Coder Decoder

Functional Programmer Lingo Explained, with Pictures

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OpenShift Developer Advocate at Red Hat


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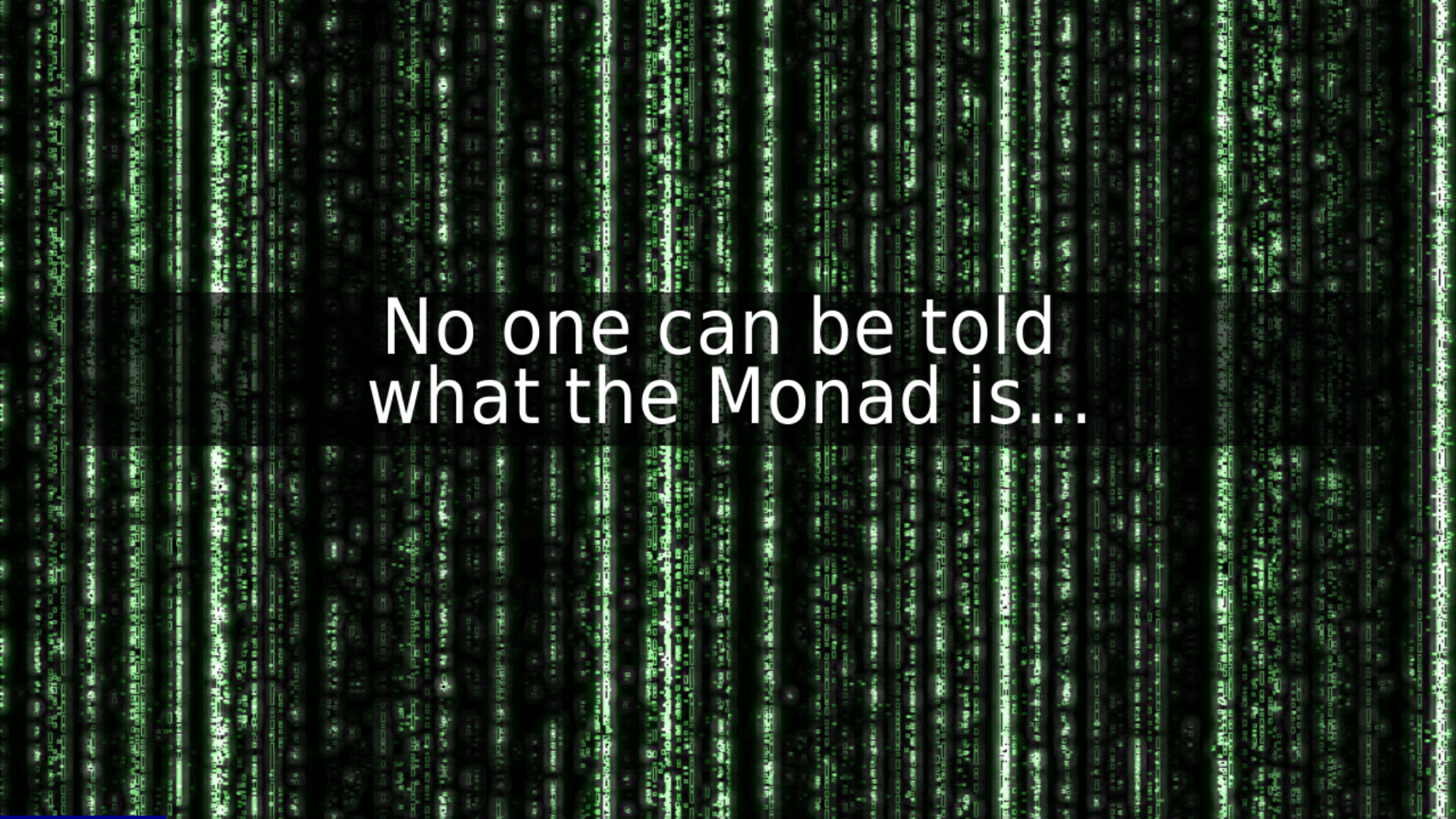
GIFAK.NET

Mission

Caveats


No one can be told
what the Monad is...

Setting the Scene

Haskell

Haskell

```
list1 = [1,2,3]
list2 = [4,5,6]
```

Haskell

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```
ghci> :info Num
class Num a where
  (+) :: a -> a -> a
  (*) :: a -> a -> a
  (-) :: a -> a -> a
  ...
  -- Defined in `GHC.Num'
instance Num Integer -- Defined in `GHC.Num'
instance Num Int -- Defined in `GHC.Num'
instance Num Float -- Defined in `GHC.Float'
instance Num Double -- Defined in `GHC.Float'
```

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```

```
interface Num<A> {
  A add(A x, A y);
  A multiply(A x, A y);
  A subtract(A x, A y);
  ...
}
```

Haskell

```haskell
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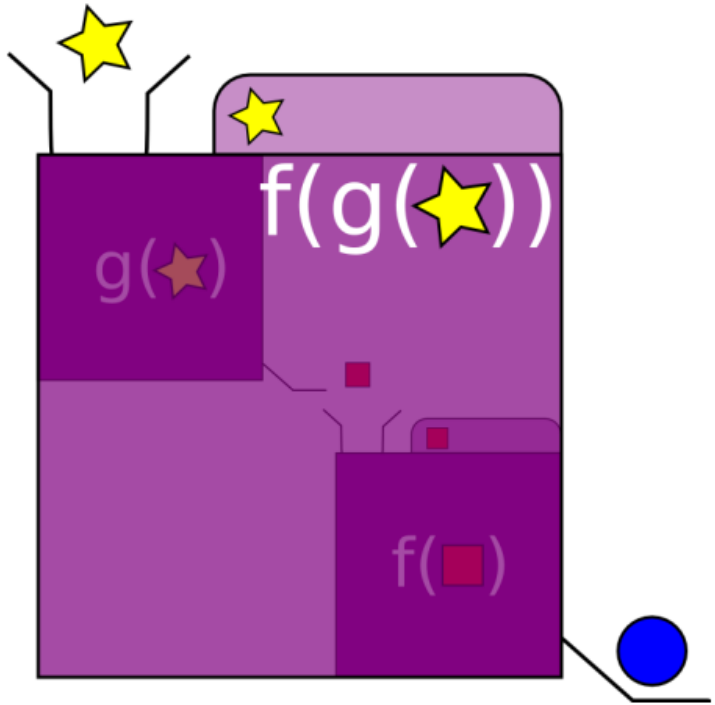
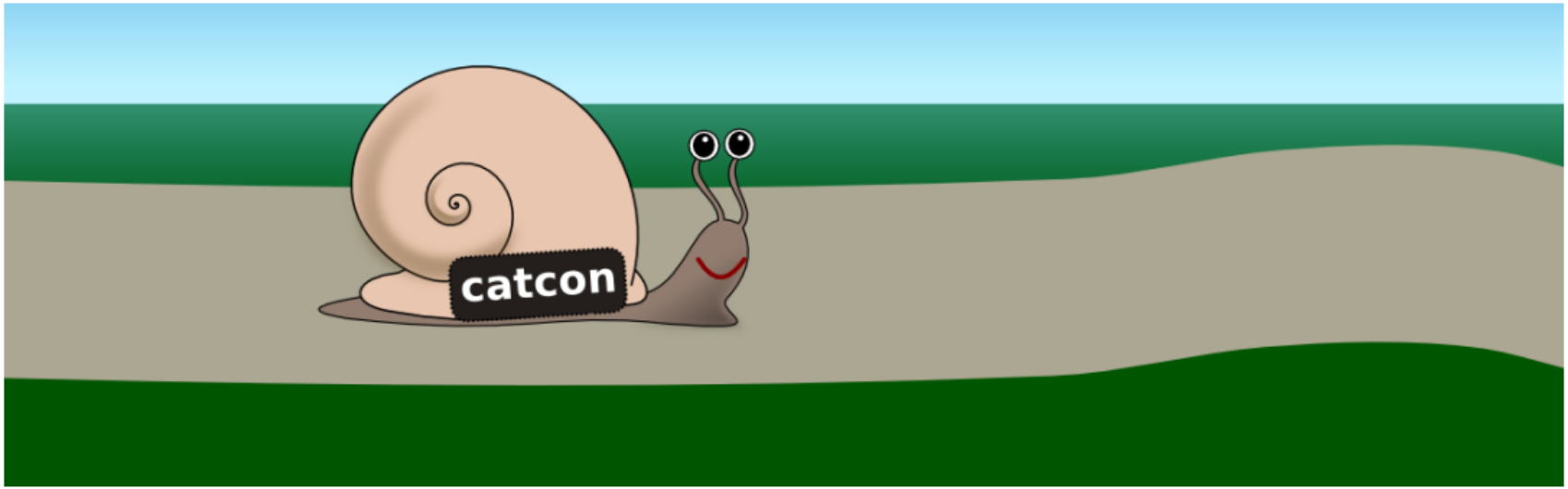
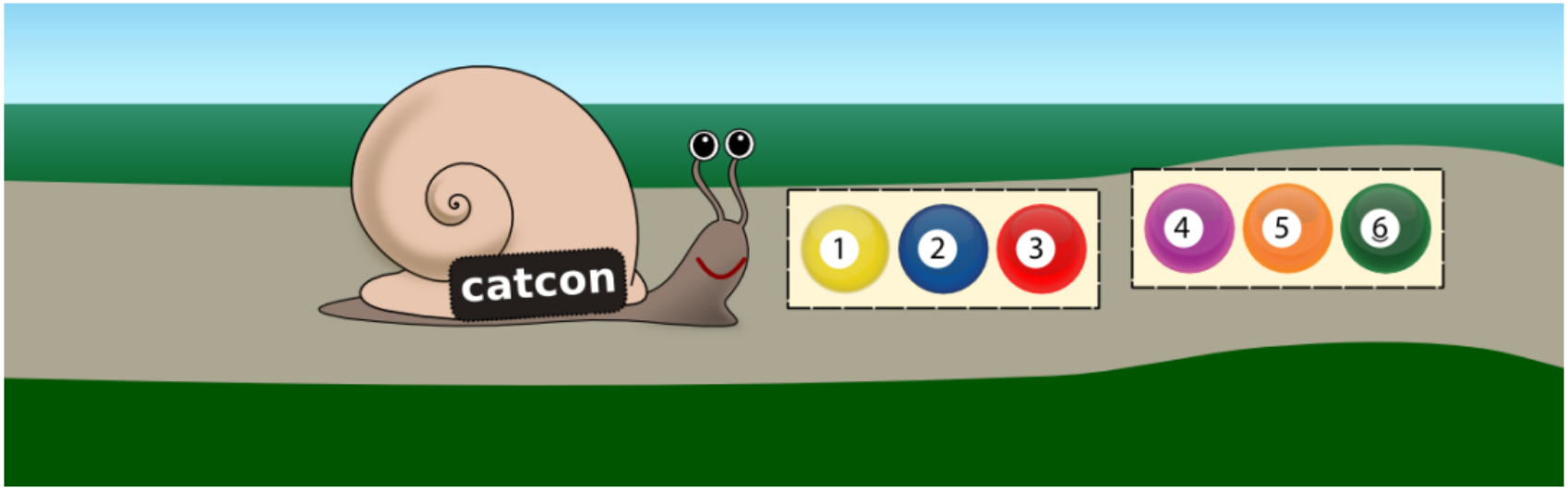

f(g(★))
g(★)
f(■)

Friendly Funky Snail



Friendly Funky Snail



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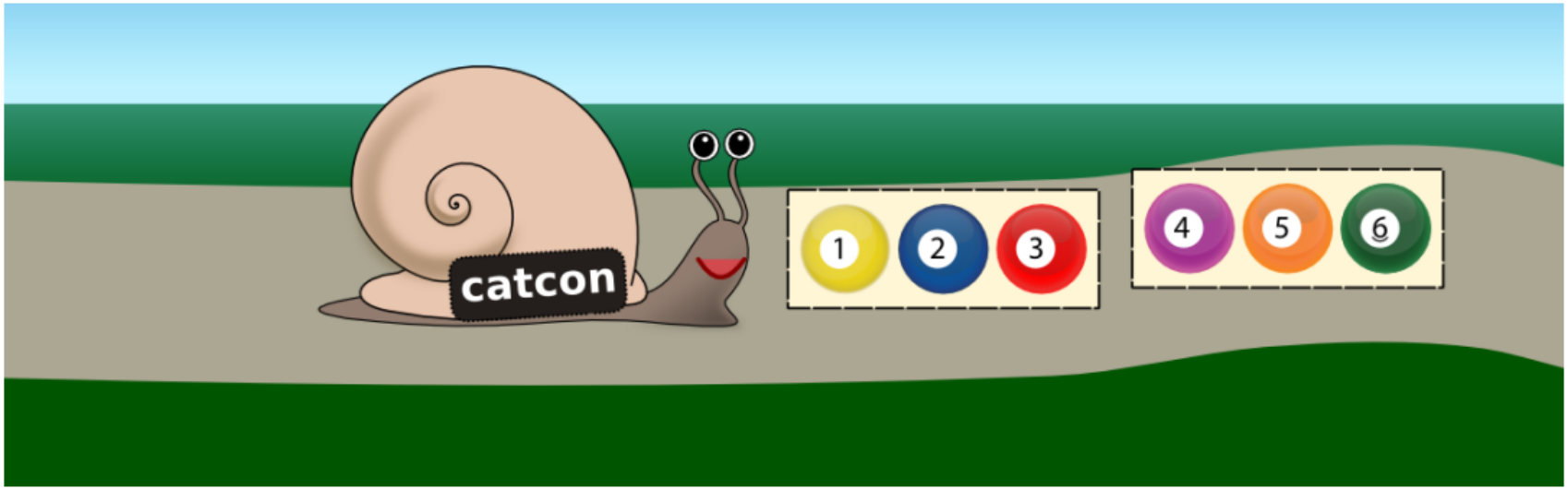

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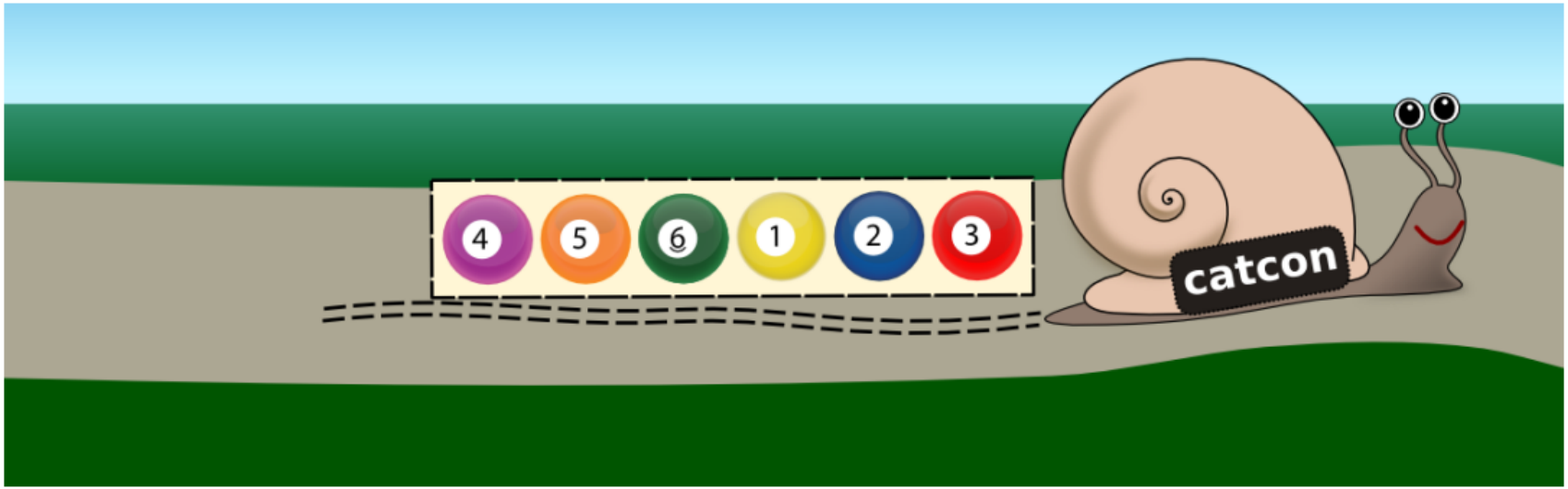

