initial system:

$$\frac{}{\Vdash \cdot}\ (\mathsf{empty}) \qquad \frac{\Vdash \Gamma}{\Gamma \vdash \mathbb{U} : \mathbb{U}}\ (\mathsf{univ}) \qquad \frac{\Gamma \vdash A : \mathbb{U}}{\Vdash \Gamma, x : A}\ (\mathsf{ext}) \qquad \frac{\Vdash \Gamma, x : A}{\Gamma, x : A \vdash x : A}\ (\mathsf{var})$$

$$\frac{\Vdash \Gamma}{\Gamma \vdash \mathbb{E}_k : \mathbb{U}}\ (\mathbb{E}) \qquad \frac{\Vdash \Gamma \qquad c \in \mathbb{E}_k}{\Gamma \vdash c : \mathbb{E}_k}\ (\mathbb{E}_{\mathsf{i}}) \qquad \frac{\Gamma \vdash e : \mathbb{E}_k \qquad (\Gamma, x : \mathbb{E}_k \vdash e_c : A)_{c \in \mathbb{E}_k}}{\Gamma \vdash \mathsf{let}\ x := e\ \mathsf{in}\ (c \Rightarrow e_c) : A\{x := e\}}\ (\mathbb{E}_{\mathsf{e}})$$

$$\frac{\Gamma \vdash A_0 : \mathbb{U} \qquad \cdots \qquad \Gamma, x_0 : A_0, \ldots, x_{n-1} : A_{n-1} \vdash A_n : \mathbb{U}}{\Gamma \vdash \Pi(x_0 : A_0, \ldots, x_{n-1} : A_{n-1}).\, A_n : \mathbb{U}}\ (\Pi)$$

$$\frac{\Gamma, x_0 : A_0, \ldots, x_{n-1} : A_{n-1} \vdash e : A_n}{\Gamma \vdash \lambda(x_0 : A_0, \ldots, x_{n-1} : A_{n-1}).\, e : \Pi(x_0 : A_0, \ldots, x_{n-1} : A_{n-1}).\, A_n}\ (\Pi_{\mathsf{i}})$$

$$\frac{\Gamma \vdash e : \Pi(x_0 : A_0, \ldots, x_{n-1} : A_{n-1}).\, A_n \qquad \Gamma \vdash e_0 : A_0 \qquad \cdots \qquad \Gamma \vdash e_{n-1} : A_{n-1}\{x_k := e_k\}}{\Gamma \vdash e\,@\,(e_0, \ldots, e_{n-1}) : A_n\{x_k := e_k\}}\ (\Pi_{\mathsf{e}})$$

$$\frac{\Gamma \vdash A_0 : \mathbb{U} \qquad \cdots \qquad \Gamma, x_0 : A_0, \ldots, x_{n-1} : A_{n-1} \vdash A_n : \mathbb{U}}{\Gamma \vdash \Sigma(x_0 : A_0, \ldots, x_{n-1} : A_{n-1}).\, A_n : \mathbb{U}}\ (\Sigma)$$

$$\frac{\Gamma \vdash e_0 : A_0 \qquad \ldots \qquad \Gamma \vdash e_n : A_n\{x_k := e_k\}}{\Gamma \vdash (e_1, \ldots, e_n) : \Sigma(x_1 : A_0, \ldots, x_{n-1} : A_{n-1}).\, A_n}\ (\Sigma_{\mathsf{i}})$$

$$\frac{\Gamma \vdash e_1 : \Sigma(x_1 : A_0, \ldots, x_{n-1} : A_{n-1}).\, A_n \qquad \Gamma, x_0 : A_0, \ldots, x_n : A_n \vdash e_2 : B\{z := (x_0, \ldots, x_n)\}}{\Gamma \vdash \mathsf{let}\ (x_0, \ldots, x_n) := e_1\ \mathsf{in}\ e_2 : B\{z := e_1\}}\ (\Sigma_{\mathsf{e}})$$

$$\frac{\Gamma, x : A \vdash e : A}{\Gamma \vdash \mathsf{fix}\, x.\, e : A}\ (\mathsf{fix}) \qquad \frac{}{\Gamma \vdash c : A_c}\ (\mathsf{constant})$$

polarize:

$$\frac{}{\Vdash \cdot}\ (\mathsf{empty}) \qquad \frac{\Vdash \Gamma}{\Gamma \vdash \mathbb{U} : \mathbb{U}}\ (\mathsf{univ}) \qquad \frac{\Gamma \vdash P : \mathbb{U}}{\Vdash \Gamma, x : P}\ (\mathsf{ext}) \qquad \frac{\Vdash \Gamma, x : P}{\Gamma, x : P \vdash x : P}\ (\mathsf{var})$$

