Records

FbR

Syntax:

$e ::= \cdots \mid \{\ell = e, \ldots\} \mid e \underbrace{.}_{\text{syntax of FbR}} \ell$

$\ell ::= (\text{identifier})$

$v ::= \cdots \mid \{\ell = v, \ldots\}$

In a record expression or record value, all labels ℓ are restricted to be unique. The order of labels in record values is irrelevant: differently-ordered records are interchangeable if all other things are equal.

$\{x = 5\}$

$\{x = 5, y = 2\}$

$\{x = 4, y = \text{True}, \text{fish} = \text{False}\}$

$\{x = 1+2, y = \text{False}\}.x \Rightarrow 3$

$\cancel{\ell_a = \ell_b}$

Operational Semantics

$\forall i \in \{1..n\} \underbrace{.}_{\text{theory}} e_i \Rightarrow v_i$

Record $\dfrac{e_1 \Rightarrow v_1 \quad \cdots \quad e_n \Rightarrow v_n}{\{\ell_1 = e_1, \ldots, \ell_n = e_n\} \Rightarrow \{\ell_1 = v_1, \ldots, \ell_n = v_n\}}$

Projection $\dfrac{e \Rightarrow \{\ell_1 = v_1, \ldots, \ell_n = v_n\} \quad \ell' = \ell_k}{e.\ell' \Rightarrow v_k}$

Variants

$\boxed{FbV}$

$e ::= \ldots \mid `l\ e \mid \text{Match } e \text{ With} \mid `l\ x \to e \mid `l\ x \to e \mid \ldots$

$v ::= \ldots \mid `l\ v$

$l ::= (\text{identifier})$

In every Match expression, all labels l are restricted to be unique.

$`Q\ (1+3) \Rightarrow `Q\ 4$

Match $`Q\ (1+3)$ With
$\mid `Q\ n \to n+1$
$\mid `R\ n \to n-1$
$\Rightarrow 5$

Operational Semantics

Variant $\dfrac{e \Rightarrow v}{`l\ e \Rightarrow `l\ v}$

Match $\dfrac{e \Rightarrow `l'\ v' \quad l' = l_k \quad e_k[v'/x_k] \Rightarrow v}{\text{Match } e \text{ With } \mid `l_1\ x_1 \to e_1 \mid \ldots \mid `l_n\ x_n \to e_n \Rightarrow v}$

OCaml

```
match x with
| Plus(Int a, Int b) ->
```

Encoding records in variants & vice versa

FbV encoding records

$$\{l_1 = e_1, \ldots, l_n = e_n\} \stackrel{\text{def}}{=} \begin{array}{l} \text{Let } x_1' = e_1 \text{ In} \\ \vdots \\ \text{Let } x_n' = e_n \text{ In} \\ \text{Function name} \rightarrow \\ \quad \text{Match name With} \\ \quad \mid \text{`}l_1\ x_1 \rightarrow x_1' \\ \quad \vdots \\ \quad \mid \text{`}l_n\ x_n \rightarrow x_n' \end{array}$$

$$e.l \stackrel{\text{def}}{=} e\ (\text{`}l\ 0)$$

FbR encoding variants

$$\begin{array}{l} \text{Match } e \text{ With} \\ \mid \text{`}l_1\ x_1 \rightarrow e_1 \\ \vdots \\ \mid \text{`}l_n\ x_n \rightarrow e_n \end{array} \stackrel{\text{def}}{=} \begin{array}{l} e\ \{ l_1 = \text{Function } x_1 \rightarrow e_1, \\ \quad \vdots \\ \quad l_n = \text{Function } x_n \rightarrow e_n \\ \} \end{array}$$

$$\text{`}l\ e \stackrel{\text{def}}{=} \begin{array}{l} \text{Let } x = e \text{ In} \\ \text{Function } m \rightarrow \\ \quad m.l\ x \end{array}$$