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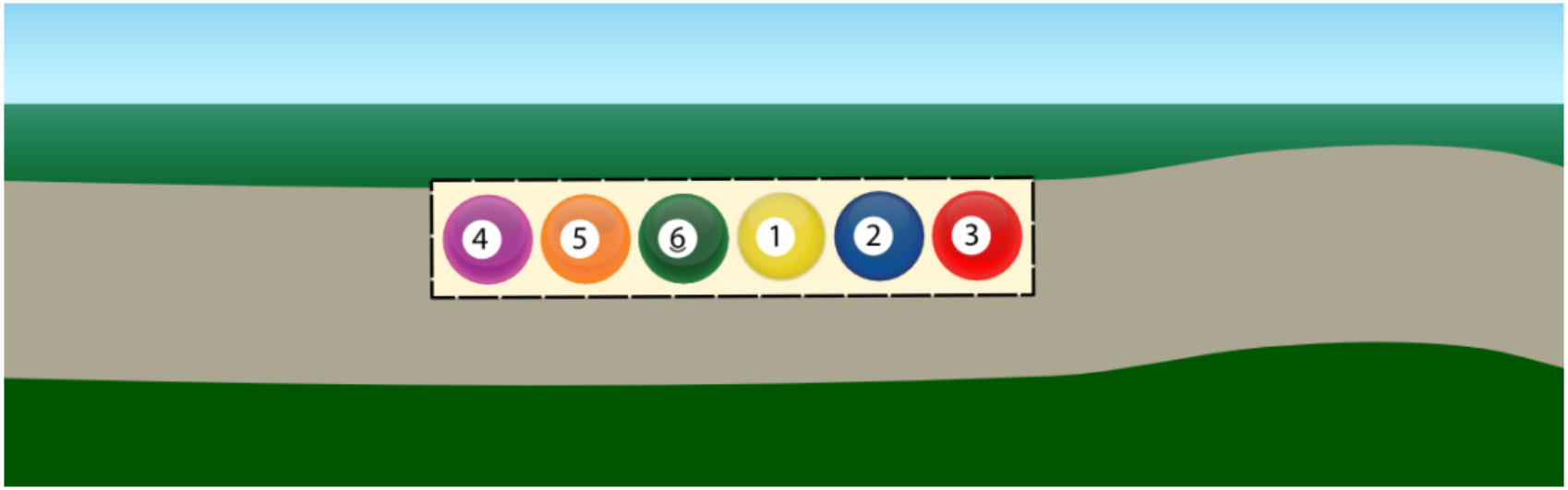
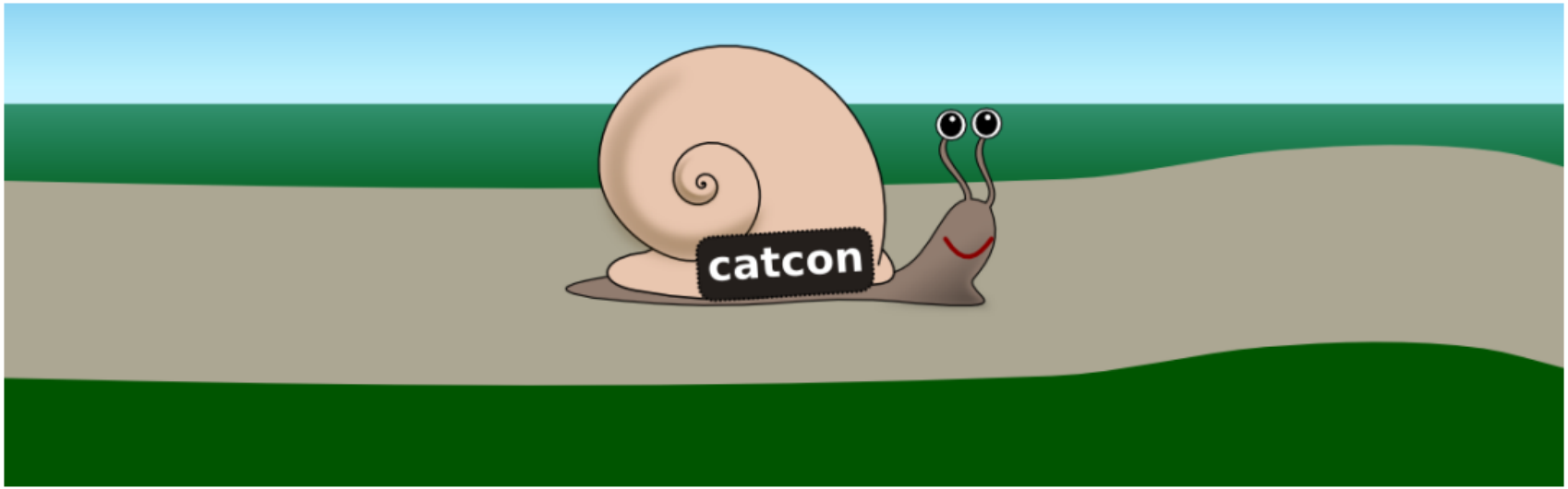
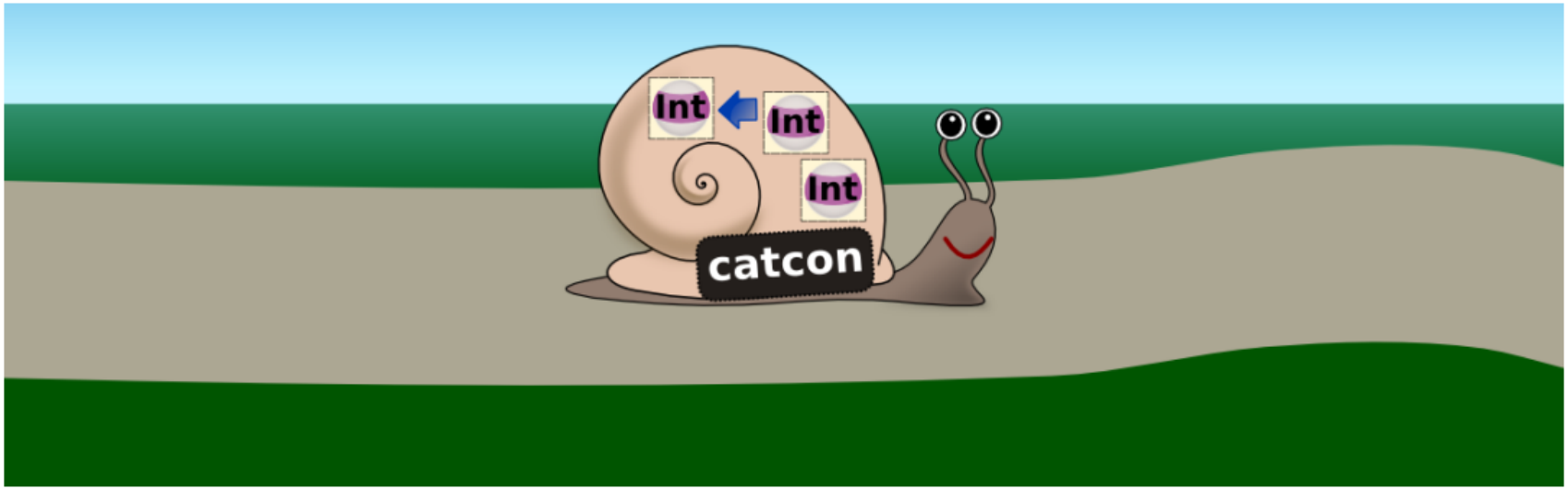


Friendly Funky Snail



Friendly Funky Snail



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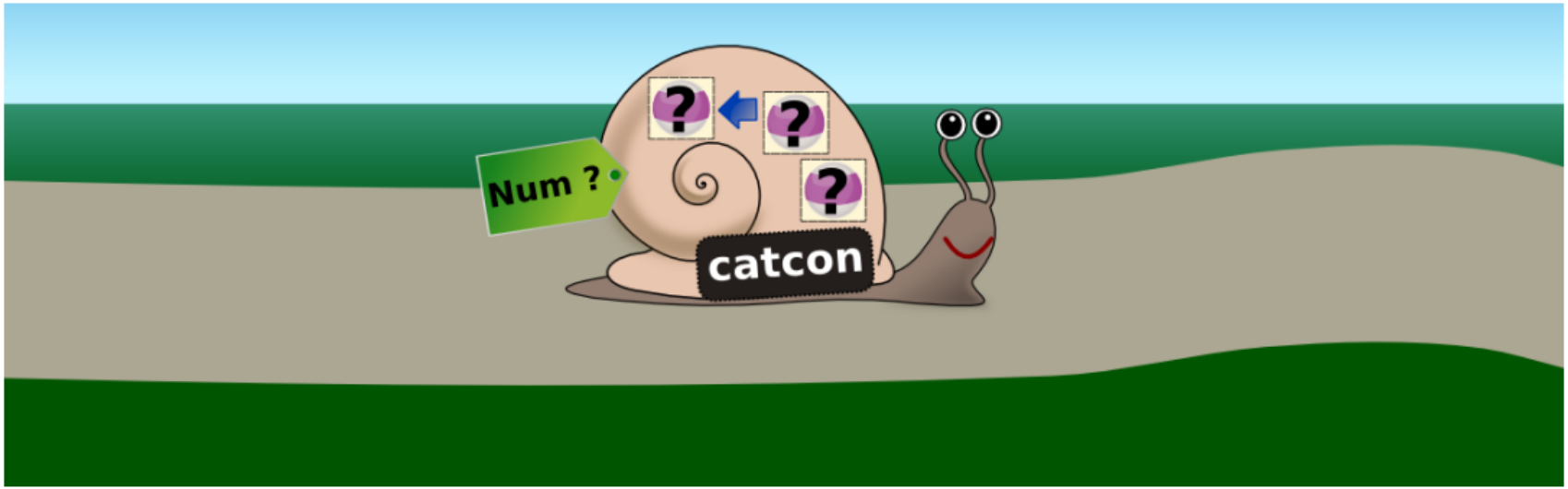
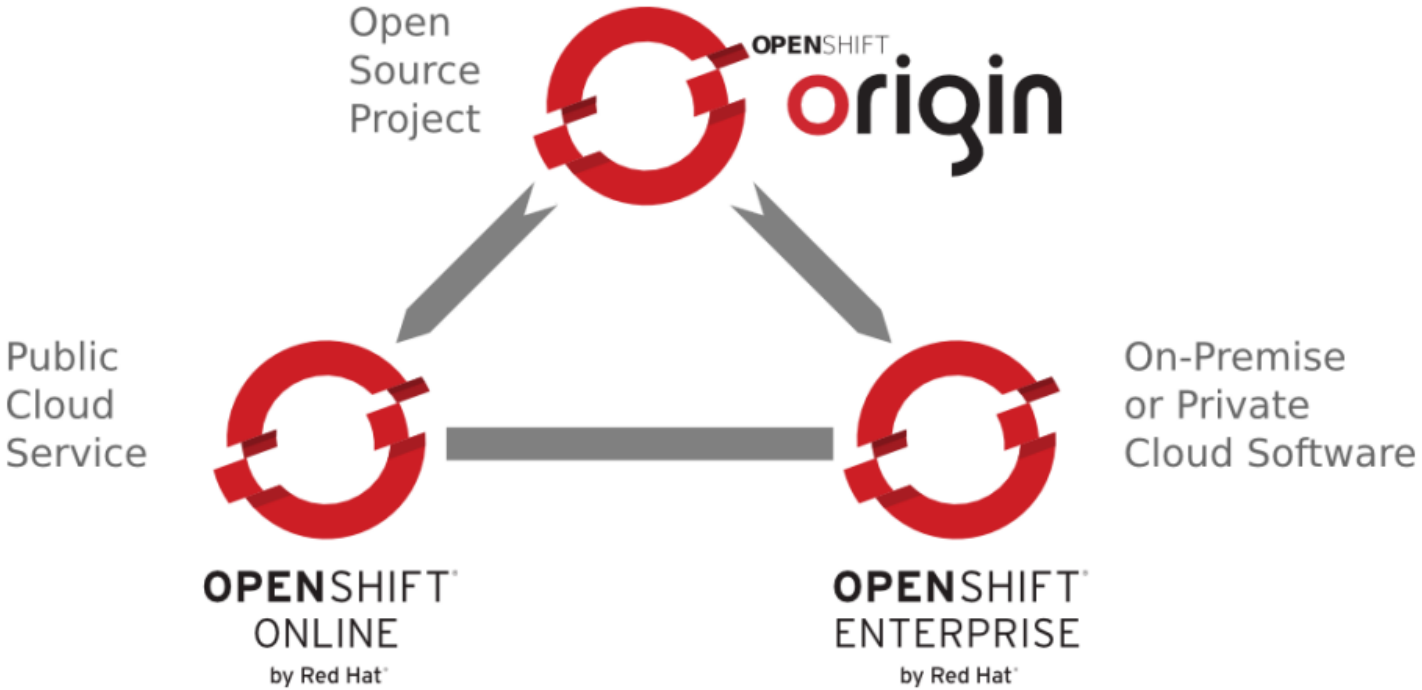


OpenShift


Open
Source
Project
OPENSHIFT
origin
Public
Cloud
Service
On-Premise
or Private
Cloud Software
OPENSHIFT
ONLINE
by Red Hat
OPENSHIFT
ENTERPRISE
by Red Hat

Wubble Demo App

Wubble

Wordset:

Functional Programming 101

Number of bubbles:

Submit

Referential Transparency

WHAT: A property of an expression in a program that can be replaced with its value without changing the behaviour of the program

