If}(\mathbf{p} \stackrel{\mathbf{r}}{=} [\forall \mathbf{x}: \mathbf{y}], \text{Ded}_8(\mathbf{p}^2, \mathbf{p}^1 :: \mathbf{b}), \text{If}(\mathbf{p} \stackrel{\mathbf{r}}{=} [\mathbf{a}], \mathbf{p} \in_t \mathbf{b}, \text{Ded}_8^*(\mathbf{p}^t, \mathbf{b})))]$

$[\text{Ded}_8(\mathbf{p}, \mathbf{b}) \xrightarrow{\text{tex}} \text{“$

$\text{Ded}_8(\#1.$

$\#2.$

$\text{)”}]$

$[\text{Ded}_8(\mathbf{p}, \mathbf{b}) \xrightarrow{\text{pyk}} \text{“deduction eight * bound * end deduction”}]$

$\text{Ded}_8^*(*, *)$

$[\text{Ded}_8^*(\mathbf{p}, \mathbf{b}) \xrightarrow{\text{val}} \mathbf{b}!\text{If}(\mathbf{p}, \mathbf{T}, \text{If}(\text{Ded}_8(\mathbf{p}^h, \mathbf{b}), \text{Ded}_8^*(\mathbf{p}^t, \mathbf{b}), \mathbf{F}))]$

$[\text{Ded}_g^*(p, b) \xrightarrow{\text{tex}} \text{“Ded}_8^*(\#1. \#2.)\text{”}]$

$[\text{Ded}_g^*(p, b) \xrightarrow{\text{pyk}} \text{“deduction eight * bound * end deduction”}]$

S

$[\text{S} \xrightarrow{\text{tex}} \text{“S”}]$

$[\text{S} \xrightarrow{\text{pyk}} \text{“system s”}]$

Neg

$[\text{Neg} \xrightarrow{\text{tex}} \text{“Neg”}]$

$[\text{Neg} \xrightarrow{\text{pyk}} \text{“double negation”}]$

MP

$[\text{MP} \xrightarrow{\text{tex}} \text{“MP”}]$

$[\text{MP} \xrightarrow{\text{pyk}} \text{“rule mp”}]$

Gen

$[\text{Gen} \xrightarrow{\text{tex}} \text{“Gen”}]$

$[\text{Gen} \xrightarrow{\text{pyk}} \text{“rule gen”}]$

Ded

$[\text{Ded} \xrightarrow{\text{tex}} \text{“Ded”}]$

$[\text{Ded} \xrightarrow{\text{pyk}} \text{“deduction”}]$

S1

[S1 $\xrightarrow{\text{tex}}$ “
S1”]

[S1 $\xrightarrow{\text{pyk}}$ “axiom s one”]

S2

[S2 $\xrightarrow{\text{tex}}$ “
S2”]

[S2 $\xrightarrow{\text{pyk}}$ “axiom s two”]

S3

[S3 $\xrightarrow{\text{tex}}$ “
S3”]

[S3 $\xrightarrow{\text{pyk}}$ “axiom s three”]

S4

[S4 $\xrightarrow{\text{tex}}$ “
S4”]

[S4 $\xrightarrow{\text{pyk}}$ “axiom s four”]

S5

[S5 $\xrightarrow{\text{tex}}$ “
S5”]

[S5 $\xrightarrow{\text{pyk}}$ “axiom s five”]

S6

[S6 $\xrightarrow{\text{tex}}$ “
S6”]

[S6 $\xrightarrow{\text{pyk}}$ “axiom s six”]

S7

[S7 $\xrightarrow{\text{tex}}$ “
S7”]

[S7 $\xrightarrow{\text{pyk}}$ “axiom s seven”]

S8

[S8 $\xrightarrow{\text{tex}}$ “
S8”]

[S8 $\xrightarrow{\text{pyk}}$ “axiom s eight”]

S9

[S9 $\xrightarrow{\text{tex}}$ “
S9”]

[S9 $\xrightarrow{\text{pyk}}$ “axiom s nine”]

Repetition

[Repetition $\xrightarrow{\text{proof}}$ $\lambda c. \lambda x. [S \vdash \forall \underline{a}: [\underline{a}^I]]$]

[Repetition $\xrightarrow{\text{stmt}}$ $S \vdash \forall \underline{a}: [\underline{a} \vdash \underline{a}]$]

[Repetition $\xrightarrow{\text{tex}}$ “
Repetition”]

[Repetition $\xrightarrow{\text{pyk}}$ “repetition”]

A1'

[A1' $\xrightarrow{\text{proof}}$ $\lambda c. \lambda x. \mathcal{P}([S \vdash \forall \underline{a}: \forall \underline{b}: [[\forall \underline{a}: \forall \underline{b}: [\underline{a} \vdash [\underline{b} \vdash [[\text{Repetition} \triangleright \underline{a}] \gg \underline{a}]]]] ; [[\text{Ded} \triangleright \forall \underline{a}: \forall \underline{b}: [\underline{a} \vdash [\underline{b} \vdash \underline{a}]]]] \gg [\underline{a} \Rightarrow [\underline{b} \Rightarrow \underline{a}]]]]], p_0, c)$]

[A1' $\xrightarrow{\text{stmt}}$ $S \vdash \forall \underline{a}: \forall \underline{b}: [\underline{a} \Rightarrow [\underline{b} \Rightarrow \underline{a}]]$]

[A1' $\xrightarrow{\text{tex}}$ “
A1'”]

[A1' $\xrightarrow{\text{pyk}}$ “lemma a one”]

A2'

