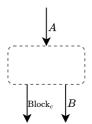
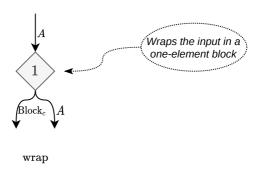
Monadic Interface



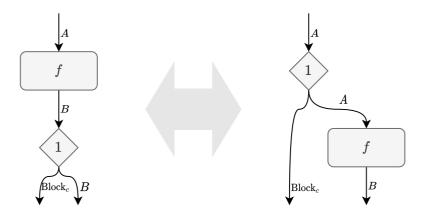
Unit Transformation



Unit is a natural transformation.



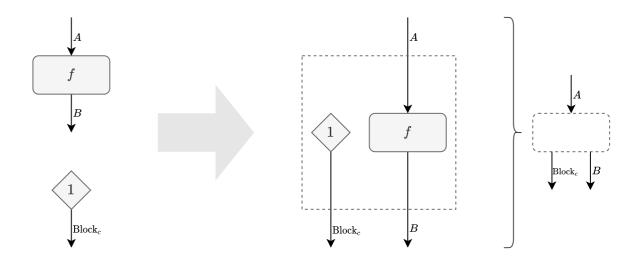
Indeed, for any f:A o B,



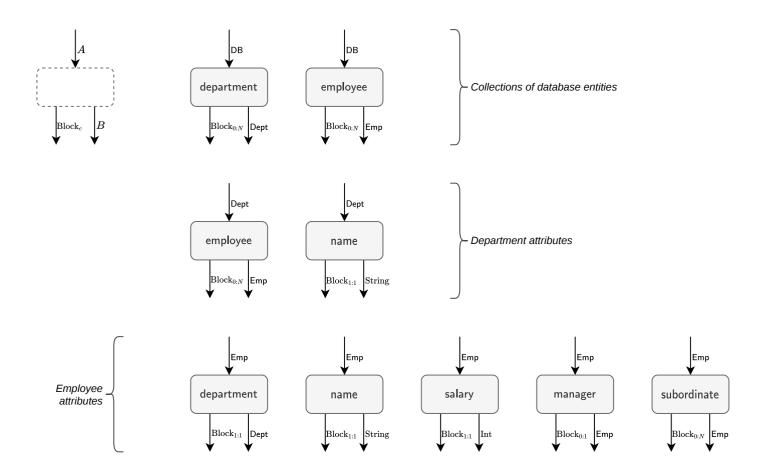
 $\operatorname{chain_of}(f, \operatorname{wrap}) \equiv \operatorname{chain_of}(\operatorname{wrap}, \operatorname{with_elements}(f))$

Using Unit Transformation

Unit transformation can adapt any regular transformation to the monadic interface.

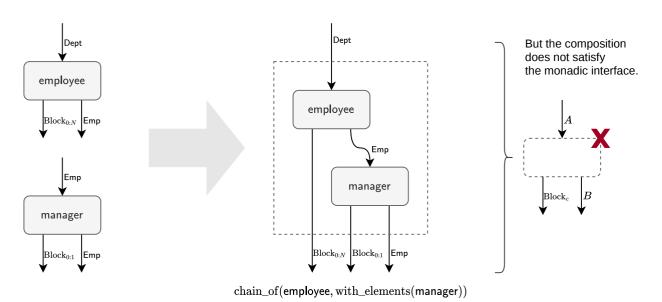


Monadic Interface: Examples

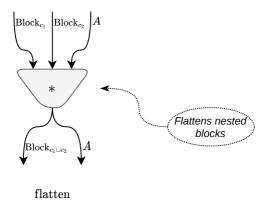


Composition Challenge

Two monadic transformations can be composed.



Multiplication Transformation

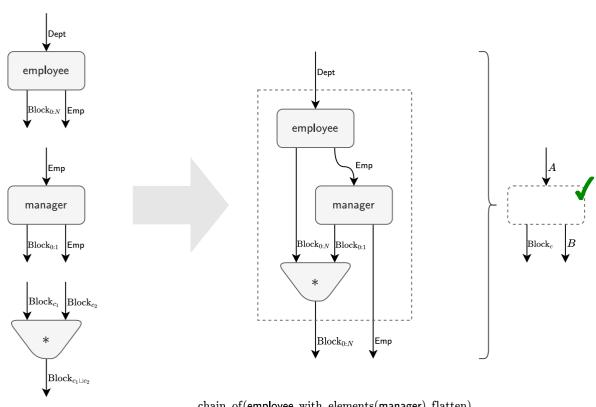


It is easy to check that the multiplication is a natural transformation.