WHY: We can reason about program behaviour

```
score = succ (2 + 3)
main = putStrLn (show score)
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$ ./main
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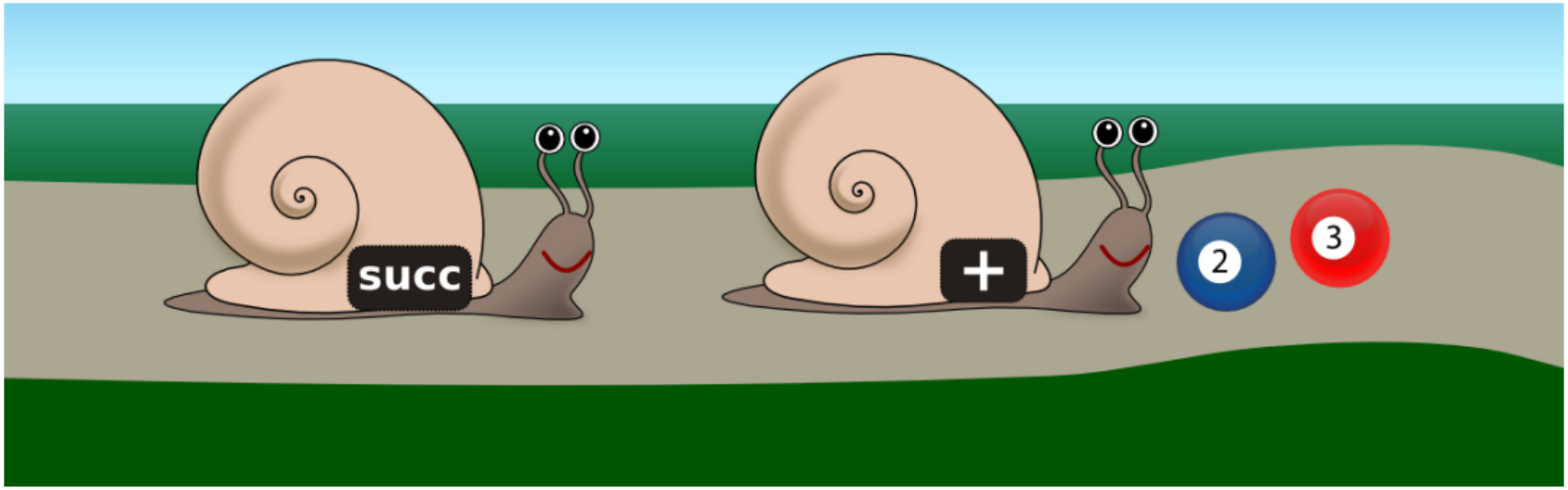

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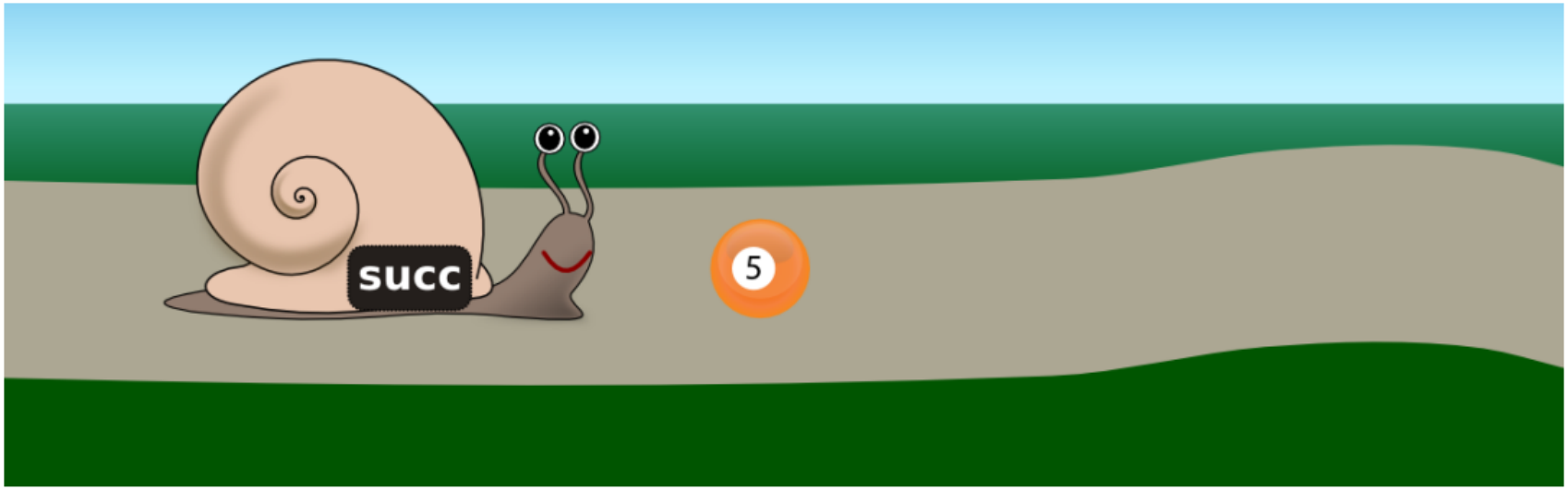

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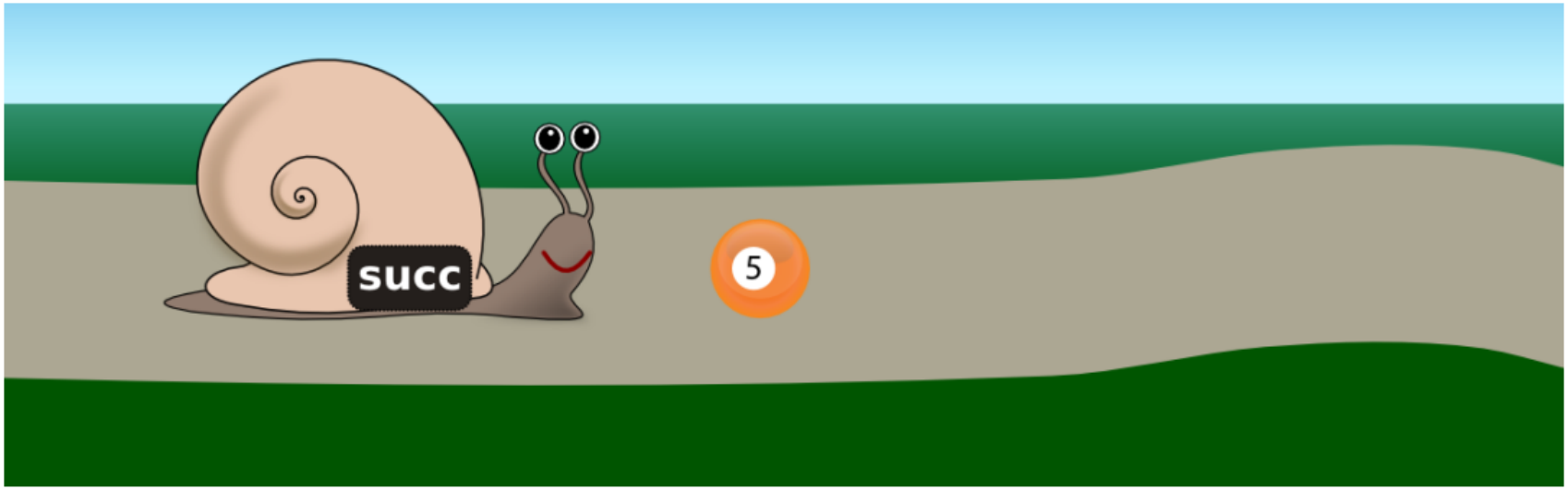

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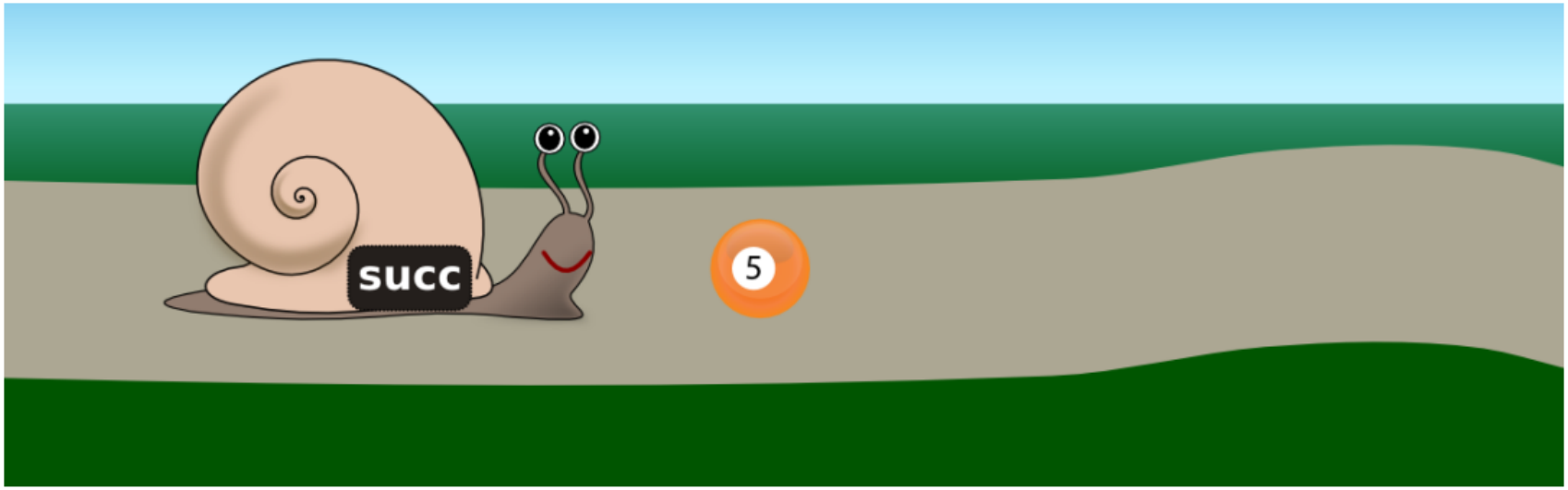
score = succ 5
main = putStrLn (show (succ 5))

$ ./main
6
```



