initial system:

$$
\frac{}{\Vdash \emptyset}\ (\mathsf{empty}) \qquad \frac{\Vdash \Gamma}{\Gamma \vdash \mathbb{U}_i : \mathbb{U}_{i+1}}\ (\mathsf{univ}) \qquad \frac{\Gamma \vdash A : \mathbb{U}_i}{\Gamma \vdash A : \mathbb{U}_{i+1}}\ (\mathsf{hier})
$$

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

$$
\frac{\Gamma \vdash A : \mathbb{U}_i \qquad \Gamma, x : A \vdash B : \mathbb{U}_i}{\Gamma \vdash \Pi(x : A).\, B : \mathbb{U}_i}\ (\Pi)
$$

$$
\frac{\Gamma, x : A \vdash e : B}{\Gamma \vdash \lambda x.\, e : \Pi(x : A).\, B}\ (\Pi_{\mathsf{i}}) \qquad \frac{\Gamma \vdash e_1 : \Pi(x : A).\, B \qquad \Gamma \vdash e_2 : A}{\Gamma \vdash e_1 \mathbin{@} e_2 : B[e_1/x]}\ (\Pi_{\mathsf{e}})
$$

$$
\frac{\Gamma \vdash A : \mathbb{U}_i \qquad \Gamma, x : A \vdash B : \mathbb{U}_i}{\Gamma \vdash \Sigma(x : A).\, B : \mathbb{U}_i}\ (\Sigma)
$$

$$
\frac{\Gamma \vdash e_1 : A_1 \qquad \ldots \qquad \Gamma \vdash e_n : A_n[e_1/x_1] \ldots [e_{n-1}/x_{n-1}]}{\Gamma \vdash (e_1, \ldots, e_n) : \Sigma(x_1 : A_1, \ldots, x_{n-1} : A_{n-1}).\, A_n}\ (\Sigma_{\mathsf{i}})
$$

$$
\frac{\Gamma \vdash e_1 : \Sigma(x_1 : A_1, \ldots, x_{n-1} : A_{n-1}).\, A_n \qquad \Gamma, x_1 : A_1, \ldots, x_n : A_n \vdash e_2 : B[(x_1, \ldots, x_n)/z]}{\Gamma \vdash \mathsf{let}\ (x_1, \ldots, x_n) = e_1\ \mathsf{in}\ e_2 : B[e_1/z]}\ (\Sigma_{\mathsf{e}})
$$

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

after closure conversion:

$$\frac{}{\Vdash \emptyset}\ (\mathsf{empty}) \qquad \frac{\Vdash \Gamma}{\Gamma \vdash \mathbb{U}_i : \mathbb{U}_{i+1}}\ (\mathsf{univ}) \qquad \frac{\Gamma \vdash A : \mathbb{U}_i}{\Gamma \vdash A : \mathbb{U}_{i+1}}\ (\mathsf{hier})$$

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

$$\frac{\Gamma \vdash A : \mathbb{U}_i \qquad \Gamma, x : A \vdash B : \mathbb{U}_i}{\Gamma \vdash \Pi(x : A).\, B : \mathbb{U}_i}\ (\Pi)$$

$$\frac{x_1 : A_1, \ldots, x_n : A_n \vdash e : B}{\Gamma \vdash \lambda(x_1, \ldots, x_n).\, e : \Pi(x_1 : A_1, \ldots, x_n : A_n).\, B}\ (\Pi_{\mathsf{i}})$$

$$\frac{\Gamma \vdash e : \Pi(x_1 : A_1, \ldots, x_n : A_n).\, B \qquad \Gamma \vdash e_1 : A_1 \quad \ldots \quad \Gamma \vdash e_n : A_n}{\Gamma \vdash e\,@\,(e_1, \ldots, e_n) : B[e_i / x_i]}\ (\Pi_{\mathsf{e}})$$

$$\frac{\Gamma \vdash A : \mathbb{U}_i \qquad \Gamma, x : A \vdash B : \mathbb{U}_i}{\Gamma \vdash \Sigma(x : A).\, B : \mathbb{U}_i}\ (\Sigma)$$

$$\frac{\Gamma \vdash e_1 : A_1 \qquad \ldots \qquad \Gamma \vdash e_n : A_n[e_1/x_1] \ldots [e_{n-1}/x_{n-1}]}{\Gamma \vdash (e_1, \ldots, e_n) : \Sigma(x_1 : A_1, \ldots, x_{n-1} : A_{n-1}).\, A_n}\ (\Sigma_{\mathsf{i}})$$

$$\frac{\Gamma \vdash e_1 : \Sigma(x_1 : A_1, \ldots, x_{n-1} : A_{n-1}).\, A_n \qquad \Gamma, x_1 : A_1, \ldots, x_n : A_n \vdash e_2 : B[(x_1, \ldots, x_n)/z]}{\Gamma \vdash \mathsf{let}\ (x_1, \ldots, x_n) = e_1\ \mathsf{in}\ e_2 : B[e_1/z]}\ (\Sigma_{\mathsf{e}})$$

