Monads reference card

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Syntax

monad component	DSL application
$m :: \star \to \star$	Expressions parameterized on return type
$return :: a \to m\,a$	constant expression
$(\gg\!=) :: m\ a \to (a \to m\,b) \to m\,b$	bind an a returned by the lhs into the rhs

bind

Laws

name	law	a DSL aspect
left identity	$return\,a \gg\!= (\lambda x.\, m\,x) \equiv m\,a$	inlining/factorizing a constant
right identity	$m \gg\!= (\lambda x.\, return\,x) \equiv m$	removal/introduction of useless return
associativity	$(m \gg\!= f) \gg\!= g \equiv m \gg\!= (\lambda x.\, f\,x \gg\!= g)$	extension/shrinking of scope

"do"

$$\begin{array}{lll|ll} \text{do} & x \leftarrow \alpha & & \alpha & \gg\!=\lambda x. \\ & y \leftarrow \beta & & \beta & \gg\!=\lambda y. \\ & \gamma & & \gamma & \end{array}$$

- parentheses are not needed
- x may appear in γ

Comprehensions

$$\begin{array}{lll|ll} [& \gamma & & & \\ | & x \leftarrow \alpha & & \alpha & \gg\!=\lambda x. \\ , & y \leftarrow \beta & & \beta & \gg\!=\lambda y. \\ ] & & & \text{return } \gamma & \end{array}$$

- $\gg\!=$ can be used to "flatten" levels of the monad.
- $join :: m(m\,a) \to m\,a$
- $join\,xs = xs \gg\!= id$