$$\text{Env says } e : \tau$$

$$\frac{}{\text{Env} \quad \text{number} : \text{num}}$$

$$\frac{l : \text{num} \qquad r : \text{num}}{\text{Env says } (+ \ l \ r) : \text{num}}$$

$$\frac{f : (t_1 \to t_2) \qquad a : t_1}{\text{Env} \quad (f \ a) : t_2}$$

$$\frac{(\text{extend } (x : \tau) \ \mathcal{E}) \quad b : t_2}{\mathcal{E} \quad (\lambda \ (x : \tau) \ b) : (t \to t_2)}$$

"proves" "has"

$$\frac{e_1 : \text{num} \qquad e_2 : t \qquad e_3 : t}{\mathcal{E} \vdash (\text{if0} \ e_1 \ e_2 \ e_3) : t}$$

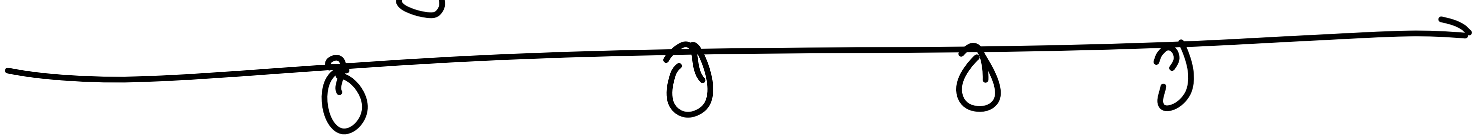
$$\Omega = ((\lambda\ (x)\ (x\ x))\ \leftarrow\ \omega$$
$$(\lambda\ (x)\ (x\ x)))$$

$$\omega : t_1 \to t_2$$
$$: (\ \ \to\ \ ) \to t_2$$

$$(\lambda\ (x : \underline{\ \ t_1\ \ }) : \underline{\ \ t_2\ \ }$$
$$(x\ \ x))$$

STLC

Strong-normalization



$$\frac{\text{extend } \mathcal{E} \; [f : (a_t \to r_t), \; a : a_t] \quad b : r_t \qquad \text{extend } \mathcal{E} \; [f : (a_t \to r_t)] \quad u : t}{\mathcal{E} \vdash (\text{rec } f \; (a : a_t) : r_t \;\; b \;\; u) : t}$$

```
(rec fact (n : num) : num
  (if0 n
       1
       (* n (fact
              (- n 1))))
  (fact 10))
```