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

polarize:

$$\frac{}{\Vdash \emptyset}\ (\mathsf{empty}) \qquad \frac{\Vdash \Gamma}{\Gamma \vdash \mathbb{U}_i : \mathbb{U}_{i+1}}\ (\mathsf{univ}) \qquad \frac{\Gamma \vdash A : \mathbb{U}_i}{\Gamma \vdash A : \mathbb{U}_{i+1}}\ (\mathsf{hier})$$

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

$$\frac{\Gamma \vdash P : \mathbb{U}_i \qquad \Gamma, x : P \vdash N : \mathbb{U}_i}{\Gamma \vdash \Pi(x : P).\, N : \mathbb{U}_i}\ (\Pi)$$

$$\frac{\Gamma, x : P \vdash e : N}{\Gamma \vdash \lambda x.\, e : \Pi(x : P).\, N}\ (\Pi_{\mathsf{i}})$$

$$\frac{\Gamma \vdash e_1 : \Pi(x : P).\, N \qquad \Gamma \vdash e_2 : P}{\Gamma \vdash e_1 \mathbin{@} e_2 : N[e_1/x]}\ (\Pi_{\mathsf{e}})$$

$$\frac{\Gamma \vdash P : \mathbb{U}_i \qquad \Gamma, x : P \vdash Q : \mathbb{U}_i}{\Gamma \vdash \Sigma(x : P).\, Q : \mathbb{U}_i}\ (\Sigma)$$

$$\frac{\Gamma \vdash e_1 : P_1 \qquad \ldots \qquad \Gamma \vdash e_n : P_n[e_1/x_1]\ldots[e_{n-1}/x_{n-1}]}{\Gamma \vdash (e_1, \ldots, e_n) : \Sigma(x_1 : P_1, \ldots, x_{n-1} : P_{n-1}).\, P_n}\ (\Sigma_{\mathsf{i}})$$

$$\frac{\Gamma \vdash e_1 : \Sigma(x_1 : P_1, \ldots, x_{n-1} : P_{n-1}).\, P_n \qquad \Gamma, x_1 : P_1, \ldots, x_n : P_n \vdash e_2 : N[(x_1, \ldots, x_n)/z]}{\Gamma \vdash \mathsf{let}\ (x_1, \ldots, x_n) = e_1\ \mathsf{in}\ e_2 : N[e_1/z]}\ (\Sigma_{\mathsf{e}})$$

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

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

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

after closure conversion:

$$\frac{}{\Vdash \varnothing}\ (\mathsf{empty}) \qquad \frac{\Vdash \Gamma}{\Gamma \vdash \mathbb{U}_i : \mathbb{U}_{i+1}}\ (\mathsf{univ}) \qquad \frac{\Gamma \vdash A : \mathbb{U}_i}{\Gamma \vdash A : \mathbb{U}_{i+1}}\ (\mathsf{hier})$$

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

$$\frac{\Gamma \vdash P : \mathbb{U}_i \qquad \Gamma, x : P \vdash N : \mathbb{U}_i}{\Gamma \vdash \Pi(x : P).\, N : \mathbb{U}_i}\ (\Pi)$$

$$\frac{x_1 : P_1, \ldots, x_n : P_n \vdash e : N}{\Gamma \vdash \mathsf{thunk}\,(\lambda(x_1, \ldots, x_n).\, e) : {\downarrow}\Pi(x_1 : P_1, \ldots, x_n : P_n).\, N}\ (\Pi_{\mathsf{i}})$$

$$\frac{\Gamma \vdash e : {\downarrow}\Pi(x_1 : P_1, \ldots, x_n : P_n).\, N \qquad \Gamma \vdash e_1 : P_1 \quad \ldots \quad \Gamma \vdash e_n : P_n}{\Gamma \vdash (\mathsf{force}\, e_1) \mathbin{@} (e_1, \ldots, e_n) : N[e_i / x_i]}\ (\Pi_{\mathsf{e}})$$

$$\frac{\Gamma \vdash P : \mathbb{U}_i \qquad \Gamma, x : P \vdash Q : \mathbb{U}_i}{\Gamma \vdash \Sigma(x : P).\, Q : \mathbb{U}_i}\ (\Sigma)$$

$$\frac{\Gamma \vdash e_1 : P_1 \qquad \ldots \qquad \Gamma \vdash e_n : P_n[e_1 / x_1] \ldots [e_{n-1} / x_{n-1}]}{\Gamma \vdash \mathsf{return}\,(e_1, \ldots, e_n) : \Sigma(x_1 : P_1, \ldots, x_{n-1} : P_{n-1}).\, P_n}\ (\Sigma_{\mathsf{i}})$$

$$\frac{\Gamma \vdash e : \Sigma(x_1 : P_1, \ldots, x_{n-1} : P_{n-1}).\, P_n \qquad \Gamma, x_1 : P_1, \ldots, x_n : P_n \vdash e' : N[(x_1, \ldots, x_n) / z]}{\Gamma \vdash \mathsf{let}\ (x_1, \ldots, x_n) = e\ \mathsf{in}\ e' : N[e / z]}\ (\Sigma_{\mathsf{e}})$$

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

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