

$e ::= n \mid x \mid \text{True} \mid \text{False} \mid x_1 \text{ binop } x_2 \mid f(x_1 \dots x_n)$
 $\mid \text{let } x = e_1 \text{ in } e_2 \mid \text{if } x_1 \text{ then } e_t \text{ else } e_f$
 $\mid (x_1, x_2) \mid \text{fst } x \mid \text{snd } x$
 $\mid \text{parallel } x \text{ i.e. } \mid x_1 ! x_2$
 $\mid \text{for } x. y \text{ i.s.e.}$

Judgment $H \vdash e \rightsquigarrow v, H \mid K$

$\frac{}{H \vdash x \rightsquigarrow H(x), H \mid K} \text{Var}$

$\frac{H(x_i) = v_i \quad [y_i \mapsto v_i] H \vdash e_f \rightsquigarrow v, H' \mid K}{H \vdash f(x_1 \dots x_n) \rightsquigarrow v, H' \mid K_1^{\text{app}}(n) \cdot K \cdot K_2^{\text{app}}} \text{App}$

$\frac{H \vdash e_1 \rightsquigarrow v_1, H' \mid K_1 \quad [x \mapsto v_1] H' \vdash e_2 \rightsquigarrow v_2, H'' \mid K_2}{H \vdash \text{let } x = e_1 \text{ in } e_2, H'' \mid K_1^{\text{let}} \cdot K_1 \cdot K_2^{\text{let}} \cdot K_2 \cdot K_3} \text{Let}$

$\frac{H(x) = n \quad [i \mapsto j] H \vdash e \rightsquigarrow v_j, H_j \mid K_j}{H \vdash \text{parallel } x \text{ i.e.} \rightsquigarrow [v_1 \dots v_n], \oplus H_j \mid K_1^{\text{par}} \cdot \odot K_j \cdot K_2^{\text{par}}(n)} \text{Par}$

$\frac{H(x_1) = [..v_i..] \quad H(x_2) = i}{H \vdash x_1 ! x_2 \rightsquigarrow v_i, H \mid K} \text{ix}$

$\frac{H(x) = n \quad [i \mapsto j] H_j \vdash e \rightsquigarrow v_j, H_{j+1} \mid K_j \quad (H_0 = H) \quad j = 0..n-1}{H \vdash \text{parallel } x \text{ i.e.} \rightsquigarrow [v_0 \dots v_{n-1}], H_n \mid K_1^{\text{par}} \cdot \odot K_1 \cdot K_2^{\text{par}}(n)} \text{Par}$

$\frac{H(x) = n \quad H(y) = v_0 \quad [i \mapsto j, s \mapsto v_j] H_j \vdash e \rightsquigarrow v_{j+1}, H_{j+1} \mid K_j \quad j = 0..n-1}{H \vdash \text{for } x y \text{ i.s.e.} \rightsquigarrow v_n, H_n \mid K_1^{\text{for}} \cdot \odot K_1 \cdot K_2^{\text{for}}} \text{For}$

~~let $x = 1$~~

$$\begin{aligned} \text{fac } z &= S(z) \\ \text{fac}(Sn) &= n * \text{fac } n \\ \text{me} \end{aligned}$$

$$\Gamma \vdash e \rightsquigarrow v \mid K$$

$$\frac{\Gamma(x)=n \quad [i \mapsto j] \Gamma \vdash e \rightsquigarrow v_j \mid K_j \quad j=0..n-1}{\Gamma \vdash \text{parallel } x \text{ i.e. } \rightsquigarrow [v_0 \dots v_{n-1}] \mid K_1^{\text{par}} \cdot \odot K_k \cdot K_2^{\text{par}}(n)} \text{Par}$$

$$\frac{\Gamma(x)=n \quad \Gamma(y)=v_0 \quad [i \mapsto j, s \mapsto v_j] \Gamma \vdash e \rightsquigarrow v_{j+1} \mid K_j \quad j=0..n-1}{\Gamma \vdash \text{for } x \text{ y i.s.e. } \rightsquigarrow v_n \mid K_1^{\text{for}} \cdot \odot K_k \cdot K_2^{\text{for}}} \text{For}$$