[A2' $\xrightarrow{\text{proof}}$ $\lambda c. \lambda x. \mathcal{P}(\lceil S \vdash \forall a: \forall b: \forall c: [[\forall a: \forall b: \forall c: [[a \Rightarrow [b \Rightarrow c]]] \vdash [[a \Rightarrow b]] \vdash [a \vdash [[[[MP \triangleright [a \Rightarrow b]]] \triangleright a] \gg b] ; [[[[MP \triangleright [a \Rightarrow [b \Rightarrow c]]]] \triangleright a] \gg [b \Rightarrow c]] ; [[[[MP \triangleright [b \Rightarrow c]]] \triangleright b] \gg c]]]]] ; [[Ded \triangleright \forall a: \forall b: \forall c: [[a \Rightarrow [b \Rightarrow c]]] \vdash [[a \Rightarrow b]] \vdash [a \vdash c]]]] \gg [[a \Rightarrow [b \Rightarrow c]] \Rightarrow [[a \Rightarrow b] \Rightarrow [a \Rightarrow c]]]] \rceil, p_0, c)$

[A2' $\xrightarrow{\text{stmt}}$ $S \vdash \forall a: \forall b: \forall c: [[a \Rightarrow [b \Rightarrow c]] \Rightarrow [[a \Rightarrow b] \Rightarrow [a \Rightarrow c]]]]$

[A2' $\xrightarrow{\text{tex}}$ “
A2'”]

[A2' $\xrightarrow{\text{pyk}}$ “lemma a two”]

A4'

[A4' $\xrightarrow{\text{proof}}$ $\lambda c. \lambda x. \mathcal{P}(\lceil S \vdash [[[[\bar{x} + \bar{y}] = [\bar{y} + \bar{x}]]] \vdash [[\text{Repetition} \triangleright [[\bar{x} + \bar{y}] = [\bar{y} + \bar{x}]]] \gg [[\bar{x} + \bar{y}] = [\bar{y} + \bar{x}]]]] ; [[Ded \triangleright [[[\bar{x} + \bar{y}] = [\bar{y} + \bar{x}]]] \vdash [[\bar{x} + \bar{y}] = [\bar{y} + \bar{x}]]]] \gg [[\forall_{\text{obj}} \bar{x}: \forall_{\text{obj}} \bar{y}: [[\bar{x} + \bar{y}] = [\bar{y} + \bar{x}]]] \Rightarrow [[2 + 3] = [3 + 2]]]]] \rceil, p_0, c)$

[A4' $\xrightarrow{\text{stmt}}$ $S \vdash [[\forall_{\text{obj}} \bar{x}: \forall_{\text{obj}} \bar{y}: [[\bar{x} + \bar{y}] = [\bar{y} + \bar{x}]]] \Rightarrow [[2 + 3] = [3 + 2]]]]$

[A4' $\xrightarrow{\text{tex}}$ “
A4'”]

[A4' $\xrightarrow{\text{pyk}}$ “lemma a four”]

A5'

[A5' $\xrightarrow{\text{proof}}$ $\lambda c. \lambda x. \mathcal{P}(\lceil S \vdash [[[[[2 + 3] = 5] \Rightarrow [[[2 + 3] + \bar{x}] = [5 + \bar{x}]]]] \vdash [[[2 + 3] = 5] \vdash [[[[MP \triangleright [[[2 + 3] = 5] \Rightarrow [[[2 + 3] + \bar{x}] = [5 + \bar{x}]]]] \triangleright [[2 + 3] = 5]] \gg [[[2 + 3] + \bar{x}] = [5 + \bar{x}]]] ; [[Gen \triangleright [[[2 + 3] + \bar{x}] = [5 + \bar{x}]]]] \gg \forall_{\text{obj}} \bar{x}: [[[2 + 3] + \bar{x}] = [5 + \bar{x}]]]]] ; [[Ded \triangleright [[[[2 + 3] = 5] \Rightarrow [[[2 + 3] + \bar{x}] = [5 + \bar{x}]]]] \vdash [[[2 + 3] = 5] \vdash \forall_{\text{obj}} \bar{x}: [[[2 + 3] + \bar{x}] = [5 + \bar{x}]]]]] \gg [[\forall_{\text{obj}} \bar{x}: [[[2 + 3] = 5] \Rightarrow [[[2 + 3] + \bar{x}] = [5 + \bar{x}]]]] \Rightarrow [[[2 + 3] = 5] \Rightarrow \forall_{\text{obj}} \bar{x}: [[[2 + 3] + \bar{x}] = [5 + \bar{x}]]]]]] \rceil, p_0, c)$

[A5' $\xrightarrow{\text{stmt}}$ $S \vdash [[\forall_{\text{obj}} \bar{x}: [[[2 + 3] = 5] \Rightarrow [[[2 + 3] + \bar{x}] = [5 + \bar{x}]]]] \Rightarrow [[[2 + 3] = 5] \Rightarrow \forall_{\text{obj}} \bar{x}: [[[2 + 3] + \bar{x}] = [5 + \bar{x}]]]]]$

[A5' $\xrightarrow{\text{tex}}$ “

A5”]

[A5' $\xrightarrow{\text{pyk}}$ “lemma a five”]

Prop 3.2a

[Prop 3.2a $\xrightarrow{\text{proof}}$ $\lambda c. \lambda x. \mathcal{P}(\lceil S \vdash \forall \underline{a}: [[S5 \gg [[\underline{a} + 0] = \underline{a}]] ; [[[S1 \triangleright [[\underline{a} + 0] = \underline{a}]] \triangleright [[\underline{a} + 0] = \underline{a}]] \gg [\underline{a} = \underline{a}]]] \rceil, p_0, c)$]

[Prop 3.2a $\xrightarrow{\text{stmt}}$ $S \vdash \forall \underline{a}: [\underline{a} = \underline{a}]$]

[Prop 3.2a $\xrightarrow{\text{tex}}$ “
Prop\ 3.2a”]

[Prop 3.2a $\xrightarrow{\text{pyk}}$ “prop three two a”]

