Computational model of lambda calculus

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1 General Definitions

Definition 1.1. *An enumeration operator (or e-operator) ψ^A is a r.e. set. For any $A \subseteq \mathbb{N}$*

$$x \in \psi^A \iff \exists u\,(finite\,D_u \subseteq A)((x,u) \in \psi) \tag{1}$$

Definition 1.2. *If A is a r.e. set then ψ_A is the enumeration operator defined by it, namely*

$$x \in \psi_A^B \iff \exists u\,(D_u isfinite)((x,u) \in A \land D_u \subseteq B) \tag{2}$$

Definition 1.3. *If θ is an enumeration operator then G_θ is a well-defined r.e. set defining it, namely*

$$(x,u) \in G_\theta \iff x \in \theta^{D_u} \tag{3}$$

Lemma 1.1. *If ψ is an enumeration operator, then $\psi_{G_\psi} = \psi$*

Proof. TO BE DONE @anton □

Definition 1.4. *Let η be an assigment of r.e. sets to the variables of lambda calculus. With every λ-term E we inductively associate a r.e. set $[\![E]\!]_\eta$:*

1. $[\![x]\!]_\eta = \eta(x)$
2. $[\![E_1 E_2]\!]_\eta = \psi_{[\![E_1]\!]_\eta}([\![E_2]\!]_\eta)$
3. $[\![\lambda x.E]\!]_\eta = G_{\lambda X.[\![E]\!]_{\eta[x:=X]}}$

Where $\lambda X.[\![E]\!]_{\eta[x:=X]}$ is a function

$$A \in W \mapsto [\![E]\!]_{\eta[x:=A]} \tag{4}$$

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References

[1] S. B. Cooper, *Computability Theory.* 2003.

[2] P. Odifreddi, *Classical recursion theory.* 1989.