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Higher-Order Function

WHAT: A function that takes a function as an argument or returns one as a result

WHY: Glue pieces of code together; reduce code repetition; modular design

```
ghci> let list1 = [1,2,3]
```

```
ghci> let list1 = [1,2,3]

ghci> :type map
```

```
ghci> let list1 = [1,2,3]

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map :: (a -> b) -> [a] -> [b]
```

```
ghci> let list1 = [1,2,3]

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map :: (a -> b) -> [a] -> [b]

ghci> map (\elem -> elem * 2) list1
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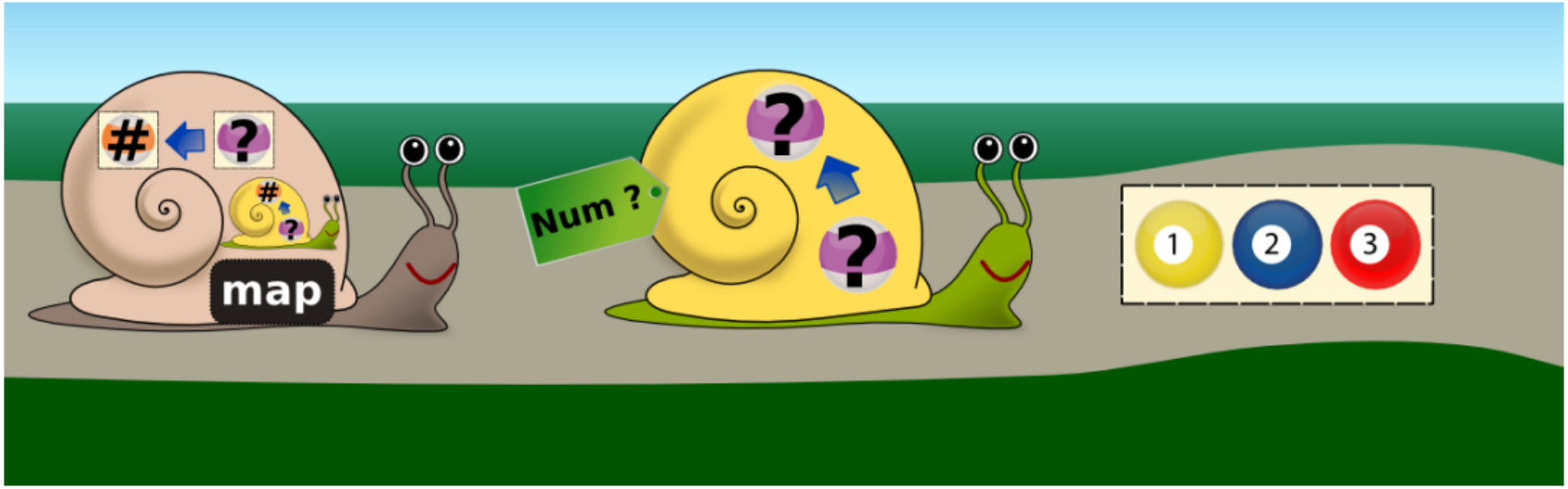

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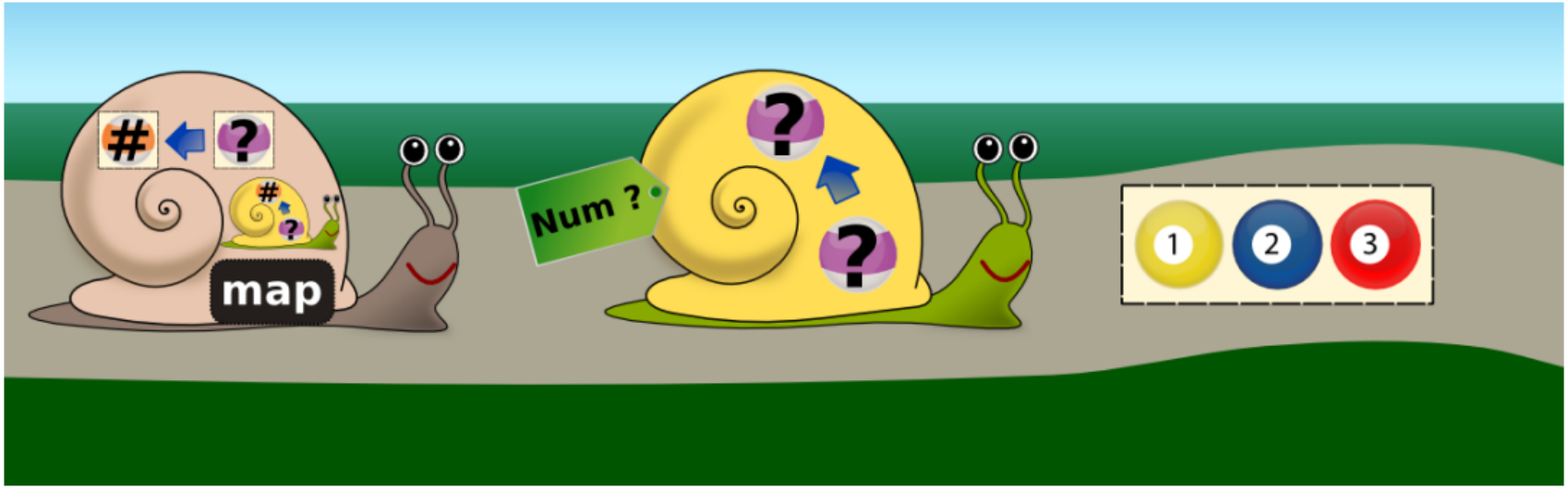