Prop 3.2b

[Prop 3.2b $\xrightarrow{\text{proof}}$ $\lambda c. \lambda x. \mathcal{P}(\lceil S \vdash \forall \underline{a}: \forall \underline{b}: [[\underline{a} = \underline{b}] \vdash [[\text{Prop 3.2a} \gg [\underline{a} = \underline{a}]] ; [[[S1 \triangleright [\underline{a} = \underline{b}]] \triangleright [\underline{a} = \underline{a}]] \gg [\underline{b} = \underline{a}]]]] \rceil, p_0, c)$]

[Prop 3.2b $\xrightarrow{\text{stmt}}$ $S \vdash \forall \underline{a}: \forall \underline{b}: [[\underline{a} = \underline{b}] \vdash [\underline{b} = \underline{a}]]$]

[Prop 3.2b $\xrightarrow{\text{tex}}$ “
Prop\ 3.2b”]

[Prop 3.2b $\xrightarrow{\text{pyk}}$ “prop three two b”]

Prop 3.2c

[Prop 3.2c $\xrightarrow{\text{proof}}$ $\lambda c. \lambda x. \mathcal{P}(\lceil S \vdash \forall \underline{a}: \forall \underline{b}: \forall \underline{c}: [[\underline{a} = \underline{b}] \vdash [[\underline{b} = \underline{c}] \vdash [[[\text{Prop 3.2b} \triangleright [\underline{a} = \underline{b}]] \gg [\underline{b} = \underline{a}]] ; [[[S1 \triangleright [\underline{b} = \underline{a}]] \triangleright [\underline{b} = \underline{c}]] \gg [\underline{a} = \underline{c}]]]]] \rceil, p_0, c)$]

[Prop 3.2c $\xrightarrow{\text{stmt}}$ $S \vdash \forall \underline{a}: \forall \underline{b}: \forall \underline{c}: [[\underline{a} = \underline{b}] \vdash [[\underline{b} = \underline{c}] \vdash [\underline{a} = \underline{c}]]]$]

[Prop 3.2c $\xrightarrow{\text{tex}}$ “
Prop\ 3.2c”]

[Prop 3.2c $\xrightarrow{\text{pyk}}$ “prop three two c”]

Prop 3.2d

[Prop 3.2d $\xrightarrow{\text{proof}}$ $\lambda c. \lambda x. \mathcal{P}([S \vdash \forall \underline{a}: \forall \underline{b}: \forall \underline{c}: [[\underline{a} = \underline{c}] \vdash [[\underline{b} = \underline{c}] \vdash [[[\text{Prop 3.2b} \triangleright [\underline{b} = \underline{c}]] \gg [\underline{c} = \underline{b}]]] ; [[[\text{Prop 3.2c} \triangleright [\underline{a} = \underline{c}]] \triangleright [\underline{c} = \underline{b}]] \gg [\underline{a} = \underline{b}]]]]]] , p_0, c)$

[Prop 3.2d $\xrightarrow{\text{stmt}}$ $S \vdash \forall \underline{a}: \forall \underline{b}: \forall \underline{c}: [[\underline{a} = \underline{c}] \vdash [[\underline{b} = \underline{c}] \vdash [\underline{a} = \underline{b}]]]]$

[Prop 3.2d $\xrightarrow{\text{tex}}$ “
Prop\ 3.2d”]

[Prop 3.2d $\xrightarrow{\text{pyk}}$ “prop three two d”]

Prop 3.2e₁

[Prop 3.2e₁ $\xrightarrow{\text{proof}}$ $\lambda c. \lambda x. \mathcal{P}([S \vdash \forall \underline{a}: \forall \underline{b}: [[\forall \underline{a}: \forall \underline{b}: [[\underline{a} = \underline{b}] \vdash [[S5 \gg [[\underline{a} + 0] = \underline{a}]]] ; [[[[\text{Prop 3.2c} \triangleright [[\underline{a} + 0] = \underline{a}]] \triangleright [\underline{a} = \underline{b}]] \gg [[\underline{a} + 0] = \underline{b}]]] ; [[S5 \gg [[\underline{b} + 0] = \underline{b}]]] ; [[[\text{Prop 3.2d} \triangleright [[\underline{a} + 0] = \underline{b}]] \triangleright [[\underline{b} + 0] = \underline{b}]] \gg [[\underline{a} + 0] = [\underline{b} + 0]]]]]]]] ; [[\text{Ded} \triangleright \forall \underline{a}: \forall \underline{b}: [[\underline{a} = \underline{b}] \vdash [[\underline{a} + 0] = [\underline{b} + 0]]]] \gg [[\underline{a} = \underline{b}] \Rightarrow [[\underline{a} + 0] = [\underline{b} + 0]]]]]]] , p_0, c)$

[Prop 3.2e₁ $\xrightarrow{\text{stmt}}$ $S \vdash \forall \underline{a}: \forall \underline{b}: [[\underline{a} = \underline{b}] \Rightarrow [[\underline{a} + 0] = [\underline{b} + 0]]]]$

[Prop 3.2e₁ $\xrightarrow{\text{tex}}$ “
Prop\ 3.2e.1”]

[Prop 3.2e₁ $\xrightarrow{\text{pyk}}$ “prop three two e one”]