$$\frac{\Vdash \Gamma}{\Gamma \vdash \mathbb{E}_k : \mathbb{U}}\ (\mathbb{E}) \qquad \frac{\Vdash \Gamma \qquad c \in \mathbb{E}_k}{\Gamma \vdash c : \mathbb{E}_k}\ (\mathbb{E}_{\mathsf{i}}) \qquad \frac{\Gamma \vdash e : \mathbb{E}_k \qquad (\Gamma, x : \mathbb{E}_k \vdash e_c : N)_{c \in \mathbb{E}_k}}{\Gamma \vdash \mathsf{let}\ x := e\ \mathsf{in}\ (c \Rightarrow e_c) : N\{x := e\}}\ (\mathbb{E}_{\mathsf{e}})$$

$$\frac{\Gamma \vdash P_0 : \mathbb{U} \qquad \cdots \qquad \Gamma, x_0 : P_0, \ldots, x_{n-1} : P_{n-1} \vdash N : \mathbb{U}}{\Gamma \vdash \Pi(x_0 : P_0, \ldots, x_{n-1} : P_{n-1}).\, N : \mathbb{U}}\ (\Pi)$$

$$\frac{\Gamma, x_0 : P_0, \ldots, x_{n-1} : P_{n-1} \vdash e : N}{\Gamma \vdash \lambda(x_0 : P_0, \ldots, x_{n-1} : P_{n-1}).\, e : \Pi(x_0 : P_0, \ldots, x_{n-1} : P_{n-1}).\, N}\ (\Pi_{\mathsf{i}})$$

$$\frac{\Gamma \vdash e : \Pi(x_0 : P_0, \ldots, x_{n-1} : P_{n-1}).\, N \qquad \Gamma \vdash e_0 : P_0 \qquad \cdots \qquad \Gamma \vdash e_{n-1} : P_{n-1}\{x_k := e_k\}}{\Gamma \vdash e\, @\, (e_0, \ldots, e_{n-1}) : N\{x_k := e_k\}}\ (\Pi_{\mathsf{e}})$$

$$\frac{\Gamma \vdash P_0 : \mathbb{U} \qquad \cdots \qquad \Gamma, x_0 : P_0, \ldots, x_{n-1} : P_{n-1} \vdash P_n : \mathbb{U}}{\Gamma \vdash \Sigma(x_0 : P_0, \ldots, x_{n-1} : P_{n-1}).\, P_n : \mathbb{U}}\ (\Sigma)$$

$$\frac{\Gamma \vdash e_0 : P_0 \qquad \ldots \qquad \Gamma \vdash e_n : P_n\{x_k := e_k\}}{\Gamma \vdash (e_1, \ldots, e_n) : \Sigma(x_1 : P_0, \ldots, x_{n-1} : P_{n-1}).\, P_n}\ (\Sigma_{\mathsf{i}})$$

$$\frac{\Gamma \vdash e_1 : \Sigma(x_1 : P_0, \ldots, x_{n-1} : P_{n-1}).\, P_n \qquad \Gamma, x_0 : P_0, \ldots, x_n : P_n \vdash e_2 : N\{z := (x_0, \ldots, x_n)\}}{\Gamma \vdash \mathsf{let}\ (x_0, \ldots, x_n) := e_1\ \mathsf{in}\ e_2 : N\{z := e_1\}}\ (\Sigma_{\mathsf{e}})$$

$$\frac{\Gamma \vdash P : \mathbb{U}}{\Gamma \vdash {\uparrow}P : \mathbb{U}}\ (\uparrow) \qquad \frac{\Gamma \vdash e : P}{\Gamma \vdash \mathsf{return}\, e : {\uparrow}P}\ (\uparrow_{\mathsf{i}}) \qquad \frac{\Gamma \vdash e_1 : {\uparrow}P \qquad \Gamma, x : P \vdash e_2 : N}{\Gamma \vdash e_1 \rhd_x e_2 : N}\ (\uparrow_{\mathsf{e}})$$

$$\frac{\Gamma \vdash N : \mathbb{U}}{\Gamma \vdash {\downarrow}N : \mathbb{U}}\ (\downarrow) \qquad \frac{\Gamma \vdash e : N}{\Gamma \vdash \mathsf{thunk}\, e : {\downarrow}N}\ (\downarrow_{\mathsf{i}}) \qquad \frac{\Gamma \vdash e : {\downarrow}N}{\Gamma \vdash \mathsf{force}\, e : N}\ (\downarrow_{\mathsf{e}})$$

$$\frac{\Gamma, x : {\downarrow}N \vdash e : N}{\Gamma \vdash \mathsf{fix}\, x.\, e : N}\ (\mathsf{fix}) \qquad \frac{}{\Gamma \vdash c : P_c}\ (\mathsf{constant})$$

after closure conversion:

