$\Gamma \vdash t : A \Rightarrow t \in SN$

Def $[\![A]\!] \subseteq SN$ (3) CR1

Def θ válida en $\Gamma \iff \forall x{:}A \in \Gamma$ $\theta(x) \in [\![A]\!]$

teorema (1) Adecuación

$\left.\begin{array}{l}\Gamma \vdash t : A \\ \theta \text{ válida en } \Gamma\end{array}\right\} \Rightarrow \theta(t) \in [\![A]\!]$

teorema (2) id es válida en todo Γ

$\forall x{:}A \in \Gamma$

$\theta(x) = x \in [\![A]\!]$

$\Gamma \vdash t : A \Rightarrow t \in [\![A]\!] \subseteq SN$

por (1) por (3)

id válida en Γ por 2

CR2

$\left.\begin{array}{l} t \to r \\ t \in [\![A]\!]\end{array}\right\} r \in [\![A]\!]$

CR3

$Red(t) \subseteq [\![A]\!]$

$\Downarrow$

$t \in [\![A]\!]$

$A ::= A \Rightarrow A \mid N \mid \tau$

$[\![\tau]\!] = SN$

$[\![N]\!] = SN$

$[\![A \Rightarrow B]\!] = \{ t \mid \forall r \in [\![A]\!] \; t\, r \in [\![B]\!] \} \subseteq SN$

$\Gamma \vdash t : A \Rightarrow \theta(t) \in [\![A]\!]$

HI $\theta(t) \in [\![B]\!] \subseteq SN$

caso. $\dfrac{\Gamma, x{:}A \vdash t : B}{\Gamma \vdash \lambda x. t : A \Rightarrow B}$ QVQ $\lambda x. t \in [\![A \Rightarrow B]\!]$

es decir $\forall r \in [\![A]\!] \subseteq SN$

$(\lambda x. t)\, r \in [\![B]\!]$

$t[r/x]$ $\quad (\lambda x. t')\, r \in [\![B]\!]$ $\quad (\lambda x. t)\, r' \in [\![B]\!]$

$\in [\![B]\!]$

$|t'| + |r| < |t| + |r|$

$[\![A \times B]\!] = \left\{ t \;\middle|\; \begin{array}{l}\pi_1(t) \in [\![A]\!] \\ \pi_2(t) \in [\![B]\!]\end{array} \right\}$ $\quad |t| + |r|$

Interpretación
Compilación
Registros y Objetos
SR
SN

$\log C = \boxed{\sigma s. 10}$

$\sigma s. \lambda x. \text{if } x \text{ then } s(\log C \leftarrow \sigma s'.(s \# \log C - 1))$

s'

$$\frac{\Gamma \vdash t : A \quad \Gamma \vdash r : B}{\Gamma \vdash \langle t, r \rangle : A \times B} \qquad \frac{\Gamma \vdash t : A \times B}{\Gamma \vdash \pi_1 t : A} \qquad \frac{\Gamma \vdash t : A \times B}{\Gamma \vdash \pi_2 t : B}$$

$\langle v, w \rangle$ es un valor

$\Gamma, \lambda x. t \hookrightarrow \langle \lambda x. t, \Gamma \rangle$

$$\frac{\Gamma \vdash t \hookrightarrow v \quad \Gamma \vdash r \hookrightarrow w}{\Gamma \vdash \langle t, r \rangle \hookrightarrow \langle v, w \rangle} \qquad \frac{\Gamma \vdash t \hookrightarrow \langle v, w \rangle}{\Gamma \vdash \pi_1 t \hookrightarrow v}$$

$$\frac{\dfrac{\Gamma \vdash t \hookrightarrow v}{x = \langle t, \Gamma \rangle \vdash x \hookrightarrow v}}{x = \langle t, \Gamma \rangle \vdash \langle x, 1 \rangle \hookrightarrow \langle v, 1 \rangle}$$

$$\frac{\cancel{x = ? \quad y = \langle t, \Gamma \rangle \vdash xy}}{y = \langle t, \Gamma \rangle \vdash \lambda x. (xy) \hookrightarrow \langle \lambda x. (x y), y = \langle t, \Gamma \rangle \rangle}$$

$x =$

$$[\![(\lambda x{:}nat.0)\,(fix\ x{:}nat.\,x)]\!]_\emptyset$$

$$= [\![\lambda x{:}nat.0]\!]_\emptyset \left([\![fix\ x{:}nat.\,x]\!] \right)$$

$$= (a \in \mathbb{N} \mapsto 0)\ FIX(b \in \mathbb{N} \mapsto b)$$

$$= (a \in \mathbb{N} \mapsto 0)(\perp) \longrightarrow 0 \text{ en CBN}$$

$$\longrightarrow \perp \text{ en CBV}$$

$$\perp(a) = \perp$$

$$f(\perp) \longrightarrow \perp$$

$$\frac{\Gamma \vdash r \hookrightarrow \langle \{l_1 = \varsigma s.t_1, \dots, l_n = \varsigma s.t_n\}, \Delta \rangle}{\Gamma \vdash r(l_k \Leftarrow \varsigma s.t'_k) \hookrightarrow \langle \{l_1 = \varsigma s.t_1, \dots, l_k = \varsigma s.t'_k, \dots, l_n = \varsigma s.t_n\} \rangle}$$

$$x = \langle b, \Gamma \rangle \vdash \{l = \varsigma s.x\} \hookrightarrow \langle \{l = \varsigma s.x\}, x = \langle b, \Gamma \rangle \rangle$$

$$\frac{\Gamma \vdash r \hookrightarrow \langle \{l_1 = \varsigma s.t_1, \dots, l_n = \varsigma s.t_n\}, \Delta \rangle \qquad \Delta, s = \langle o, \Delta \rangle \vdash t_k \hookrightarrow v}{\Gamma \vdash r \# l_k \hookrightarrow v}$$

$$(\lambda s.t_k)\ s$$

$$\frac{}{\Gamma \vdash \lambda x.t \hookrightarrow \langle \lambda x.t, \Gamma \rangle}$$

$N^e = \mathbb{N} \cup \{error\}$

$A^e = A \cup \{error\}$

$\overbrace{\text{if } z \; e \text{ then } t \text{ else } r}^{A} \longrightarrow \overset{A}{e_A}$

$n+m \qquad A \qquad A$

$[\![Nat]\!] = \mathbb{N}^e$

$[\![A \to B]\!] = [\![A]\!] \to [\![B]\!] \cup \{e_{A\to B}\}$

$f(e_A) \to \underline{e_B}$ ....

$e_{\mathbb{N}} + n = e_{\mathbb{N}}$

$n + e_{\mathbb{N}} = e_{\mathbb{N}}$

$\times$

$\div$

$-$

$n/0 = e_{\mathbb{N}}$

$\underbrace{e}_{A\to B}(t) = e_B$

$A \to B$

$[\![t + r]\!]_\theta = [\![t]\!]_\theta + [\![r]\!]_\theta$

$\underbrace{(\lambda x.t)}_{A}\, r \longrightarrow \underbrace{t[r/x]}_{A}$

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true false

Bool

Nat

n

$t ::= x \mid \lambda x.t \ldots \mid n \mid b \mid$

$n \in \mathbb{N}$ $\qquad b = \text{true} \circ \text{false}$

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