Prop 3.2e₂

[Prop 3.2e₂ $\xrightarrow{\text{proof}}$ $\lambda c. \lambda x. \mathcal{P}([S \vdash \forall \underline{a}: \forall \underline{b}: \forall \underline{c}: [[\forall \underline{a}: \forall \underline{b}: \forall \underline{c}: [[[\underline{a} = \underline{b}] \Rightarrow [[\underline{a} + \underline{c}] = [\underline{b} + \underline{c}]]]] \vdash [[\underline{a} = \underline{b}] \vdash [[[[\text{MP} \triangleright [[\underline{a} = \underline{b}] \Rightarrow [[\underline{a} + \underline{c}] = [\underline{b} + \underline{c}]]]] \triangleright [\underline{a} = \underline{b}]] \gg [[\underline{a} + \underline{c}] = [\underline{b} + \underline{c}]]] ; [[[[S2 \triangleright [[\underline{a} + \underline{c}] = [\underline{b} + \underline{c}]]] \gg [[\underline{a} + \underline{c}]' = [\underline{b} + \underline{c}]']]] ; [[S6 \gg [[\underline{a} + [\underline{c}']] = [[\underline{a} + \underline{c}]']]] ; [[[[\text{Prop 3.2c} \triangleright [[\underline{a} + [\underline{c}']] = [[\underline{a} + \underline{c}]']]] \triangleright [[\underline{a} + \underline{c}]' = [[\underline{b} + \underline{c}]']]] \gg [[\underline{a} + [\underline{c}']] = [[\underline{b} + \underline{c}]']]]] ; [[S6 \gg [[\underline{b} + [\underline{c}']] = [[\underline{b} + \underline{c}]']]]] ; [[[\text{Prop 3.2d} \triangleright [[\underline{a} + [\underline{c}']] = [[\underline{b} + \underline{c}]']]] \triangleright [[\underline{b} + [\underline{c}']] = [[\underline{b} + \underline{c}]']]] \gg [[\underline{a} + [\underline{c}']] = [\underline{b} + [\underline{c}']]]]]]]] ; [[\text{Ded} \triangleright \forall \underline{a}: \forall \underline{b}: \forall \underline{c}: [[[\underline{a} = \underline{b}] \Rightarrow [[\underline{a} + \underline{c}] = [\underline{b} + \underline{c}]]]] \vdash [[\underline{a} = \underline{b}] \vdash [[\underline{a} + [\underline{c}']] = [\underline{b} + [\underline{c}']]]]]] \gg [[[[\underline{a} = \underline{b}] \Rightarrow [[\underline{a} + \underline{c}] = [\underline{b} + \underline{c}]]] \Rightarrow [[\underline{a} = \underline{b}] \Rightarrow [[\underline{a} + [\underline{c}']] = [\underline{b} + [\underline{c}']]]]]]]] , p_0, c)$

[Prop 3.2e₂ $\xrightarrow{\text{stmt}}$ $S \vdash \forall \underline{a}: \forall \underline{b}: \forall \underline{c}: [[[\underline{a} = \underline{b}] \Rightarrow [[\underline{a} + \underline{c}] = [\underline{b} + \underline{c}]]] \Rightarrow$

$\underline{a} = [0 + \underline{a}] \vdash [\underline{a}' = [0 + [\underline{a}]]] \gg [[\underline{a} = [0 + \underline{a}]] \Rightarrow [\underline{a}' = [0 + [\underline{a}]]]] \vdash, p_0, c]$

$[\text{Prop 3.2f}_2 \xrightarrow{\text{stmt}} S \vdash \forall \underline{a}: [\underline{a} = [0 + \underline{a}]] \Rightarrow [\underline{a}' = [0 + [\underline{a}]]]]$

$[\text{Prop 3.2f}_2 \xrightarrow{\text{tex}} \text{Prop} \setminus \text{3.2f}_2]$

$[\text{Prop 3.2f}_2 \xrightarrow{\text{pyk}} \text{“prop three two f two”}]$

Prop 3.2f

$[\text{Prop 3.2f} \xrightarrow{\text{proof}} \lambda c. \lambda x. \mathcal{P}([S \vdash \forall \underline{a}: [[\text{Prop 3.2f}_1 \gg [0 = [0 + 0]]]; [\text{Prop 3.2f}_2 \gg [[\bar{x} = [0 + \bar{x}]] \Rightarrow [\bar{x}' = [0 + [\bar{x}]]]]; [[[S9 @ \bar{x}] \triangleright [0 = [0 + 0]]] \triangleright [[\bar{x} = [0 + \bar{x}]] \Rightarrow [\bar{x}' = [0 + [\bar{x}]]]]] \gg [[\bar{x} = [0 + \bar{x}]]]]; [[\text{Ded} \triangleright [\bar{x} = [0 + \bar{x}]]] \gg [\underline{a} = [0 + \underline{a}]]]] \vdash, p_0, c)]$

$[\text{Prop 3.2f} \xrightarrow{\text{stmt}} S \vdash \forall \underline{a}: [\underline{a} = [0 + \underline{a}]]]$

$[\text{Prop 3.2f} \xrightarrow{\text{tex}} \text{Prop} \setminus \text{3.2f}]$

$[\text{Prop 3.2f} \xrightarrow{\text{pyk}} \text{“prop three two f”}]$

Prop 3.2g₁

$[\text{Prop 3.2g}_1 \xrightarrow{\text{proof}} \lambda c. \lambda x. \mathcal{P}([S \vdash \forall \underline{a}: [[S5 \gg [[\underline{a}' + 0] = [\underline{a}]]]]; [[S5 \gg [[\underline{a} + 0] = \underline{a}]]; [[[S2 \triangleright [[\underline{a} + 0] = \underline{a}]] \gg [[\underline{a} + 0]' = [\underline{a}']]]; [[[\text{Prop 3.2d} \triangleright [[\underline{a}' + 0] = [\underline{a}']]] \triangleright [[\underline{a} + 0]' = [\underline{a}']]]] \gg [[\underline{a}' + 0] = [[\underline{a} + 0]']]]] \vdash, p_0, c)]$

$[\text{Prop 3.2g}_1 \xrightarrow{\text{stmt}} S \vdash \forall \underline{a}: [[\underline{a}' + 0] = [[\underline{a} + 0]']]]$

$[\text{Prop 3.2g}_1 \xrightarrow{\text{tex}} \text{Prop} \setminus \text{3.2g}_1]$

