

CMPT 383 H7 301570853

mahdi Beigahmadi

1.

$$\frac{\text{Int } 2}{\Gamma[x \Delta \text{Int}] \vdash 2 : \text{Int}} \text{(T-Int)}$$

$$\frac{\text{Ident } x \quad \Gamma[x \Delta \text{Int}](x) = \text{Int} +}{\Gamma[x \Delta \text{Int}] \vdash x : \text{Int}} \text{(T-ident)}$$

$$\frac{\Gamma[x \Delta \text{Int}] \vdash 2 + x : \text{Int}^+}{\Gamma \vdash \lambda x : \text{Int}. 2 + x : \text{Int} \rightarrow \text{Int}} \text{(T-plus)}$$

2.

$$\frac{\text{Ident } x \quad \Gamma[x \Delta \text{Int}](x) = \text{Int}}{\Gamma[x \Delta \text{Int}] \vdash x : \text{Int}} \text{(T-ident)}$$

(T-ident)

$$\frac{\text{Ident } f \quad \Gamma[f \Delta \text{Int} \rightarrow \text{Int}](f) = \text{Int} \rightarrow \text{Int}}{\Gamma[f \Delta \text{Int} \rightarrow \text{Int}] \vdash f : \text{Int} \rightarrow \text{Int}^+}$$

(T-Ident)



Int 1

(T-int)

$$\frac{}{\Gamma \vdash \lambda x : \text{Int}. x : \text{Int} \rightarrow \text{Int}} \text{(T-Abs)}$$

(T-Abs)

$$\frac{\Gamma[f \Delta \text{Int} \rightarrow \text{Int}] \vdash \text{app } f \mid : \text{Int}^+}{\Gamma[f \Delta \text{Int} \rightarrow \text{Int}] \vdash \text{app } f \mid : \text{Int}}$$

(T-app)

$$\Gamma \vdash \text{let } f : \text{Int} \rightarrow \text{Int} = \lambda x : \text{Int}. x \text{ in app } f \mid : \text{Int}$$

(T-let)

3-

$$\left[x_1 \mapsto (\text{Int} \rightarrow x_4) \rightarrow \text{Int}, \quad x_2 \mapsto \text{Int} \rightarrow x_4, \quad x_3 \mapsto \text{Int} \right]$$

4-

$$\text{Ident } x \quad x \in \text{dom}(\Gamma[x \Delta x_1][x \Delta x_2])$$

$$\frac{\text{fresh } x_2}{\frac{\Gamma[x \Delta x_1][x \Delta x_2](x) = x_2}{\Gamma[x \Delta x_1][x \Delta x_2] \vdash x : x_2}} \text{ (CT-ident 1)}$$

$$\text{Ident } f \quad f \in \text{dom}(\Gamma[f \Delta x_1])$$

$$\frac{\Gamma[x \Delta x_1](f) = x_1}{\Gamma[x \Delta x_1] \vdash f : x_1} \text{ (CT-ident 1)}$$

Int 1

$$\text{fresh } x_B, x_4$$

$$\frac{\Gamma[x \Delta x_1] \vdash f : x_1 \{ \}}{\Gamma[x \Delta x_1] \vdash \text{app } f 1 : x_4 \{ \}} \text{ (CT-app)}$$

(CT-int)

$$\frac{\Gamma \vdash \text{let } f = \text{lambda } x.x \text{ in app } f 1 : x_4 \{ x_1 = x_3 \rightarrow x_4, \text{ Int} = x_3, x_1 = x_2 \rightarrow x_2 \}}{\Gamma \vdash \text{let } f = \text{lambda } x.x \text{ in app } f 1 : x_4 \{ x_1 = x_3 \rightarrow x_4, \text{ Int} = x_3, x_1 = x_2 \rightarrow x_2 \}} \text{ (CT-let)}$$

5-

$$\left[x_1 \mapsto \text{Int} \rightarrow \text{Int}, \quad x_2 \mapsto \text{Int}, \quad x_3 \mapsto \text{Int}, \quad x_4 \mapsto \text{Int} \right]$$