$$\frac{}{\Vdash \cdot}\ (\mathsf{empty}) \qquad \frac{\Vdash \Gamma}{\Gamma \vdash \mathbb{U} : \mathbb{U}}\ (\mathsf{univ}) \qquad \frac{\Gamma \vdash P : \mathbb{U}}{\Vdash \Gamma, x : P}\ (\mathsf{ext}) \qquad \frac{\Vdash \Gamma, x : P}{\Gamma, x : P \vdash x : P}\ (\mathsf{var})$$

$$\frac{\Vdash \Gamma}{\Gamma \vdash \mathbb{E}_k : \mathbb{U}}\ (\mathbb{E}) \qquad \frac{\Vdash \Gamma \qquad c \in \mathbb{E}_k}{\Gamma \vdash c : \mathbb{E}_k}\ (\mathbb{E}_\mathsf{i}) \qquad \frac{\Gamma \vdash e : \mathbb{E}_k \qquad (\Gamma, x : \mathbb{E}_k \vdash e_c : N)_{c \in \mathbb{E}_k}}{\Gamma \vdash \mathsf{let}\ x := e\ \mathsf{in}\ (c \Rightarrow e_c) : N\{x := e\}}\ (\mathbb{E}_\mathsf{e})$$

$$\frac{\Gamma \vdash P_0 : \mathbb{U} \qquad \cdots \qquad \Gamma, x_0 : P_0, \ldots, x_{n-1} : P_{n-1} \vdash N : \mathbb{U}}{\Gamma \vdash {\downarrow}\Pi(x_0 : P_0, \ldots, x_{n-1} : P_{n-1}).\, N : \mathbb{U}}\ (\Pi)$$

$$\frac{x_0 : P_0, \ldots, x_{n-1} : P_{n-1} \vdash e : N}{\Gamma \vdash \mathsf{thunk}\ (\lambda(x_0 : P_0, \ldots, x_{n-1} : P_{n-1}).\, e) : {\downarrow}\Pi(x_0 : P_0, \ldots, x_{n-1} : P_{n-1}).\, N}\ (\Pi_\mathsf{i})$$

$$\frac{\Gamma \vdash e : {\downarrow}\Pi(x_0 : P_0, \ldots, x_{n-1} : P_{n-1}).\, N \qquad \Gamma \vdash e_0 : P_0 \qquad \cdots \qquad \Gamma \vdash e_{n-1} : P_{n-1}\{x_k := e_k\}}{\Gamma \vdash (\mathsf{force}\, e)\ @\ (e_0, \ldots, e_{n-1}) : N\{x_k := e_k\}}\ (\Pi_\mathsf{e})$$

$$\frac{\Gamma \vdash P_0 : \mathbb{U} \qquad \cdots \qquad \Gamma, x_0 : P_0, \ldots, x_{n-1} : P_{n-1} \vdash P_n : \mathbb{U}}{\Gamma \vdash \Sigma(x_0 : P_0, \ldots, x_{n-1} : P_{n-1}).\, P_n : \mathbb{U}}\ (\Sigma)$$

$$\frac{\Gamma \vdash e_0 : P_0 \qquad \ldots \qquad \Gamma \vdash e_n : P_n\{x_k := e_k\}}{\Gamma \vdash (e_1, \ldots, e_n) : \Sigma(x_1 : P_0, \ldots, x_{n-1} : P_{n-1}).\, P_n}\ (\Sigma_\mathsf{i})$$

$$\frac{\Gamma \vdash e_1 : \Sigma(x_1 : P_0, \ldots, x_{n-1} : P_{n-1}).\, P_n \qquad \Gamma, x_0 : P_0, \ldots, x_n : P_n \vdash e_2 : N\{z := (x_0, \ldots, x_n)\}}{\Gamma \vdash \mathsf{let}\ (x_0, \ldots, x_n) := e_1\ \mathsf{in}\ e_2 : N\{z := e_1\}}\ (\Sigma_\mathsf{e})$$

$$\frac{\Gamma \vdash P : \mathbb{U}}{\Gamma \vdash {\uparrow}P : \mathbb{U}}\ ({\uparrow}) \qquad \frac{\Gamma \vdash e : P}{\Gamma \vdash \mathsf{return}\, e : {\uparrow}P}\ ({\uparrow}_\mathsf{i}) \qquad \frac{\Gamma \vdash e_1 : {\uparrow}P \qquad \Gamma, x : P \vdash e_2 : N}{\Gamma \vdash e_1 \rhd_x e_2 : N}\ ({\uparrow}_\mathsf{e})$$

$$\frac{\Gamma, x : {\downarrow}N \vdash e : N}{\Gamma \vdash \mathsf{fix}\, x.\, e : N}\ (\mathsf{fix}) \qquad \frac{}{\Gamma \vdash c : P_c}\ (\mathsf{constant})$$