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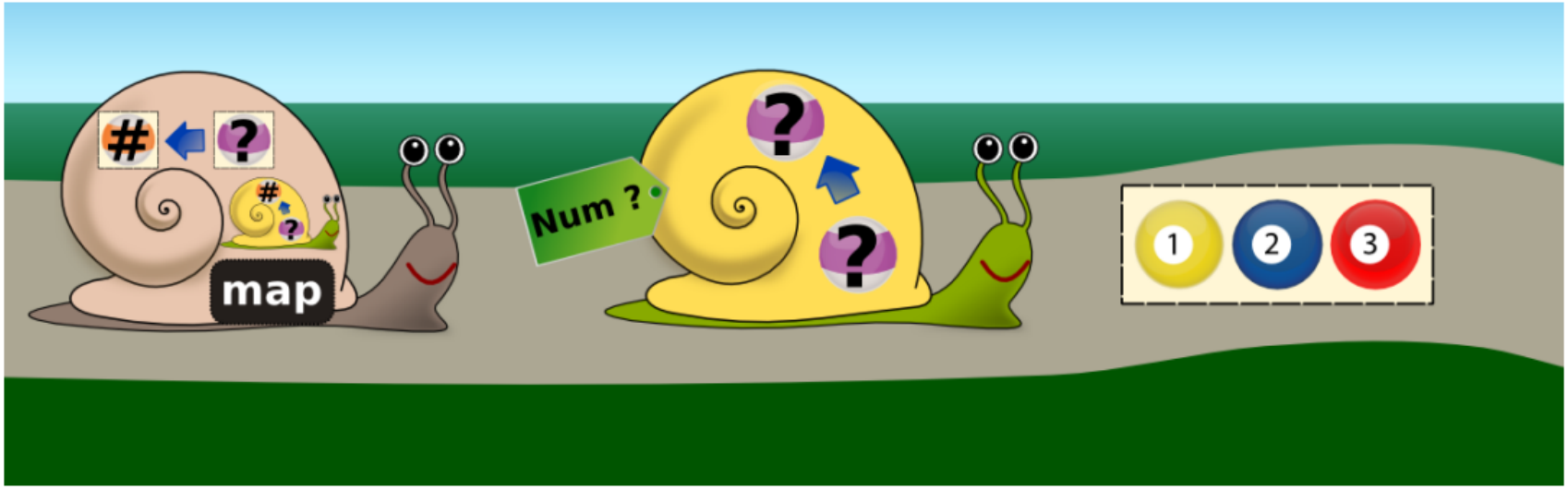

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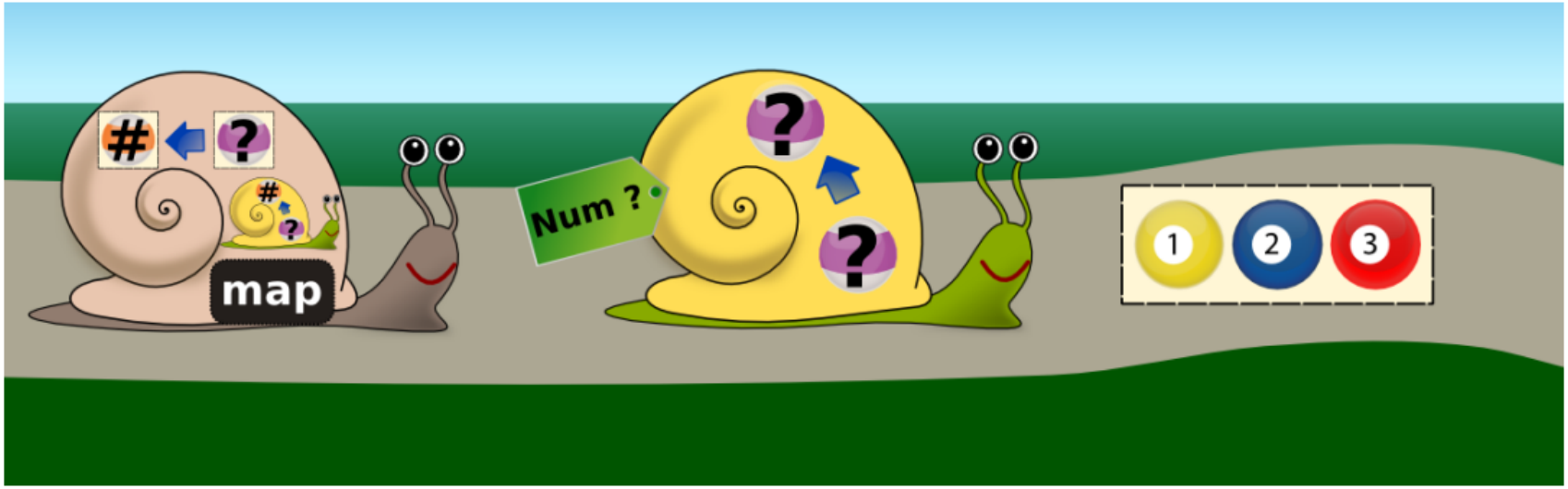

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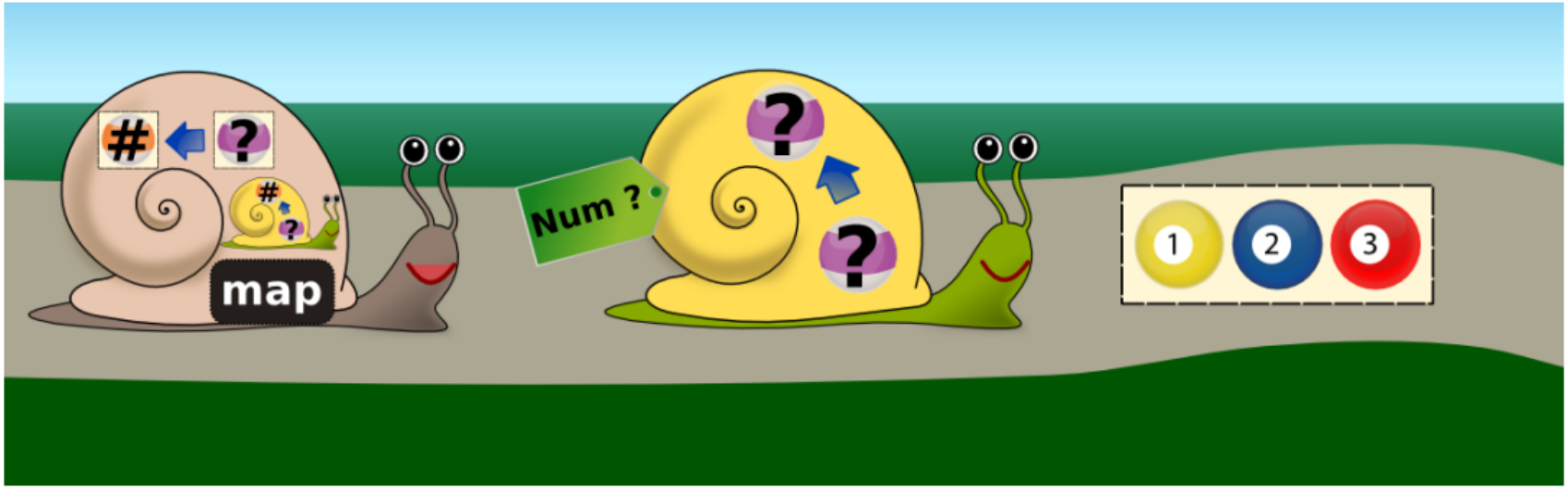

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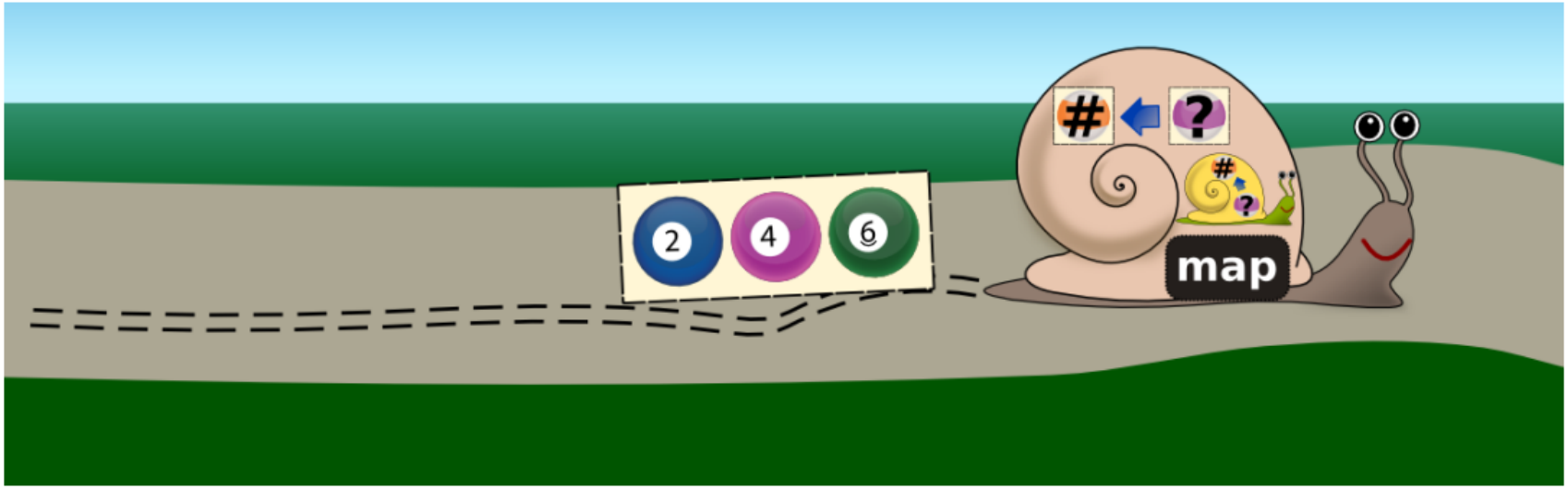

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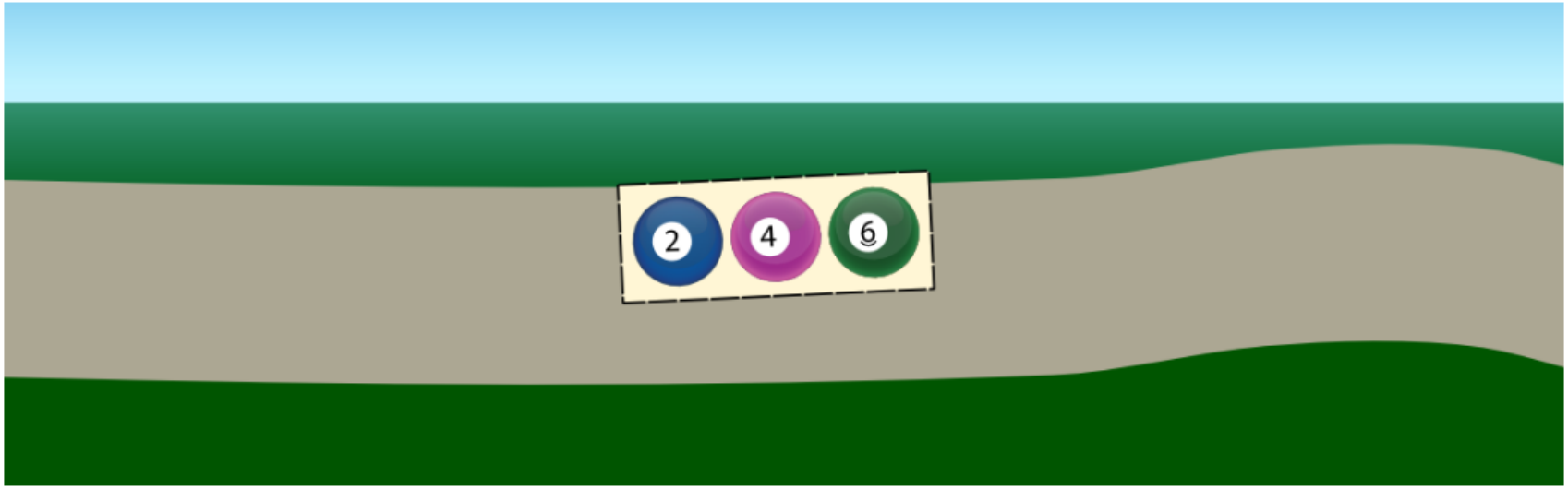

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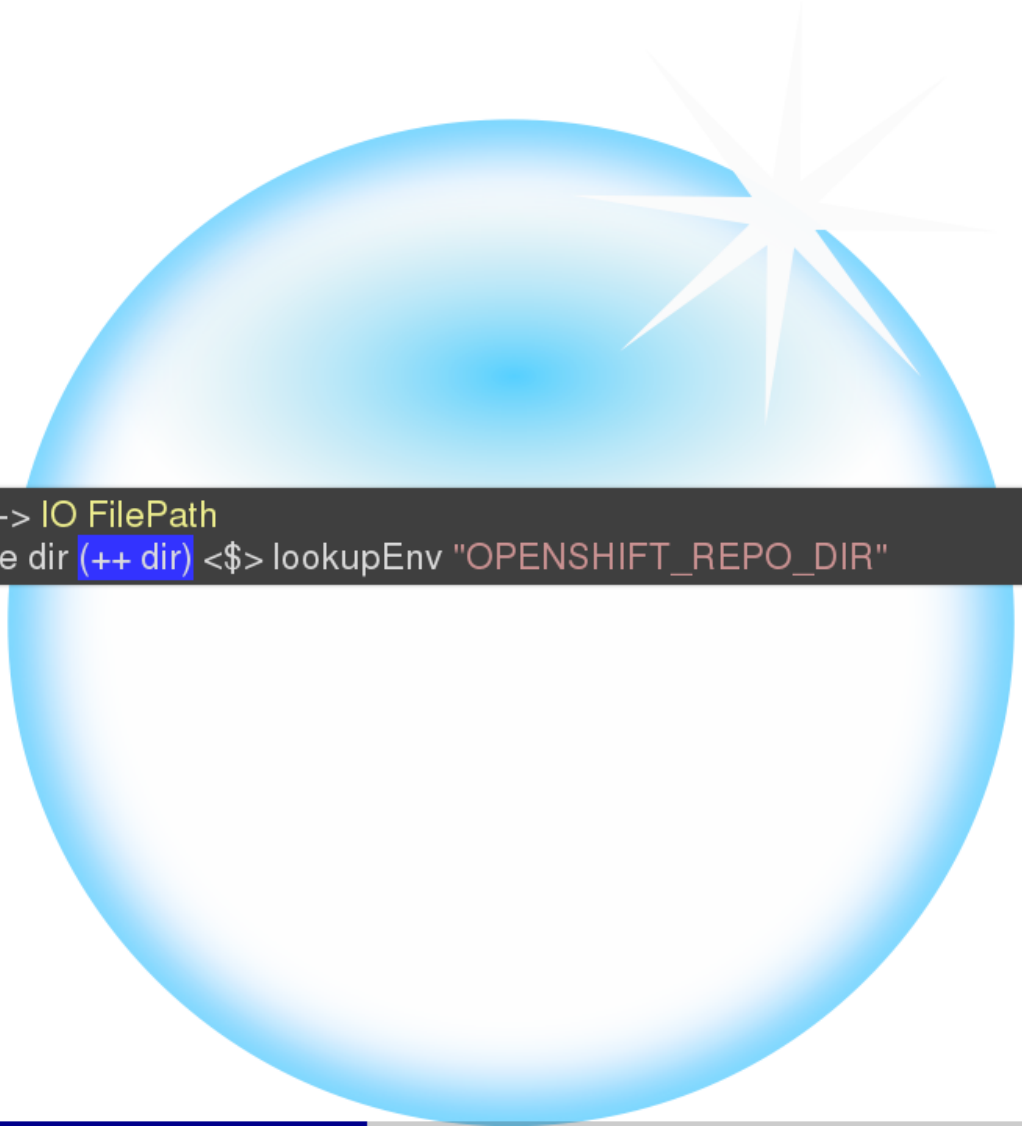

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Currying

WHAT: Evaluating multi-argument functions as a chain of functions that each take exactly one argument

WHY: Aids code reuse; can make code more readable

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catcon xs ys = ys ++ xs