$[\text{Prop 3.2g}_1 \xrightarrow{\text{pyk}} \text{“prop three two g one”}]$

Prop 3.2g₂

$[\text{Prop 3.2g}_2 \xrightarrow{\text{proof}} \lambda c. \lambda x. \mathcal{P}([S \vdash \forall \underline{a}: \forall \underline{b}: [[\forall \underline{a}: \forall \underline{b}: [[[\underline{a}' + \underline{b}] = [[\underline{a} + \underline{b}]]]]]] \vdash [[[[S2 \triangleright [[\underline{a}' + \underline{b}] = [[\underline{a} + \underline{b}]]]]] \gg [[\underline{a}' + \underline{b}]' = [[\underline{a} + \underline{b}]]]]]; [[[S6 \gg [[\underline{a}' + [\underline{b}]]] = [[\underline{a}' + \underline{b}]]]]]; [[[[\text{Prop 3.2c} \triangleright$

$$\begin{aligned} & [[\underline{a}' + [\underline{b}']] = [[\underline{a}' + \underline{b}]']] \triangleright [[\underline{a}' + \underline{b}]' = [[\underline{a} + \underline{b}]'']] \gg \\ & [[\underline{a}' + [\underline{b}']] = [[\underline{a} + \underline{b}]'']] ; [[S6 \gg [[\underline{a} + [\underline{b}']] = [[\underline{a} + \underline{b}]']]] ; [[[S2 \triangleright [[\underline{a} + [\underline{b}']] = [[\underline{a} + \underline{b}]']]] \gg [[\underline{a} + [\underline{b}']]' = [[\underline{a} + \underline{b}]'']] ; [[[Prop 3.2d \triangleright [[\underline{a}' + [\underline{b}']] = [[\underline{a} + \underline{b}]'']]] \triangleright [[\underline{a} + [\underline{b}']]' = [[\underline{a} + \underline{b}]'']] \gg [[\underline{a}' + [\underline{b}']] = [[\underline{a} + [\underline{b}']]']]]] ; [[Ded \triangleright \forall \underline{a}: \forall \underline{b}: [[[\underline{a}' + \underline{b}] = [[\underline{a} + \underline{b}]']]] \vdash [[\underline{a}' + [\underline{b}']] = [[\underline{a} + [\underline{b}']]']]] \gg [[[\underline{a}' + \underline{b}] = [[\underline{a} + \underline{b}]']]] \Rightarrow [[\underline{a}' + [\underline{b}']] = [[\underline{a} + [\underline{b}']]']]]], p_0, c) \end{aligned}$$

$$[Prop 3.2g_2 \xrightarrow{stmt} S \vdash \forall \underline{a}: \forall \underline{b}: [[[\underline{a}' + \underline{b}] = [[\underline{a} + \underline{b}]']] \Rightarrow [[\underline{a}' + [\underline{b}']] = [[\underline{a} + [\underline{b}']]']]]]$$

$$[Prop 3.2g_2 \xrightarrow{tex} \text{“} \\ Prop \setminus 3.2g.2 \text{”}]$$

$$[Prop 3.2g_2 \xrightarrow{pyk} \text{“prop three two g two”}]$$

Prop 3.2g

$$\begin{aligned} & [Prop 3.2g \xrightarrow{proof} \lambda c. \lambda x. \mathcal{P}([S \vdash \forall \underline{a}: \forall \underline{b}: [[[Prop 3.2g_1 \gg [[\underline{x}' + 0] = [[\underline{x} + 0]']]] ; [[Prop 3.2g_2 \gg [[[\underline{x}' + \underline{y}] = [[\underline{x} + \underline{y}]']] \Rightarrow [[\underline{x}' + \underline{y}'] = [[\underline{x} + [\underline{y}']]']]]] ; [[[S9 @ \underline{y}] \triangleright [[\underline{x}' + 0] = [[\underline{x} + 0]']]] \triangleright [[[\underline{x}' + \underline{y}] = [[\underline{x} + \underline{y}]']] \Rightarrow [[\underline{x}' + [\underline{y}']] = [[\underline{x} + [\underline{y}']]']]] \gg [[\underline{x}' + \underline{y}] = [[\underline{x} + \underline{y}]']]]] ; [[Ded \triangleright [[\underline{x}' + \underline{y}] = [[\underline{x} + \underline{y}]']]] \gg [[\underline{a}' + \underline{b}] = [[\underline{a} + \underline{b}]']]]], p_0, c) \end{aligned}$$

$$[Prop 3.2g \xrightarrow{stmt} S \vdash \forall \underline{a}: \forall \underline{b}: [[\underline{a}' + \underline{b}] = [[\underline{a} + \underline{b}]']]]$$

$$[Prop 3.2g \xrightarrow{tex} \text{“} \\ Prop \setminus 3.2g \text{”}]$$

$$[Prop 3.2g \xrightarrow{pyk} \text{“prop three two g”}]$$

Prop 3.2h₁

$$\begin{aligned} & [Prop 3.2h_1 \xrightarrow{proof} \lambda c. \lambda x. \mathcal{P}([S \vdash \forall \underline{a}: [[S5 \gg [[\underline{a} + 0] = \underline{a}]] ; [[Prop 3.2f \gg [\underline{a} = [0 + \underline{a}]]] ; [[[Prop 3.2c \triangleright [[\underline{a} + 0] = \underline{a}]] \triangleright [\underline{a} = [0 + \underline{a}]]] \gg [[\underline{a} + 0] = [0 + \underline{a}]]]]], p_0, c) \end{aligned}$$

$$[Prop 3.2h_1 \xrightarrow{stmt} S \vdash \forall \underline{a}: [[\underline{a} + 0] = [0 + \underline{a}]]]$$

