1 Terminology

Symbol	Meaning
v	value
α	address
σ	store; maps addresses to values
x, y, z	names
Γ	environment; maps names to addresses
$\rightarrow$	expression evaluation
$\xrightarrow{s}$	statement evaluation

2 Expression Semantics

2.1 Operators

$$\frac{(a,\sigma_0)\rightarrow(v_a\sigma_1) \qquad (b,\sigma_1)\rightarrow(v_b,\sigma_2) \qquad t=f(\sigma_2,v_a,v_b)}{(a*b,\sigma_0)\rightarrow(t,\sigma_2)}$$

where $*$ is an operator and f is the function which corresponds to that operator.

2.2 Closures

$$(\lambda x.e, \sigma) \rightarrow ((x, e, \Gamma), \sigma)$$

2.3 Function Application

$$\frac{\Gamma\vdash(f,\sigma_0)\rightarrow\big((x,e,\Gamma'),\sigma_1\big) \qquad \Gamma\vdash(a,\sigma_1)\rightarrow(v_a,\sigma_2) \qquad \Gamma',x\mapsto\alpha\vdash(e,\sigma_2[\alpha\mapsto v_a])\rightarrow(v_r\sigma_3)}{\Gamma\vdash(f(a),\sigma_0)\rightarrow(v_r,\sigma_3)}$$

where α is a fresh address

2.4 Sequencing

$$\frac{\Gamma_0\vdash(s_0,\sigma_0)\xrightarrow{s}(\Gamma_1,\sigma_1) \qquad \Gamma_1\vdash(s_1,\sigma_1)\xrightarrow{s}(\Gamma_2,\sigma_2)}{\Gamma_0\vdash(\{s_0;s_1\},\sigma_0)\xrightarrow{s}(\Gamma_2,\sigma_2)}$$

2.5 While Loops

$$\frac{\Gamma_0\vdash(e,\sigma_0)\rightarrow(T,\sigma_1) \qquad \Gamma_0\vdash(s,\sigma_1)\xrightarrow{s}(\Gamma_1,\sigma_2) \qquad \Gamma_0\vdash(\text{while } e{:}s,\sigma_2)\xrightarrow{s}(\Gamma_2,\sigma_3)}{\Gamma_0\vdash(\text{while } e{:}s,\sigma_0)\xrightarrow{s}(\Gamma_0,\sigma_3)}$$

$$\frac{\Gamma_0\vdash(e,\sigma_0)\rightarrow(F,\sigma_1)}{\Gamma_0\vdash(\text{while } e{:}s,\sigma_0)\xrightarrow{s}(\Gamma_0,\sigma_1)}$$

3 Statement Semantics