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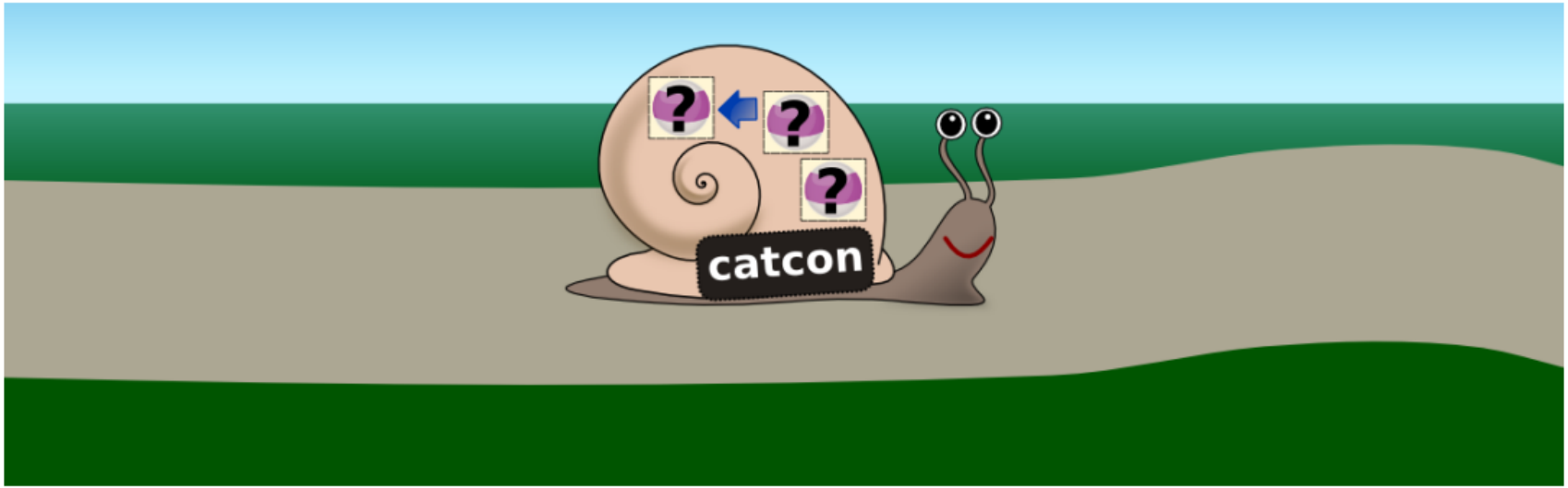

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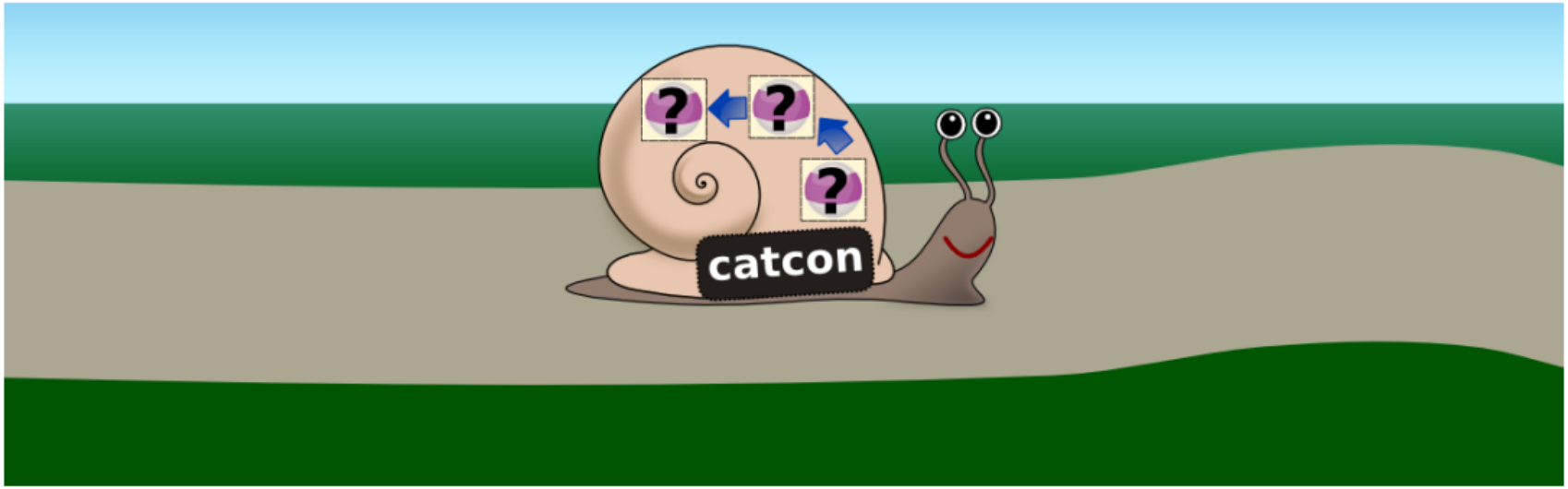

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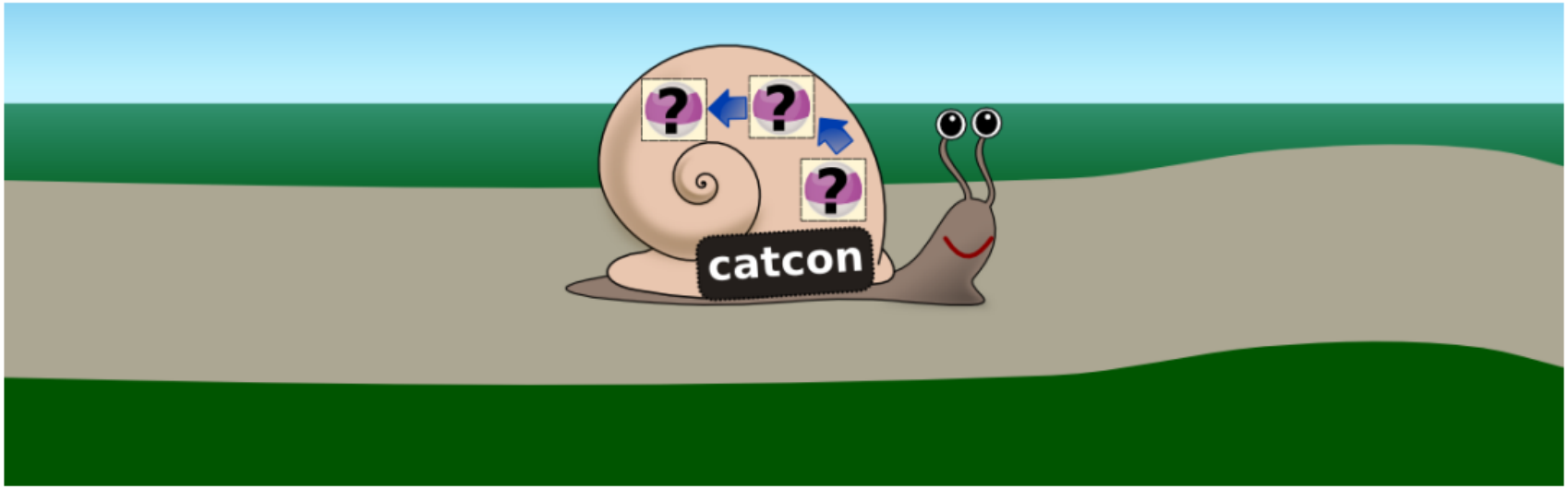

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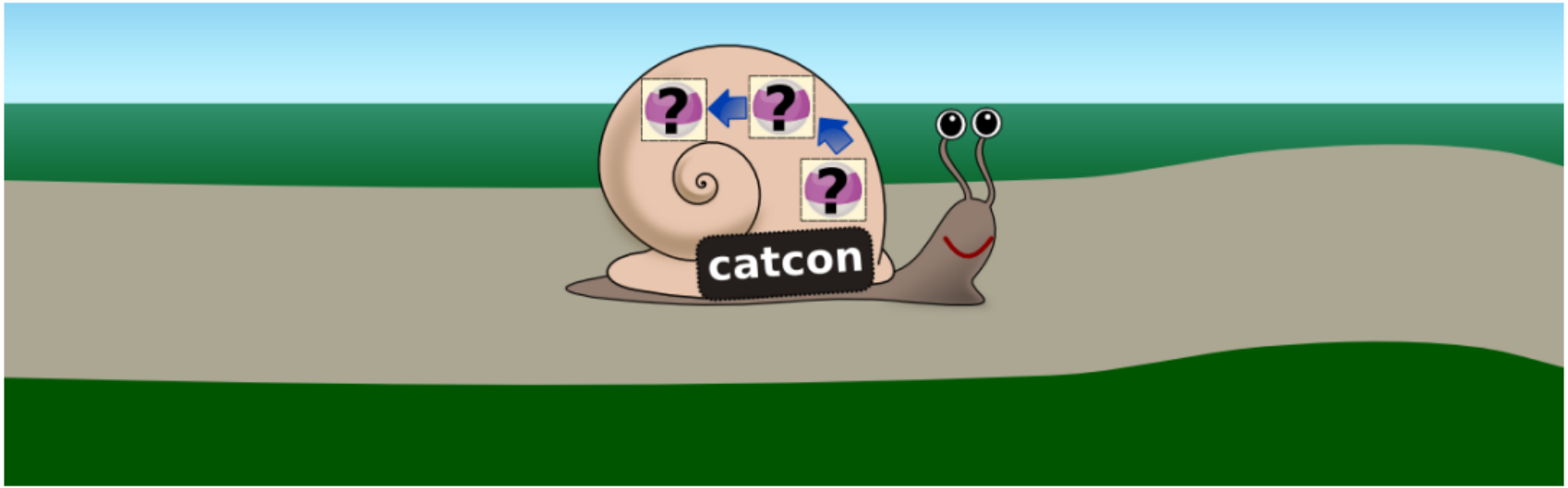

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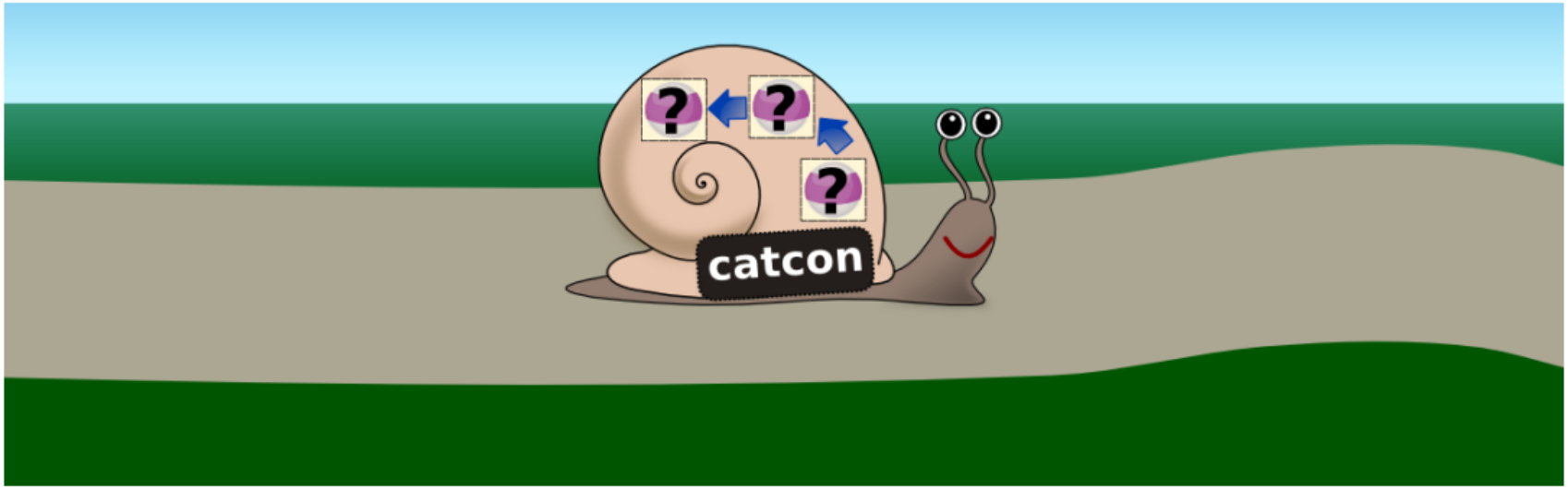

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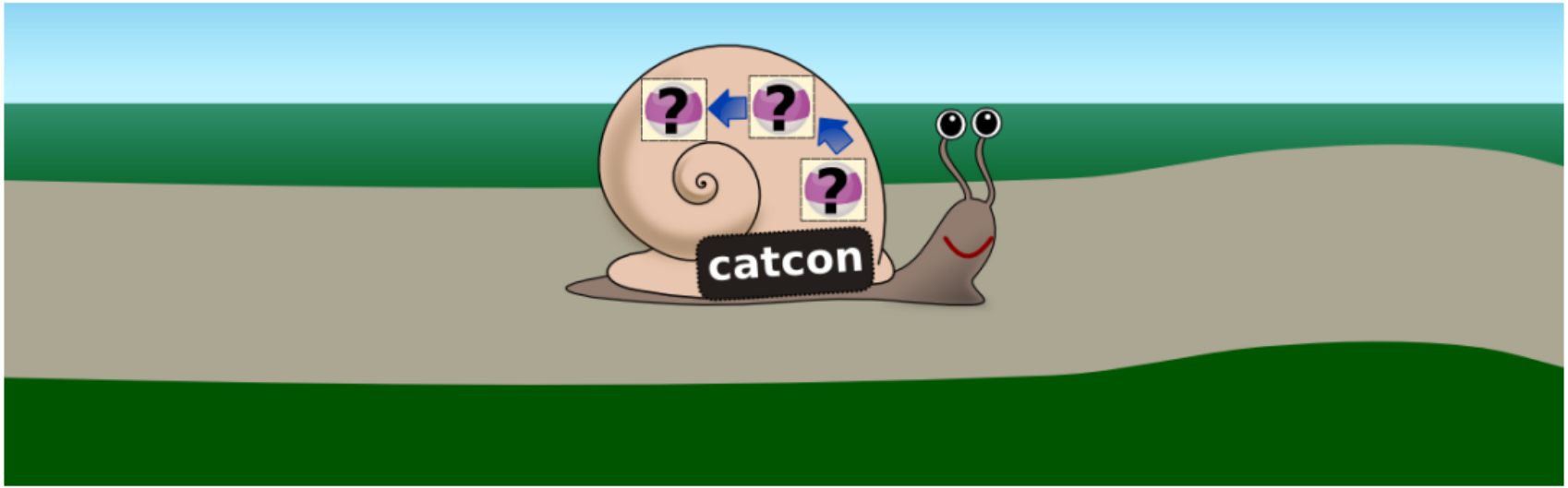

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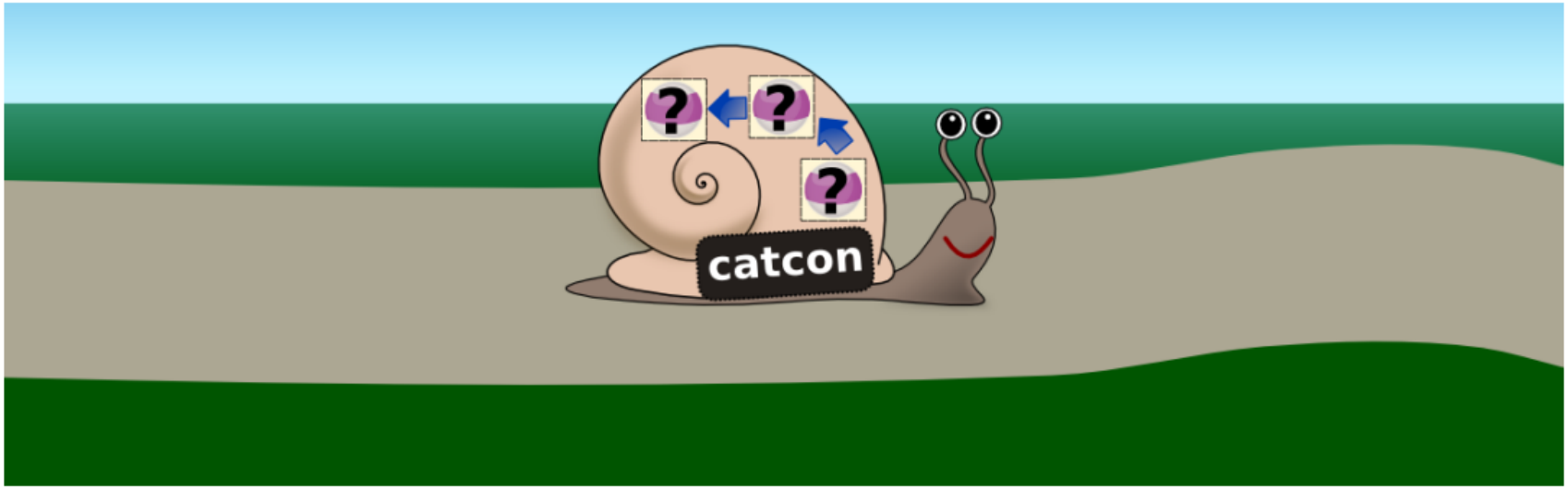

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ghci> :type map (catcon [1,2,3])
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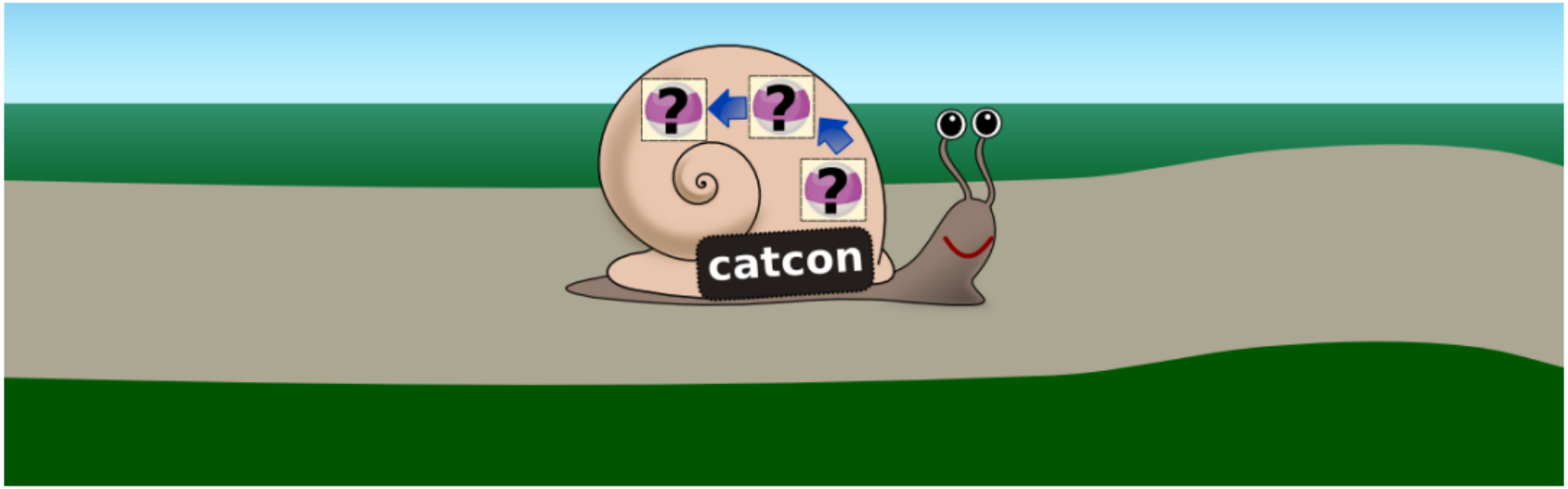

