

Figure 2: Dynamics of the simply-typed λ -calculus

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|---|---|--------------------------------------|---|--|
| VAL-UNIT | VAL-PAIR | VAL-INL | VAL-INR | VAL-LAM |
| $\frac{}{\langle \rangle \text{ val}}$ | $\frac{}{\langle e_1, e_2 \rangle \text{ val}}$ | $\frac{}{\text{inl}(e) \text{ val}}$ | $\frac{}{\text{inr}(e) \text{ val}}$ | $\frac{}{\lambda x : \tau. e \text{ val}}$ |
| VAL-NUM | D-PLUS | | D-PLUS-1 | |
| $\frac{n \in \mathbb{N}}{\text{num}[n] \text{ val}}$ | $\frac{n_1 + n_2 = n}{\text{plus}(\text{num}[n_1]; \text{num}[n_2]) \mapsto \text{num}[n]}$ | | $\frac{e_1 \mapsto e'_1}{\text{plus}(e_1; e_2) \mapsto \text{plus}(e'_1; e_2)}$ | |
| D-PLUS-2 | D-LET | | D-PROJ-TUPLE-1 | |
| $\frac{e_1 \text{ val} \quad e_2 \mapsto e'_2}{\text{plus}(e_1; e_2) \mapsto \text{plus}(e_1; e'_2)}$ | $\frac{}{\text{let}(e_1; x. e_2) \mapsto e_2[e_1/x]}$ | | $\frac{}{\pi_1(\langle e_1, e_2 \rangle) \mapsto e_1}$ | |
| D-PROJ-TUPLE-2 | D-PROJ-1 | | D-PROJ-2 | |
| $\frac{}{\pi_1(\langle e_1, e_2 \rangle) \mapsto e_2}$ | $\frac{e \mapsto e'}{\pi_1(e) \mapsto \pi_1(e')}$ | | $\frac{e \mapsto e'}{\pi_2(e) \mapsto \pi_2(e')}$ | |
| D-ABORT-1 | D-CASE-INL | | | |
| $\frac{e \mapsto e'}{\text{abort}(e) \mapsto \text{abort}(e')}$ | $\frac{}{\text{case}(\text{inl}(e); x. e_1; y. e_2) \mapsto e_1[e/x]}$ | | | |
| D-CASE-INR | D-CASE-1 | | | |
| $\frac{}{\text{case}(\text{inr}(e); x. e_1; y. e_2) \mapsto e_2[e/y]}$ | $\frac{e \mapsto e'}{\text{case}(e; x. e_1; y. e_2) \mapsto \text{case}(e'; x. e_1; y. e_2)}$ | | | |
| D-APP-1 | D-BETA | | | |
| $\frac{e_1 \mapsto e'_1}{e_1(e_2) \mapsto e'_1(e_2)}$ | $\frac{}{(\lambda x : \tau. e_1)(e_2) \mapsto e_1[e_2/x]}$ | | | |