

Comp 302 - Assignment 4

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April 4, 2018

(a) $R_{b:T} \frac{}{\text{true:boolean}}$, $R_{b:F} \frac{}{\text{false:boolean}}$, $R_{\bullet, \bullet, \tau} \frac{}{} \text{ , } R_{==} \frac{n:\text{Int} \quad m:\text{Int}}{n==m : \text{boolean}}$

- (b) Since the whole proof would be long to write, I'm going to cut it short and use \dots to represent the following recursive "let" reductions.

$$R_{\text{let}} \frac{\cdot \vdash \&y : \bullet \quad x : !\bullet}{\cdot \vdash \text{let } x = \&y \text{ in } \dots}$$

Let $\Gamma_1 = \{x : !\bullet, y : \bullet\}$

$$R_{\dots} \frac{\Gamma_1 \vdash \&x : !\bullet \quad \Gamma_1 \vdash z = \&x : !!\bullet}{\Gamma_1 \vdash \text{let } z = \&x \text{ in } (\dots)_2}$$

Let $\Gamma_2 = \{\Gamma_1, z : !!\bullet\}$

$$R_{(\dots)_2} \frac{\Gamma_3 \vdash *z : !\bullet \quad \Gamma_3 \vdash w = *z : !\bullet}{\Gamma_3 \vdash \text{let } w = *z \text{ in } (\dots)_3}$$

Let $\Gamma_4 = \{\Gamma_2, w : !\bullet\}$. Using $R_{==}$,

$$R_{(\dots)_3} \frac{w : !\bullet, x : !\bullet \vdash w == x : \text{Boolean}}{\Gamma_4 \vdash \text{if}(w == x) \text{ then let } r = *\&y \text{ in } r \text{ else let } r = **z; \text{ in } r}$$