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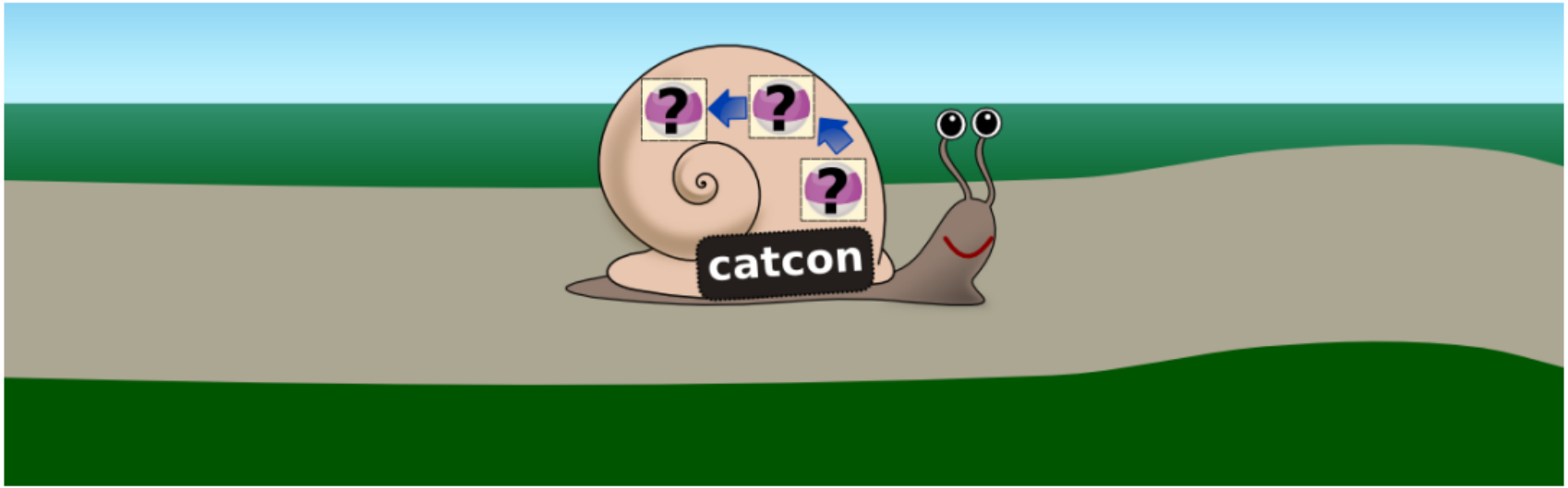

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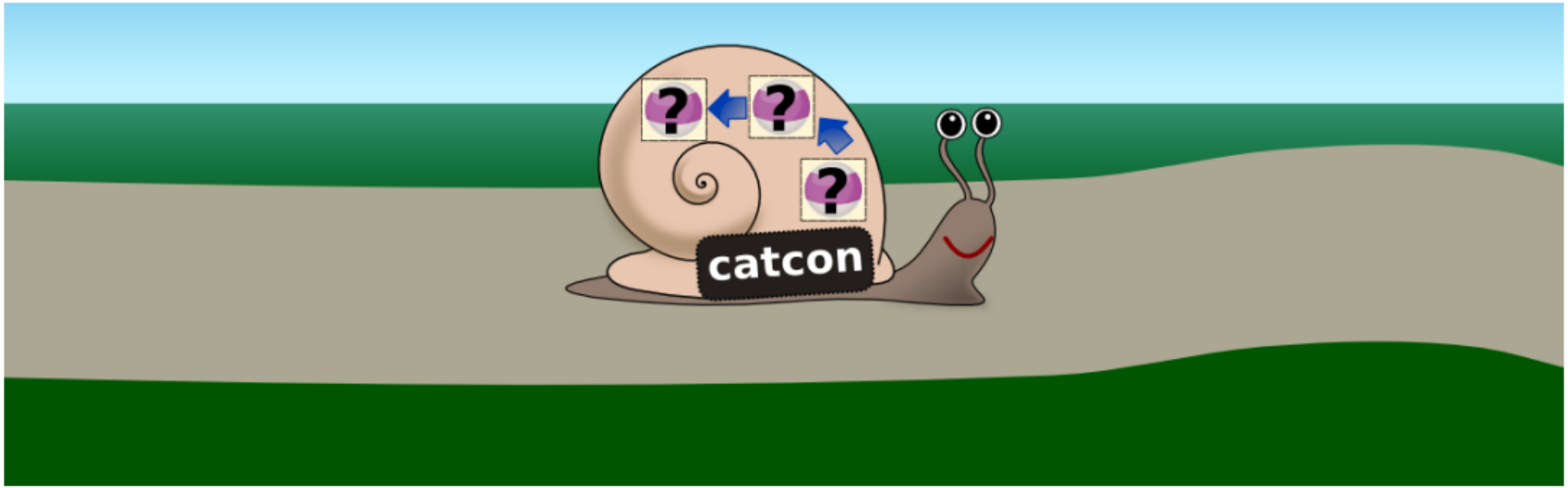

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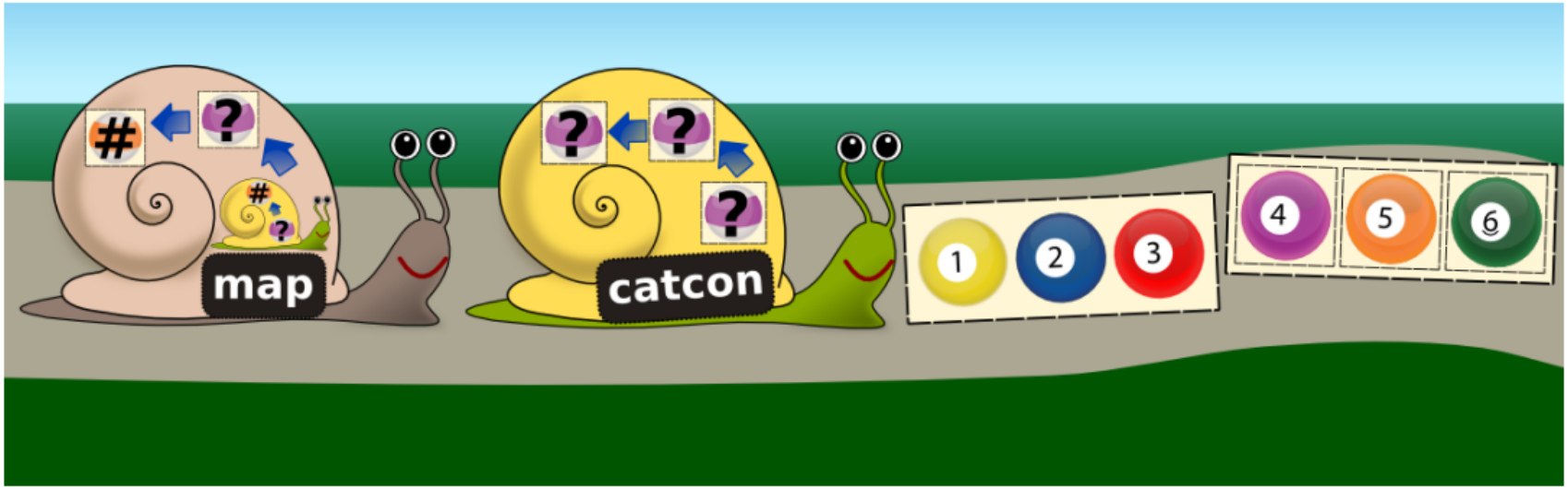

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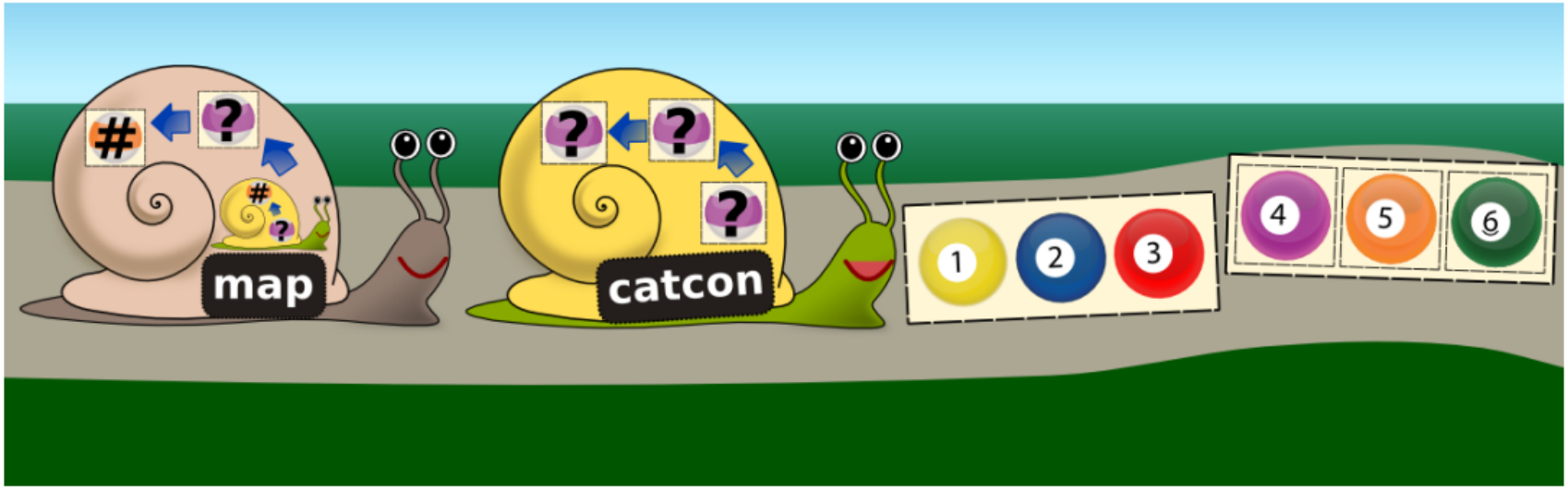

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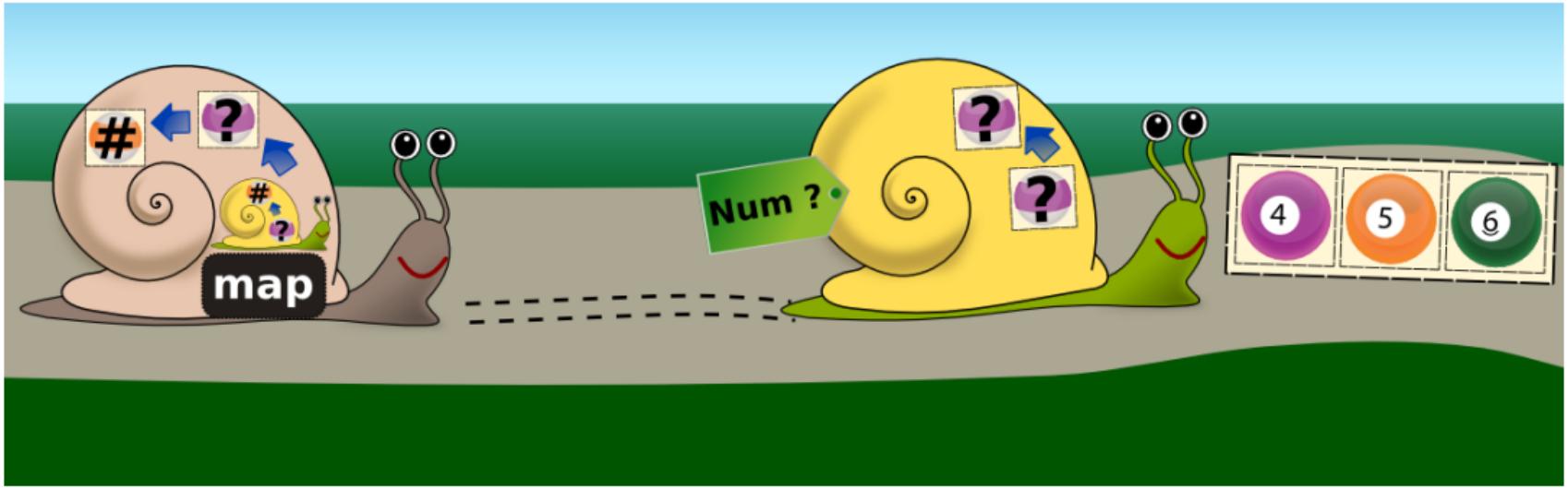

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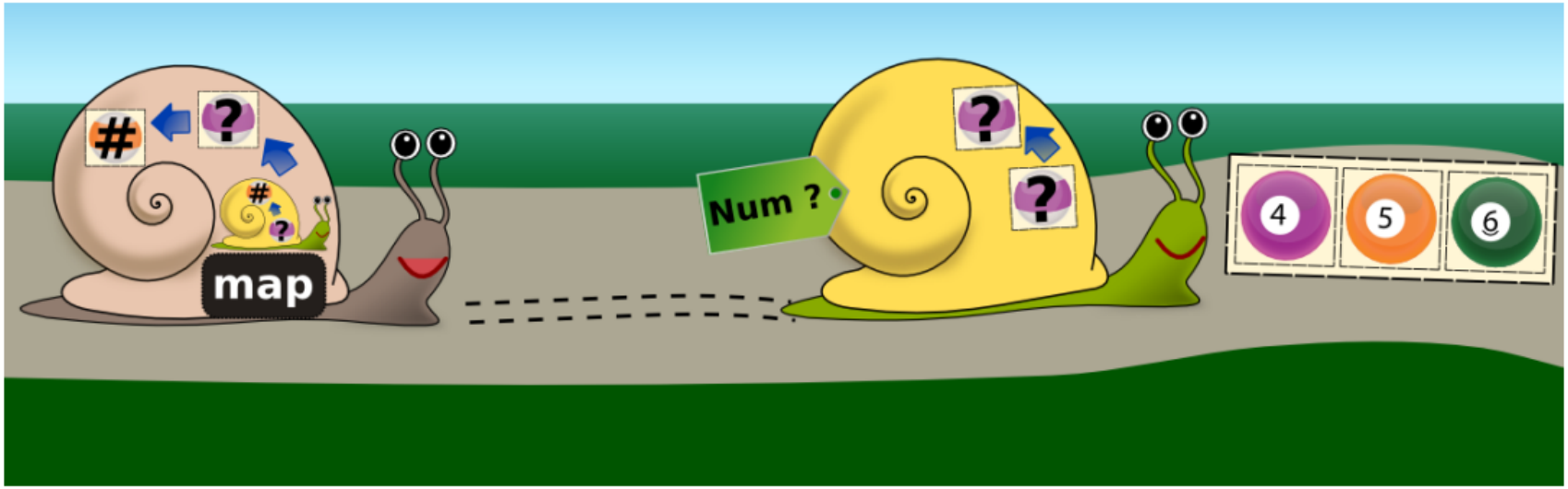

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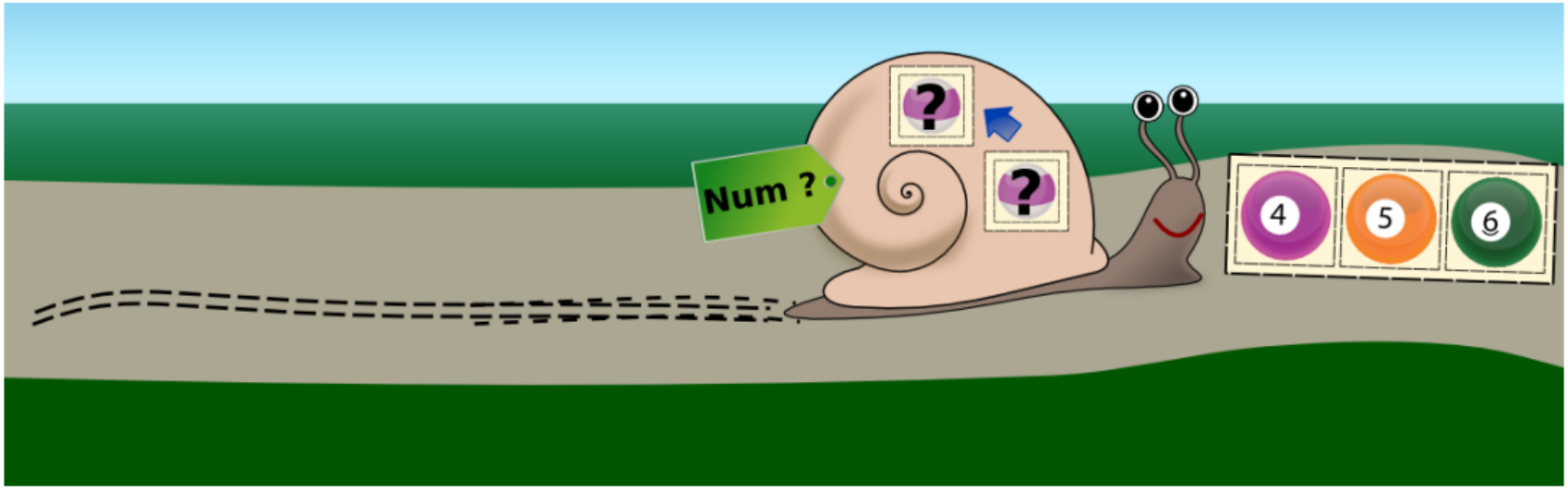

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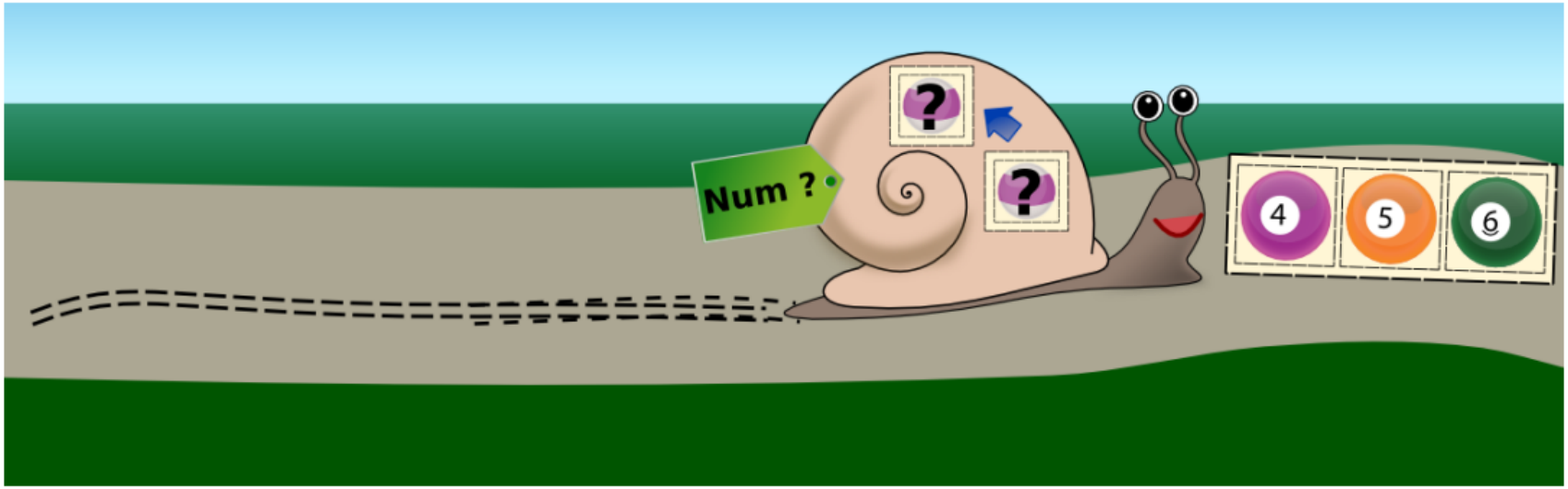

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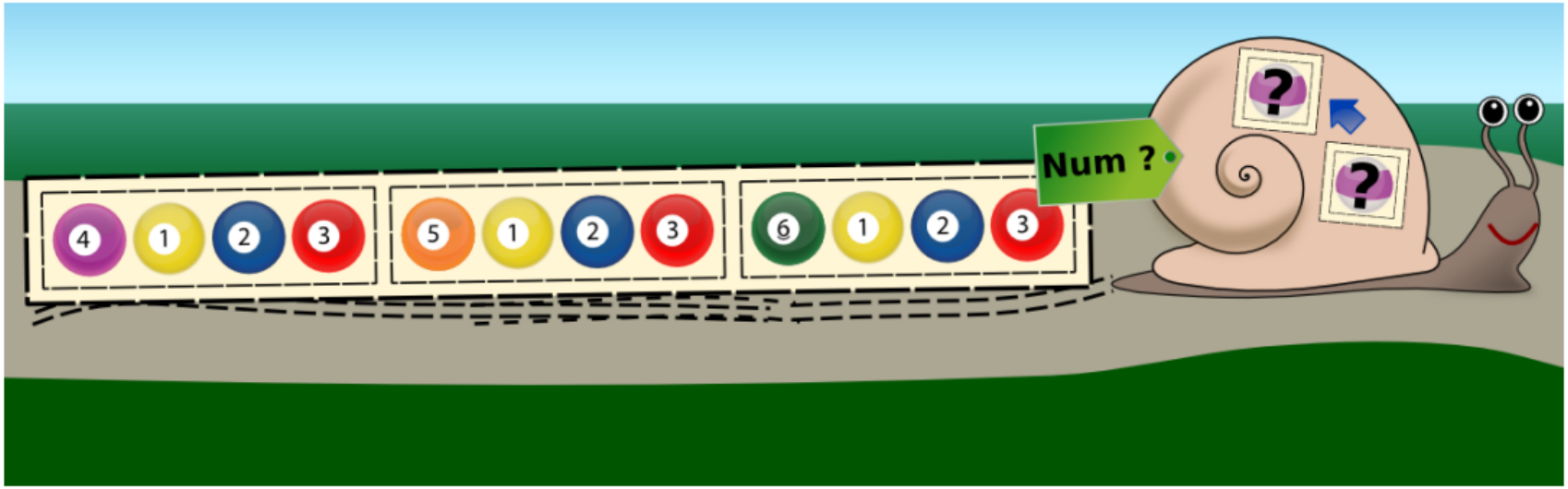

