COMMENTS ON RULES FOR VARIABLES AS RESOURCES

Deriving Bornat's Rule for Variable Declarations

The following is the rule given in the introductory class (adapted for variable permissions):

$$\frac{\{\mathrm{Own}_T(x) * \Phi\}\ C\ \{\mathrm{Own}_T(x) * \Phi'\}}{\{\Phi\}\ \mathbf{local}\ x\ \mathbf{in}\ C\ \{\Phi'\}} \quad x \notin FV(\Phi, \Phi')$$

Then there is a rule for renaming bound variables:

$$\frac{\{\Phi\}\ \mathbf{local}\ x\ \mathbf{in}\ C\ \{\Phi'\}}{\{\Phi\}\ \mathbf{local}\ z\ \mathbf{in}\ (C[z/x])\ \{\Phi'\}} \quad z \text{ fresh in } C$$

From these rules, we can derive:

$$\dfrac{\dfrac{\{\mathrm{Own}_T(z) * \Phi\}\ C[z/x]\ \{\mathrm{Own}_T(z) * \Phi'\}}{\{\Phi\}\ \mathbf{local}\ z\ \mathbf{in}\ (C[z/x])\ \{\Phi'\}} \quad z \text{ fresh in } \Phi, C, \Phi}{\dfrac{\{\Phi\}\ \mathbf{local}\ x\ \mathbf{in}\ ((C[z/x])/[x/z])\ \{\Phi'\}}{\{\Phi\}\ \mathbf{local}\ x\ \mathbf{in}\ C\ \{\Phi'\}}} \quad \begin{array}{l} x \text{ fresh in } C[z/x], \\ z \text{ fresh in } C \end{array}$$

PROCEDURE RULES

Simplifications:

- Only a single procedure
- No call-by-value parameter
- More than one reference parameter

A.
$$\frac{\{\Psi\}\, f(\bar{x})\, \{\Psi'\} \vdash \{\Phi\}\, c_1\, \{\Phi'\} \qquad \{\Psi\}\, f(\bar{x})\, \{\Psi'\} \vdash (\{\Psi\}\, c\, \{\Psi'\})[\bar{w}/\bar{x}] \quad \bar{w} \text{ distinct and fresh}}{\vdash \{\Phi\}\ \mathrm{let}\ f(\bar{x}) = c\ \mathrm{in}\ c_1\ \mathrm{end}\ \{\Phi'\}}$$

B.
$$\frac{(\{\Psi\}\, f(\bar{x})\, \{\Psi'\})[\bar{z}/\bar{x}] \vdash \{\Phi\}\, c\, \{\Phi'\} \qquad \bar{z} \text{ distinct and fresh for } \{\Psi\}f(\bar{x})\{\Psi'\}}{\{\Psi\}\, f(\bar{x})\, \{\Psi'\} \vdash \{\Phi\}\, c\, \{\Phi'\}}$$

B'.
$$\frac{(\{\Psi\}\, f(\bar{x})\, \{\Psi'\}/\delta \vdash \{\Phi\}\, c\, \{\Phi'\} \qquad \text{where } \delta \text{ is an injection on } FV(\Psi,\Psi') \cup \{\bar{x}\} \text{ and an identity on } FV(\Psi,\Psi') - \{\bar{x}\}}{\{\Psi\}\, f(\bar{x})\, \{\Psi'\} \vdash \{\Phi\}\, c\, \{\Phi'\}}$$

C. $\{\Phi\}\, f(\bar{x})\, \{\Phi'\} \vdash \{\Phi * \Delta\}\, f(\bar{x})\, \{\Phi' * \Delta\}$

C'. $\{\Psi\}\, f(\bar{x})\, \{\Psi'\} \vdash \{\Psi/\delta * \Delta\}\, f(\bar{x}/\delta)\, \{\Psi'/\delta * \Delta\}$

where $\bar{x}/\delta$ is a sequence of distinct variables not occuring in $FV(\Psi,\Psi')-\{\bar{x}\}$.