CEKS Machine

CS 6520, Spring 2000

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\begin{array}{lcl}
M & ::= & V \mid x \mid (M\ M) \mid (o\ M\ M) \mid (:=\ X\ M) \\
V & ::= & b \mid (\lambda x.M) \mid \mathsf{void} \\
E & ::= & \{x_1 = \sigma_1,\ \ldots\} \\
S & ::= & \{\sigma_1 = \langle V_1, E_1\rangle,\ \ldots\} \\
K & ::= & \mathsf{mt} \\
 & \mid & \langle \mathsf{fun}, \langle V, E\rangle, K\rangle \\
 & \mid & \langle \mathsf{arg}, \langle N, E\rangle, K\rangle \\
 & \mid & \langle \mathsf{prim}, o, \langle V, E\rangle, K\rangle \\
 & \mid & \langle \mathsf{primarg}, o, \langle N, E\rangle, K\rangle \\
 & \mid & \langle \mathsf{set}, \langle x, E\rangle, K\rangle
\end{array}
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\begin{array}{llll}
\langle\langle (M\ N), E\rangle, K, S\rangle & \longmapsto & \langle\langle M, E\rangle, \langle \mathsf{arg}, \langle N, E\rangle, K\rangle, S\rangle & 1 \\
\langle\langle (o\ M\ N), E\rangle, K, S\rangle & \longmapsto & \langle\langle M, E\rangle, \langle \mathsf{primarg}, o, \langle N, E\rangle, K\rangle, S\rangle & 2 \\
\langle\langle V, E\rangle, \langle \mathsf{fun}, \langle (\lambda x.M), E'\rangle, K\rangle, S\rangle & \longmapsto & \langle\langle M, E'[x \leftarrow \sigma]\rangle, K, S[\sigma \leftarrow \langle V, E\rangle]\rangle & 3\ \star \\
 & & \quad \text{where } \sigma \notin \mathrm{dom}(S) & \\
\langle\langle V, E\rangle, \langle \mathsf{arg}, \langle N, E'\rangle, K\rangle, S\rangle & \longmapsto & \langle\langle N, E'\rangle, \langle \mathsf{fun}, \langle V, E\rangle, K\rangle, S\rangle & 4 \\
\langle\langle b_2, E_2\rangle, \langle \mathsf{prim}, o, \langle b_1, E_1\rangle, K\rangle, S\rangle & \longmapsto & \langle\langle V, \{\}\rangle, K, S\rangle & 5 \\
 & & \quad \text{where } V = \delta(o, b_1, b_2) & \\
\langle\langle V, E\rangle, \langle \mathsf{primarg}, o, \langle N, E'\rangle, K\rangle, S\rangle & \longmapsto & \langle\langle N, E'\rangle, \langle \mathsf{prim}, o, \langle V, E\rangle, K\rangle, S\rangle & 6 \\
\langle\langle x, E\rangle, K, S\rangle & \longmapsto & \langle\langle V, E'\rangle, K, S\rangle & 7\ \star \\
 & & \quad \text{where } \langle V, E'\rangle = S(E(x)) & \\
 & & & \\
\langle\langle (:=\ x\ M), E\rangle, K, S\rangle & \longmapsto & \langle\langle M, E\rangle, \langle \mathsf{set}, \langle x, E\rangle, K\rangle, S\rangle & 8 \\
\langle\langle V, E\rangle, \langle \mathsf{set}, \langle x, E'\rangle, K\rangle, S\rangle & \longmapsto & \langle\langle \mathsf{void}, \{\}\rangle, K, S[\sigma \leftarrow \langle V, E\rangle]\rangle & 9 \\
 & & \quad \text{where } \sigma = E'(x) & \\
 & & & \\
\langle\langle M, E\rangle, K, S[\sigma_1 \leftarrow V_1, \ldots, \sigma_n \leftarrow V_n]\rangle & \longmapsto & \langle\langle M, E\rangle, K, S\rangle & \mathrm{gc} \\
\quad \text{if } \sigma_1, \ldots, \sigma_n \notin L_e(E) \cup L_k(K) \cup L_s(S) & & &
\end{array}
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\begin{array}{lcl}
L_e(E) & = & \mathrm{rng}(E) \\
 & & \\
L_k(\mathsf{mt}) & = & \emptyset \\
L_k(\langle \mathsf{fun}, \langle V, E\rangle, K\rangle) & = & L_e(E) \cup L_k(K) \\
L_k(\langle \mathsf{arg}, \langle N, E\rangle, K\rangle) & = & L_e(E) \cup L_k(K) \\
L_k(\langle \mathsf{prim}, o, \langle V, E\rangle, K\rangle) & = & L_e(E) \cup L_k(K) \\
L_k(\langle \mathsf{primarg}, o, \langle N, E\rangle, K\rangle) & = & L_e(E) \cup L_k(K) \\
L_k(\langle \mathsf{set}, \langle x, E\rangle, K\rangle) & = & L_e(E) \cup L_k(K) \\
 & & \\
L_s(\{\sigma_1 = \langle V_1, E_1\rangle, \ldots \sigma_1 = \langle V_n, E_n\rangle\}) & = & L_e(E_1) \cup \ldots L_e(E_n)
\end{array}
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