Using Multiplication Transformation

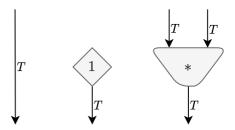
Multiplication can be used to combine two monadic transformations into a new monadic transformation.



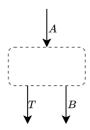
chain_of(employee, with_elements(manager), flatten)

Monad

In general, a *monad* is a functor wire which posesses two special natural transformations: unit and multiplication.

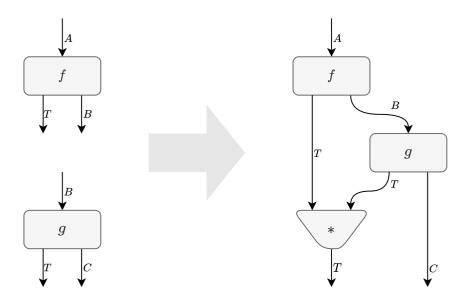


Monadic transformation is a transformation with the following shape.



Monadic Composition

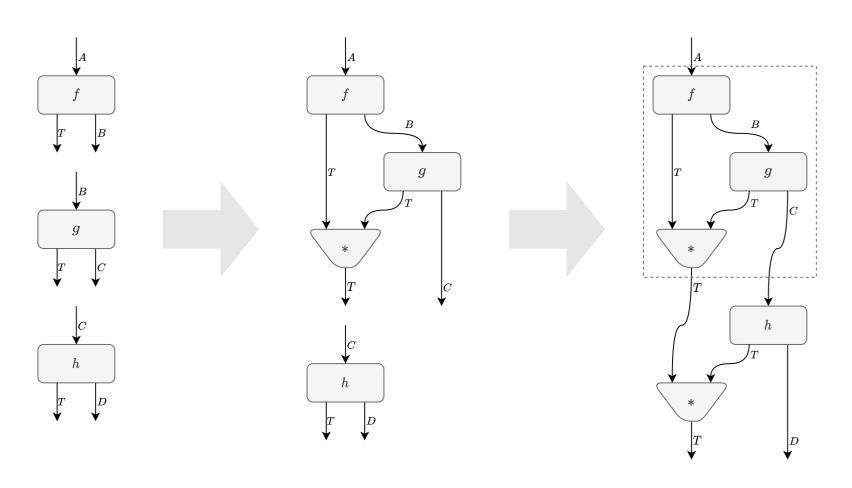
Using multiplication, two compatible monadic transformations can be composed to form a new monadic transformation.



For this definition to be coherent, unit and multiplication must satisfy certain properties.

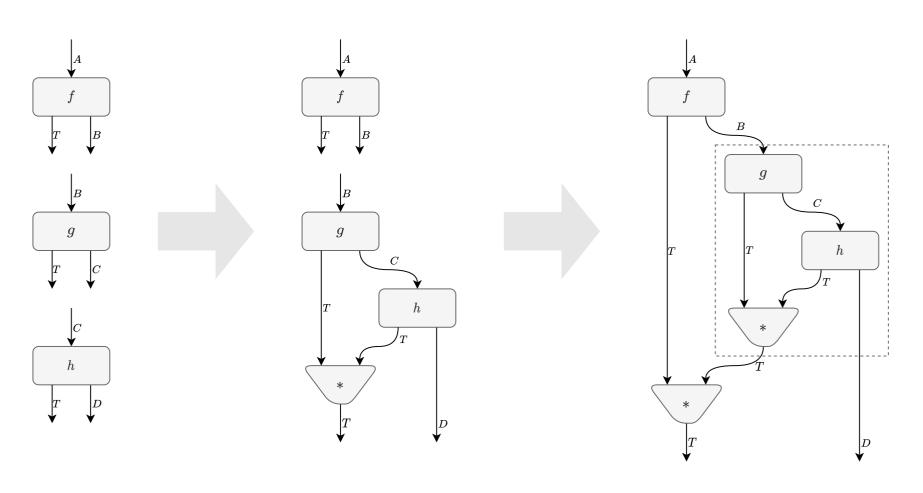
Associativity of Monadic Composition 1

Given three compatible monadic transformations, they could be composed in two distinct ways.



Associativity of Monadic Composition 2

Given three compatible monadic transformations, they could be composed in two distinct ways.



Associativity of Monadic Composition 3

We demand that these two transformations are equivalent for any f, g, and h.