$$[Prop 3.2h_1 \xrightarrow{tex} \text{“} \\ Prop \setminus 3.2h.1 \text{”}]$$

$$[Prop 3.2h_1 \xrightarrow{pyk} \text{“prop three two h one”}]$$

Prop 3.2h₂

[Prop 3.2h₂ $\xrightarrow{\text{proof}}$ $\lambda c. \lambda x. \mathcal{P}([S \vdash \forall \underline{a}: \forall \underline{b}: [[\forall \underline{a}: \forall \underline{b}: [[[\underline{a} + \underline{b}] = [\underline{b} + \underline{a}]]]]] \vdash [[[S2 \triangleright [[\underline{a} + \underline{b}] = [\underline{b} + \underline{a}]]]]] \gg [[\underline{a} + \underline{b}]' = [\underline{b} + \underline{a}]']]] ; [[[S6 \gg [[\underline{a} + [\underline{b}']] = [\underline{a} + \underline{b}]]]]] ; [[[[Prop 3.2c \triangleright [[\underline{a} + [\underline{b}']]] = [\underline{a} + \underline{b}]]]]]] \triangleright [[\underline{a} + \underline{b}]' = [\underline{b} + \underline{a}]']]] \gg [[\underline{a} + [\underline{b}']]] = [[\underline{b} + \underline{a}]']]] ; [[[Prop 3.2g \gg [[\underline{b}' + \underline{a}] = [\underline{b} + \underline{a}]]]]] ; [[[Prop 3.2d \triangleright [[\underline{a} + [\underline{b}']]] = [\underline{b} + \underline{a}]]]]] \triangleright [[\underline{b}' + \underline{a}] = [\underline{b} + \underline{a}]]]]] \gg [[\underline{a} + [\underline{b}']]] = [[\underline{b}' + \underline{a}]]]]]] ; [[[Ded \triangleright \forall \underline{a}: \forall \underline{b}: [[[\underline{a} + \underline{b}] = [\underline{b} + \underline{a}]]]]] \vdash [[\underline{a} + [\underline{b}']]] = [\underline{b}' + \underline{a}]]]]] \gg [[[\underline{a} + \underline{b}] = [\underline{b} + \underline{a}]]] \Rightarrow [[\underline{a} + [\underline{b}']]] = [\underline{b}' + \underline{a}]]]]], p_0, c)$

[Prop 3.2h₂ $\xrightarrow{\text{stmt}}$ $S \vdash \forall \underline{a}: \forall \underline{b}: [[[\underline{a} + \underline{b}] = [\underline{b} + \underline{a}]]] \Rightarrow [[\underline{a} + [\underline{b}']]] = [[\underline{b}' + \underline{a}]]]]]$

[Prop 3.2h₂ $\xrightarrow{\text{tex}}$ “
Prop \ 3.2h₂”]

[Prop 3.2h₂ $\xrightarrow{\text{pyk}}$ “prop three two h two”]

Prop 3.2h

[Prop 3.2h $\xrightarrow{\text{proof}}$ $\lambda c. \lambda x. \mathcal{P}([S \vdash \forall \underline{a}: \forall \underline{b}: [[[Prop 3.2h_1 \gg [[\bar{x} + 0] = [0 + \bar{x}]]]]] ; [[[Prop 3.2h_2 \gg [[[\bar{x} + \bar{y}] = [\bar{y} + \bar{x}]]] \Rightarrow [[\bar{x} + [\bar{y}']]] = [\bar{y}' + \bar{x}]]]]]] ; [[[[S9 @ \bar{y}] \triangleright [[\bar{x} + 0] = [0 + \bar{x}]]]] \triangleright [[[\bar{x} + \bar{y}] = [\bar{y} + \bar{x}]]]] \Rightarrow [[\bar{x} + [\bar{y}']]] = [\bar{y}' + \bar{x}]]]]] \gg [[\bar{x} + \bar{y}] = [\bar{y} + \bar{x}]]]]]] ; [[[Ded \triangleright [[\bar{x} + \bar{y}] = [\bar{y} + \bar{x}]]]] \gg [[\underline{a} + \underline{b}] = [\underline{b} + \underline{a}]]]]]], p_0, c)$

[Prop 3.2h $\xrightarrow{\text{stmt}}$ $S \vdash \forall \underline{a}: \forall \underline{b}: [[[\underline{a} + \underline{b}] = [\underline{b} + \underline{a}]]]]$

[Prop 3.2h $\xrightarrow{\text{tex}}$ “
Prop \ 3.2h”]

[Prop 3.2h $\xrightarrow{\text{pyk}}$ “prop three two h”]

Block₁(* , * , *)

[Block₁(t, s, c) $\xrightarrow{\text{val}}$ $t! [s! [c! \text{let}_1(\lambda b. \text{let}_1(\lambda x. \text{let}_1(\lambda q. \text{let}_1(\lambda q. \tilde{Q}(t, [b; q], [[b] :: b] :: [[[q] :: q] :: T) , \mathcal{M}(q, s, c) , \tilde{Q}(t, [\text{let } l \doteq x \text{ in } p]_2, [[l] :: [t^2]] :: [[p] :: [t^3]] :: [[x] :: x] :: T)) , \text{Block}_2(b) , \mathcal{M}(t^1, s, c))]]]]$

[Block₁(t, s, c) $\xrightarrow{\text{tex}}$ “
Block_1(#1.

, #2.

, #3.

)”]
 $[\text{Block}_1(t, s, c) \xrightarrow{\text{pyk}} \text{“block one * state * cache * end block”}]$

Block₂(*)

$[\text{Block}_2(b) \xrightarrow{\text{val}} \text{If}(b \stackrel{r}{=} [x \vdash y], \tilde{Q}(b, [x \vdash y], [[x] :: [b^1]] :: [[[[[y] :: \text{Block}_2(b^2)] :: T]], \text{If}(b \stackrel{r}{=} [x \Vdash y], \tilde{Q}(b, [x \Vdash y], [[x] :: [b^1]] :: [[[[[y] :: \text{Block}_2(b^2)] :: T]], \text{If}(b \stackrel{r}{=} [\forall x: y], \tilde{Q}(b, [\forall x: y], [[x] :: [b^1]] :: [[[[[y] :: \text{Block}_2(b^2)] :: T]], \text{If}(b \stackrel{r}{=} [x; y], \text{Block}_2(b^2), \text{If}(b \stackrel{r}{=} [x \gg y], b^2, \perp)))))))]$

$[\text{Block}_2(b) \xrightarrow{\text{tex}} \text{“Block.2(\#1.)”}]$

$[\text{Block}_2(b) \xrightarrow{\text{pyk}} \text{“block two * end block”}]$

*hide

Predef: hide

$[x^{\text{hide}} \xrightarrow{\text{tex}} \text{“\#1. \{ \} ^ \{ \text{hide} \} ”}]$

$[x^{\text{hide}} \xrightarrow{\text{pyk}} \text{“* hide”}]$

MacroIndent(*)

$[\text{MacroIndent}(x) \xrightarrow{\text{name}} \text{“MacroIndent(\#1.)”}]$

$[\text{MacroIndent}(x) \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[\text{MacroIndent}(x) \doteq x]])]$

$[\text{MacroIndent}(x) \xrightarrow{\text{tex}} \text{“\% \leftskip=1em \% \#1.”}]$

$[\text{MacroIndent}(x) \xrightarrow{\text{pyk}} \text{“macro indent *”}]$

*'

[x' $\xrightarrow{\text{tex}}$ "#1.
{ }"]

[x' $\xrightarrow{\text{pyk}}$ "* suc"]

* = *

[x = y $\xrightarrow{\text{tex}}$ "#1.
= #2."]

[x = y $\xrightarrow{\text{pyk}}$ "* equal *"]

* \neq *

[x \neq y $\xrightarrow{\text{tex}}$ "#1.
\neq #2."]

[x \neq y $\xrightarrow{\text{pyk}}$ "* unequal *"]

*var

[x^{var} $\xrightarrow{\text{val}}$ x $\stackrel{r}{=} [\bar{x}]$]

[x^{var} $\xrightarrow{\text{tex}}$ "#1.
{ }^{var}"]

[x^{var} $\xrightarrow{\text{pyk}}$ "* is object var"]

~~#~~⁰

[x^{#0}y $\xrightarrow{\text{val}}$ $\lambda c. [[x^{\text{var}} \wedge [y^c]] \wedge [x^{\#1}y]]$]

[x^{#0}y $\xrightarrow{\text{tex}}$ "#1.
\#. ⁰#2."]

[x^{#0}y $\xrightarrow{\text{pyk}}$ "* avoid zero *"]

#¹

[x#¹y $\xrightarrow{\text{val}}$ If(y^{var}, $\neg [x \stackrel{t}{=} y]$),
If($\neg [y \stackrel{r}{=} [\forall_{\text{obj}x}: y]]$, x#* [y^t]),
If(x $\stackrel{t}{=} [y^1]$, T, x#¹ [y²]))]

[x#¹y $\xrightarrow{\text{tex}}$ “#1.
\#. ^ 1#2.”]

[x#¹y $\xrightarrow{\text{pyk}}$ “* avoid one *”]

#^{}*

[x#*y $\xrightarrow{\text{val}}$ x!If(y, T, If(x#¹ [y^h], x#* [y^t], F))]

[x#*y $\xrightarrow{\text{tex}}$ “#1.
\#. ^ *#2.”]

[x#*y $\xrightarrow{\text{pyk}}$ “* avoid star *”]

∃*: *

[∃x: y $\xrightarrow{\text{tex}}$ “
\exists #1.
\colon #2.”]

[∃x: y $\xrightarrow{\text{pyk}}$ “exist * indeed *”]

∀*: *

[∀x: y $\xrightarrow{\text{macro}}$ λt.λs.λc.λM̃(If($\neg [t^1 \stackrel{r}{=} [x, y]]$), Q̃(t, [∀_{obj}x: y], [[x] :: [t¹]] :: [[y] :: [t²]] :: T), Q̃(t, [∀_{obj}x: ∀y: z], [[x] :: [t¹¹]] :: [[[y] :: [t¹²]] :: [[[z] :: [t²]] :: T]])), s, c)]

[∀x: y $\xrightarrow{\text{tex}}$ “
\forall #1.
\colon #2.”]

[∀x: y $\xrightarrow{\text{pyk}}$ “for all * indeed *”]

$\forall_{\text{obj}} * : *$

$[\forall_{\text{obj}} x : y \xrightarrow{\text{tex}} \text{“}\#1.\text{”}$
 $\backslash\text{forall_}\{\text{obj}\} \#1.$
 $\backslash\text{colon } \#2.\text{”}]$

$[\forall_{\text{obj}} x : y \xrightarrow{\text{pyk}} \text{“for all objects } * \text{ indeed } *”]$

$* \Rightarrow *$

$[x \Rightarrow y \xrightarrow{\text{tex}} \text{“}\#1.$
 $\backslash\text{Rightarrow } \#2.\text{”}]$

$[x \Rightarrow y \xrightarrow{\text{pyk}} \text{“} * \text{ imply } *”]$

$* \Leftrightarrow *$

$[x \Leftrightarrow y \xrightarrow{\text{tex}} \text{“}\#1.$
 $\backslash\text{Leftrightarrow } \#2.\text{”}]$

$[x \Leftrightarrow y \xrightarrow{\text{pyk}} \text{“} * \text{ if and only if } *”]$

$* \# *$

$[x \# y \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[x \# y \doteq [x] \#^0 [y]])]]$

$[x \# y \xrightarrow{\text{tex}} \text{“}\#1.$
 $\backslash\#.\#2.\text{”}]$

$[x \# y \xrightarrow{\text{pyk}} \text{“} * \text{ avoid } *”]$

$* \triangleright *$

$[x \triangleright y \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{\mathcal{M}}_4(t, s, c, [[x \triangleright y \doteq [\text{MP} \triangleright x] \triangleright y]])]]$

$[x \triangleright y \xrightarrow{\text{tex}} \text{“}\#1.$
 $\backslash\text{unrhd } \#2.\text{”}]$

$[x \triangleright y \xrightarrow{\text{pyk}} \text{“} * \text{ object modus ponens } *”]$

$\Pi * : *$

```
[ $\Pi x: y \xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \tilde{M}(\text{If}(\neg [t^1 \stackrel{r}{=} [x, y]], \tilde{Q}(t, [\forall x: y], [[x] :: [t^1]] :: [[y] :: [t^2]] :: T)), \tilde{Q}(t, [\forall x: \Pi y: z], [[x] :: [t^{11}]] :: [[y] :: [t^{12}]] :: [[z] :: [t^2]] :: T))), s, c)$ 
```

```
[ $\Pi x: y \xrightarrow{\text{tex}}$  “  
\Pi #1.  
\colon #2.”]
```

```
[ $\Pi x: y \xrightarrow{\text{pyk}}$  “for all terms * indeed *”]
```

Begin *; * : End; *

```
[Begin b; l : End; p  $\xrightarrow{\text{name}}$  “  
Begin \, #1.  
; #2.  
: End ; #3.”]
```

```
[Begin b; l : End; p  $\xrightarrow{\text{macro}} \lambda t. \lambda s. \lambda c. \text{Block}_1(t, s, c)$ ]
```

```
[Begin b; l : End; p  $\xrightarrow{\text{tex}}$  “  
\newline \makebox [0.1\textwidth]{}%  
\parbox [b]{0.4\textwidth}{\raggedright  
\setlength {\parindent}{-0.1\textwidth}}%  
\makebox [0.1\textwidth][l]{$  
\if \relax \csname lgwprooflinep\endcsname L_? \else  
\global \advance \lgwproofline by 1  
L\ifnum \lgwproofline <10 0\fi \number \lgwproofline  
\fi  
$} $Block {} \gg {}$} \quad  
\parbox [t]{0.4\textwidth} {$Begin  
$\hfill \makebox [0mm][l]{\quad ;} } #1.  
\newline \makebox [0.1\textwidth]{}%  
\parbox [b]{0.4\textwidth}{\raggedright  
\setlength {\parindent}{-0.1\textwidth}}%  
\makebox [0.1\textwidth][l]{$#2.  
$} $Block {} \gg {}$} \quad  
\parbox [t]{0.4\textwidth} {$End  
$\hfill \makebox [0mm][l]{\quad ;} } #3.”]
```

```
[Begin b; l : End; p  $\xrightarrow{\text{pyk}}$  “block * line * end block *”]
```

Last block line * \gg * ;

```
[Last block line a  $\gg$  i ;  $\xrightarrow{\text{name}}$  “  
Last\ block\ line \, #1.  
\gg #2.  
\,;”]
```

```
[Last block line a  $\gg$  i ;  $\xrightarrow{\text{macro}}$  \t.\s.\c.\tilde{\mathcal{M}}_4(t,s,c, [[Last block line a  $\gg$  i ;  $\doteq$  (a  $\gg$   
i)])]
```

```
[Last block line a  $\gg$  i ;  $\xrightarrow{\text{tex}}$  “  
\newline \makebox [0.1\textwidth]{}%  
\parbox [b]{0.4\textwidth }{\raggedright  
\setlength {\parindent }{-0.1\textwidth }%  
\makebox [0.1\textwidth ][l]{$  
\if \relax \csname lgwprooflinep\endcsname L_? \else  
\global \advance \lgwproofline by 1  
L\ifnum \lgwproofline <10 0\fi \number \lgwproofline  
\fi  
$;}$#1.  
{ }\gg { }$}\quad  
\parbox [t]{0.4\textwidth }{ $#2.  
$\hfill \makebox [0mm][l]{\quad ; }$”]
```

```
[Last block line l  $\gg$  i ;  $\xrightarrow{\text{pyk}}$  “because * indeed * end line”]
```

Arbitrary \gg * ; *

```
[Arbitrary  $\gg$  i ; p  $\xrightarrow{\text{name}}$  “  
Arbitrary \gg #1.  
; #2.”]
```

```
[Arbitrary  $\gg$  i ; p  $\xrightarrow{\text{macro}}$  \t.\s.\c.\tilde{\mathcal{M}}_4(t,s,c, [[Arbitrary  $\gg$  i ; p  $\doteq$   $\Pi$ i: p]])]
```

```
[Arbitrary  $\gg$  i ; p  $\xrightarrow{\text{tex}}$  “  
\newline \makebox [0.1\textwidth ][l]{$  
\if \relax \csname lgwprooflinep\endcsname L_? \else  
\global \advance \lgwproofline by 1  
L\ifnum \lgwproofline <10 0\fi \number \lgwproofline  
\fi  
$;} \makebox [0.4\textwidth ][l]{$Arbitrary\}\gg\{\}\$}\quad  
\parbox [t]{0.4\textwidth }{ $#1.  
$\hfill \makebox [0mm][l]{\quad ; }$#2.”]
```

```
[Arbitrary  $\gg$  i ; p  $\xrightarrow{\text{pyk}}$  “any term * end line *”]
```


* | *

[x | y $\xrightarrow{\text{tex}}$ “#1.
\mathrel{ } #2.”]

[x | y $\xrightarrow{\text{pyk}}$ “* alternative *”]

→

[\rightarrow $\xrightarrow{\text{tex}}$ “
\rightarrow ”]

[\rightarrow $\xrightarrow{\text{pyk}}$ “evaluates to”]

* \ \ *

[x \ \ y $\xrightarrow{\text{name}}$ “#1.
\backslash \ \backslash #2.”]

[x \ \ y $\xrightarrow{\text{tex}}$ “#1.
\{ } #2.”]

[x \ \ y $\xrightarrow{\text{pyk}}$ “* safe row *”]

*The pyk compiler, version 0.grue.20060417 by Klaus Grue
GRD-2006-05-26.UTC:13:59:58.555187 = MJD-53881.TAI:14:00:31.555187 =
LGT-4655368831555187e-6*