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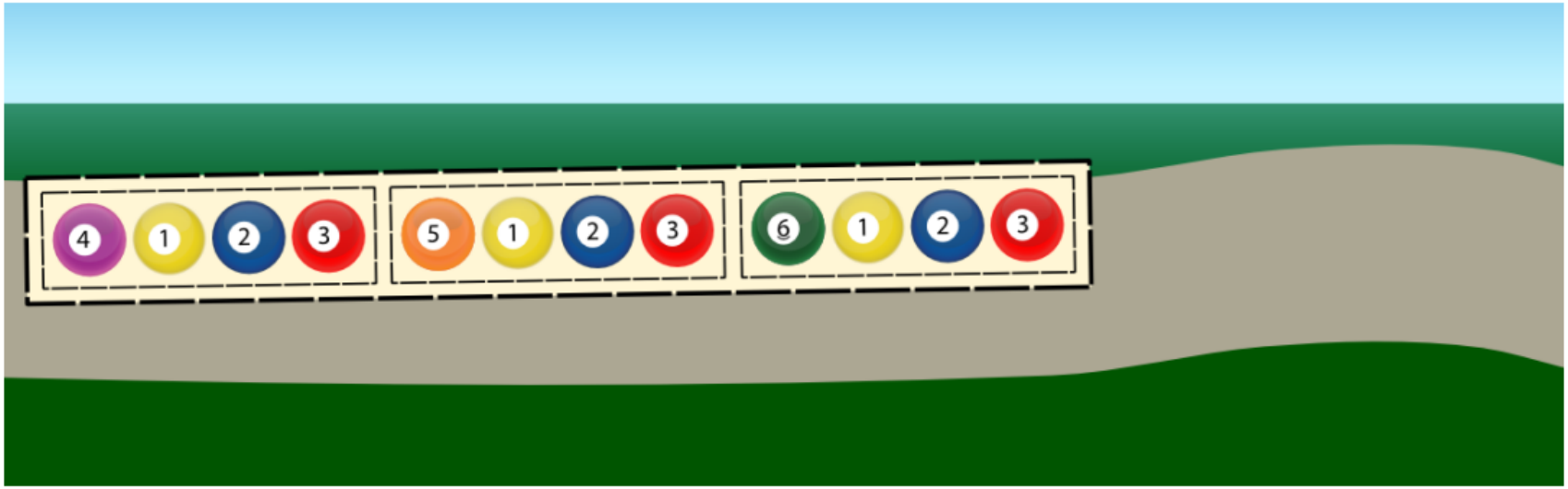

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staticPath :: FilePath -> IO FilePath
staticPath dir = maybe dir (++ dir) <$> lookupEnv "OPENSHIFT_REPO_DIR"
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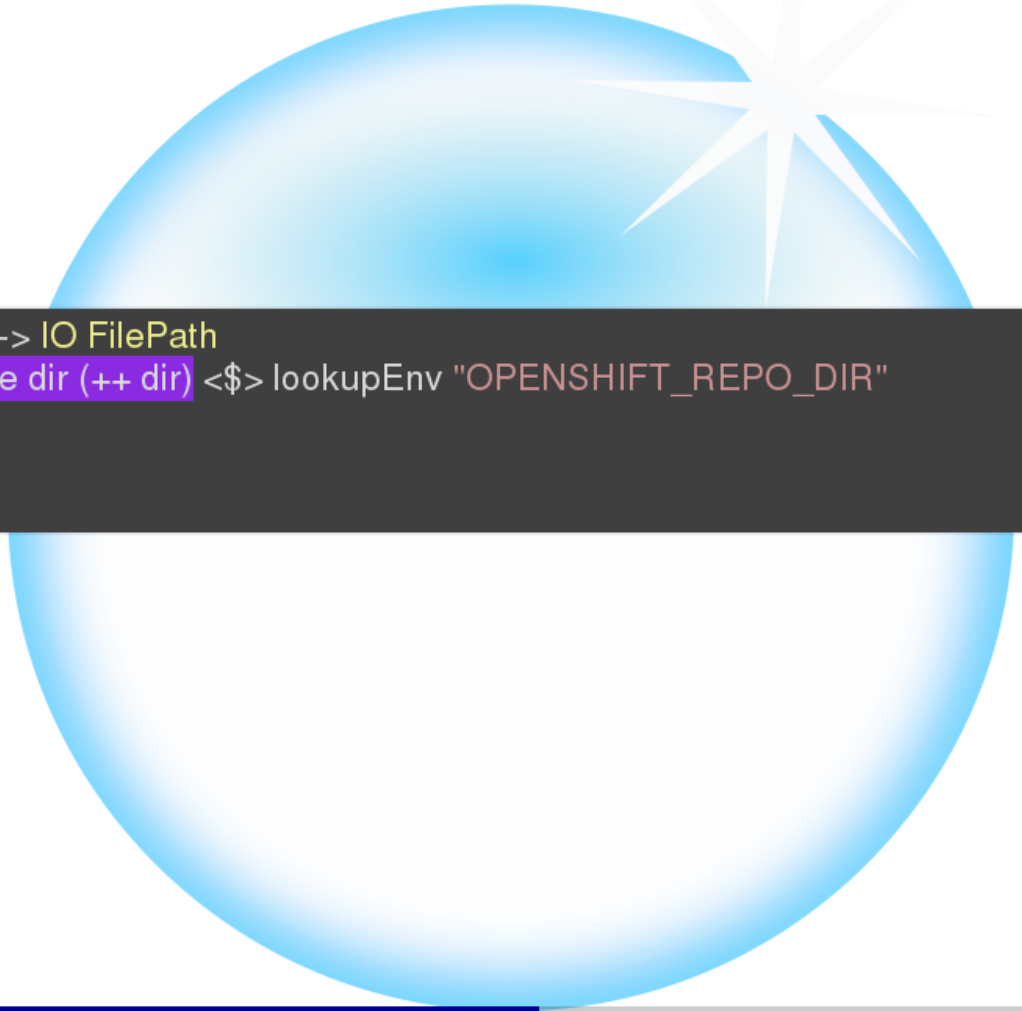

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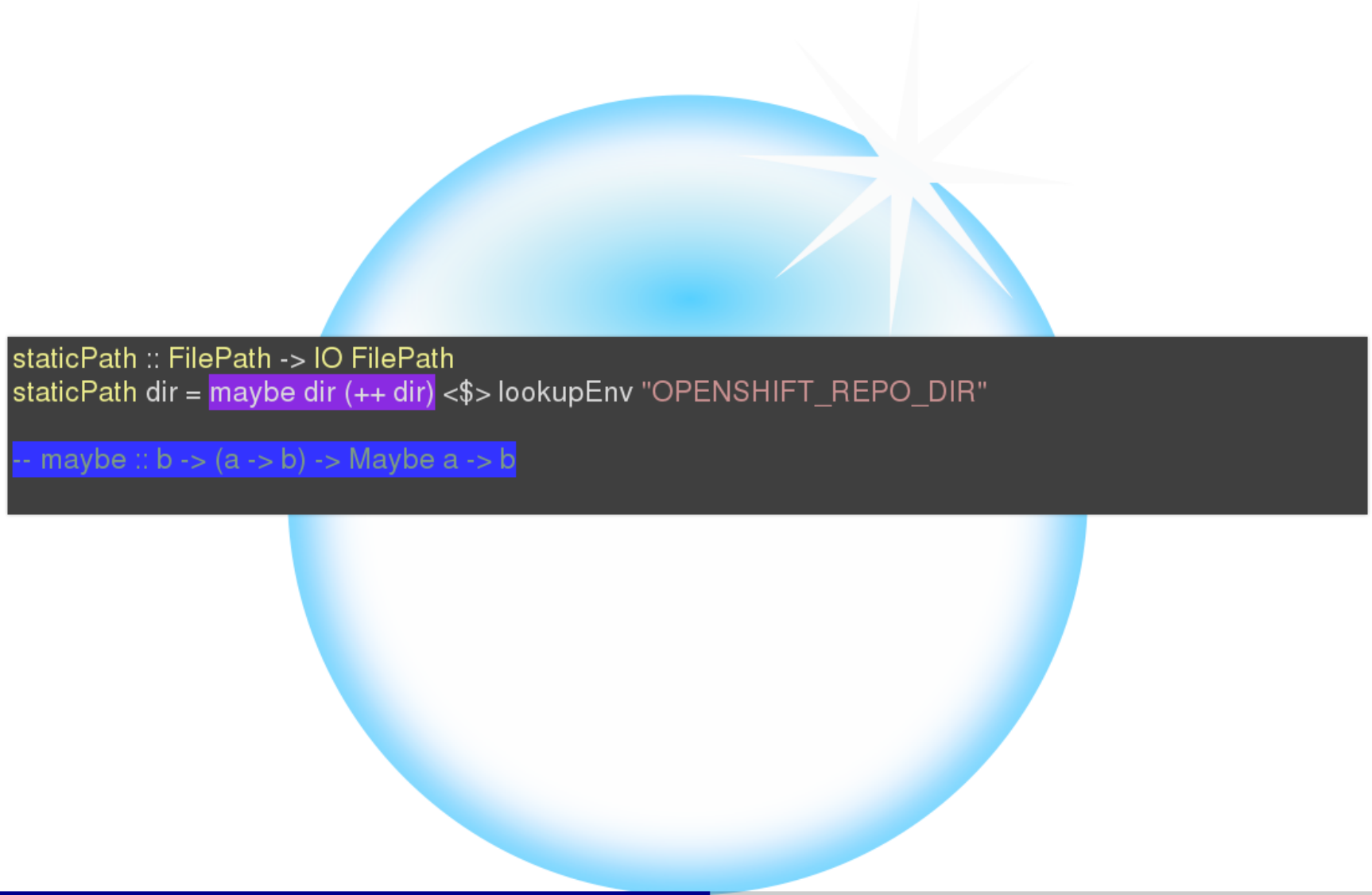
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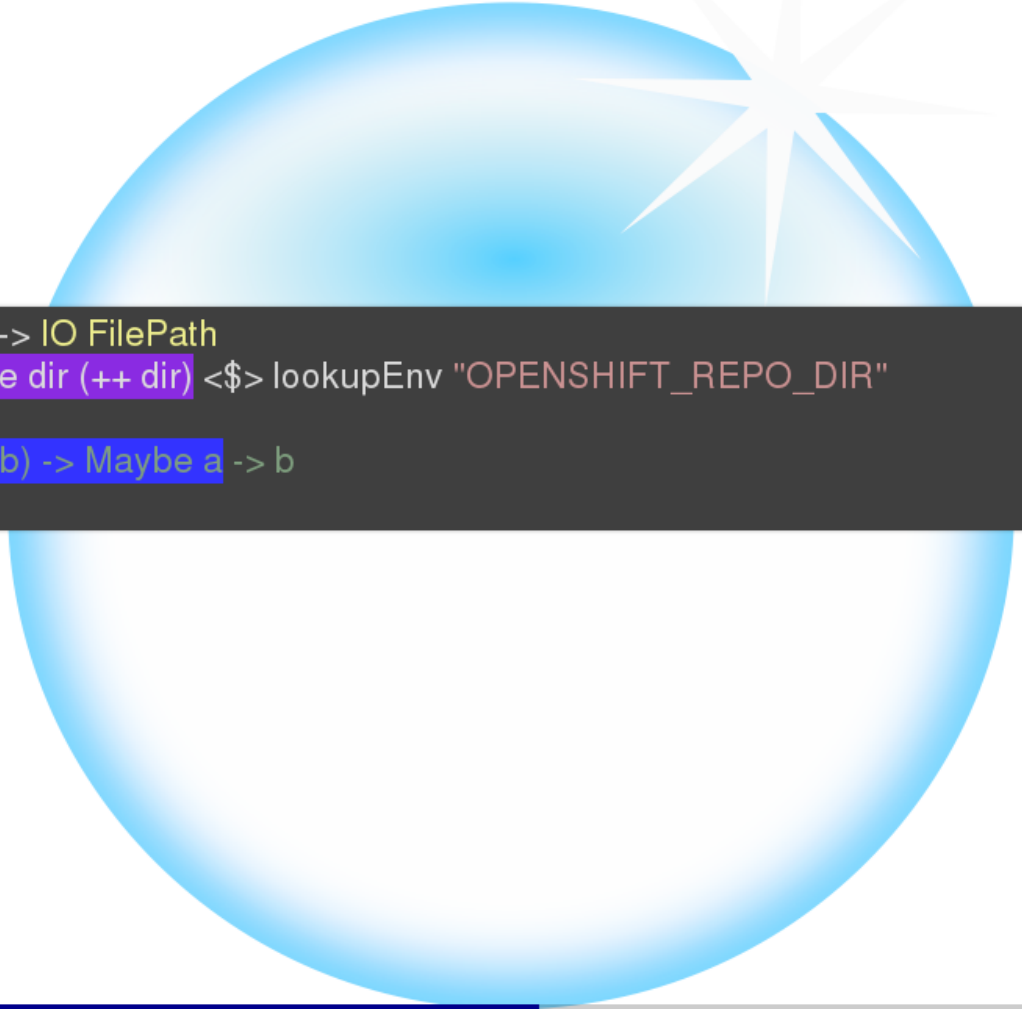

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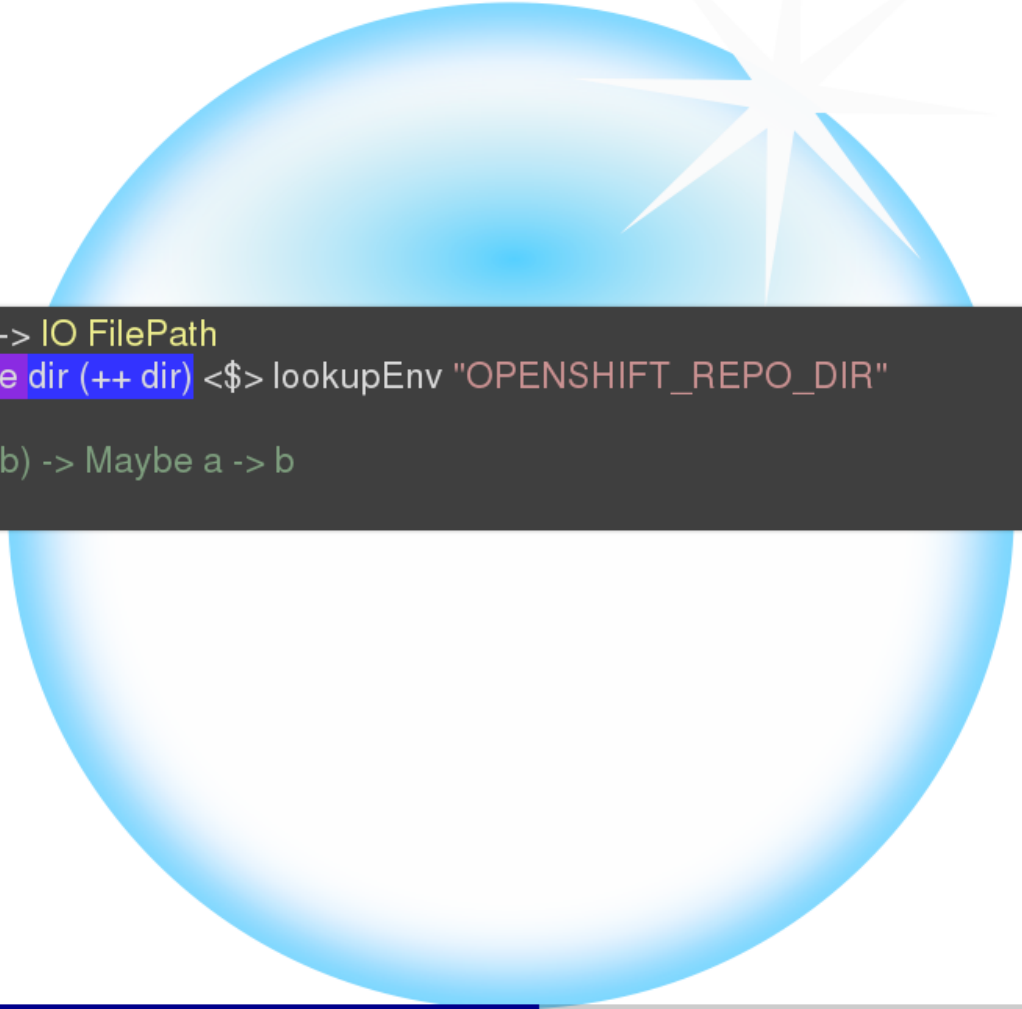

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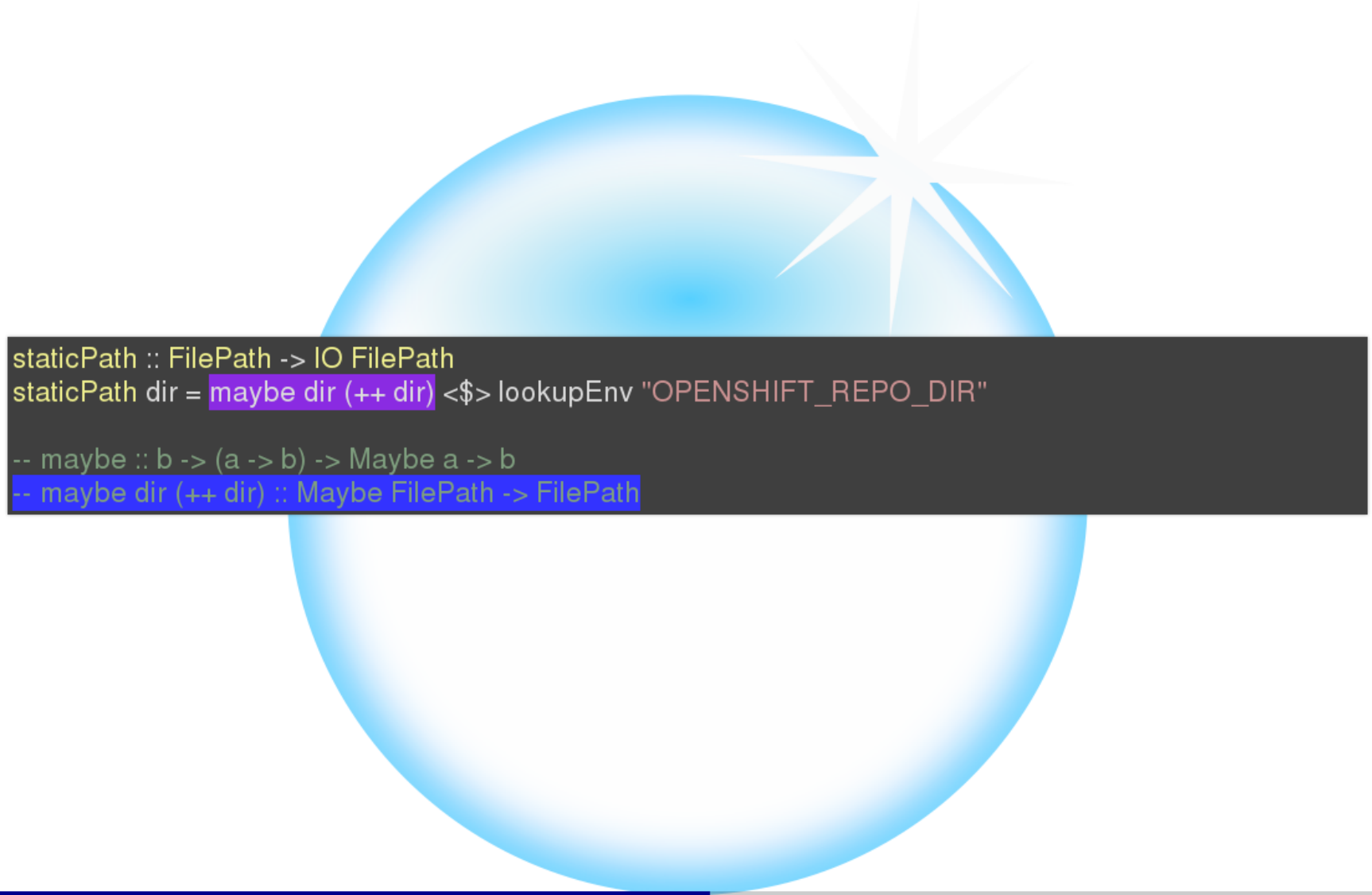
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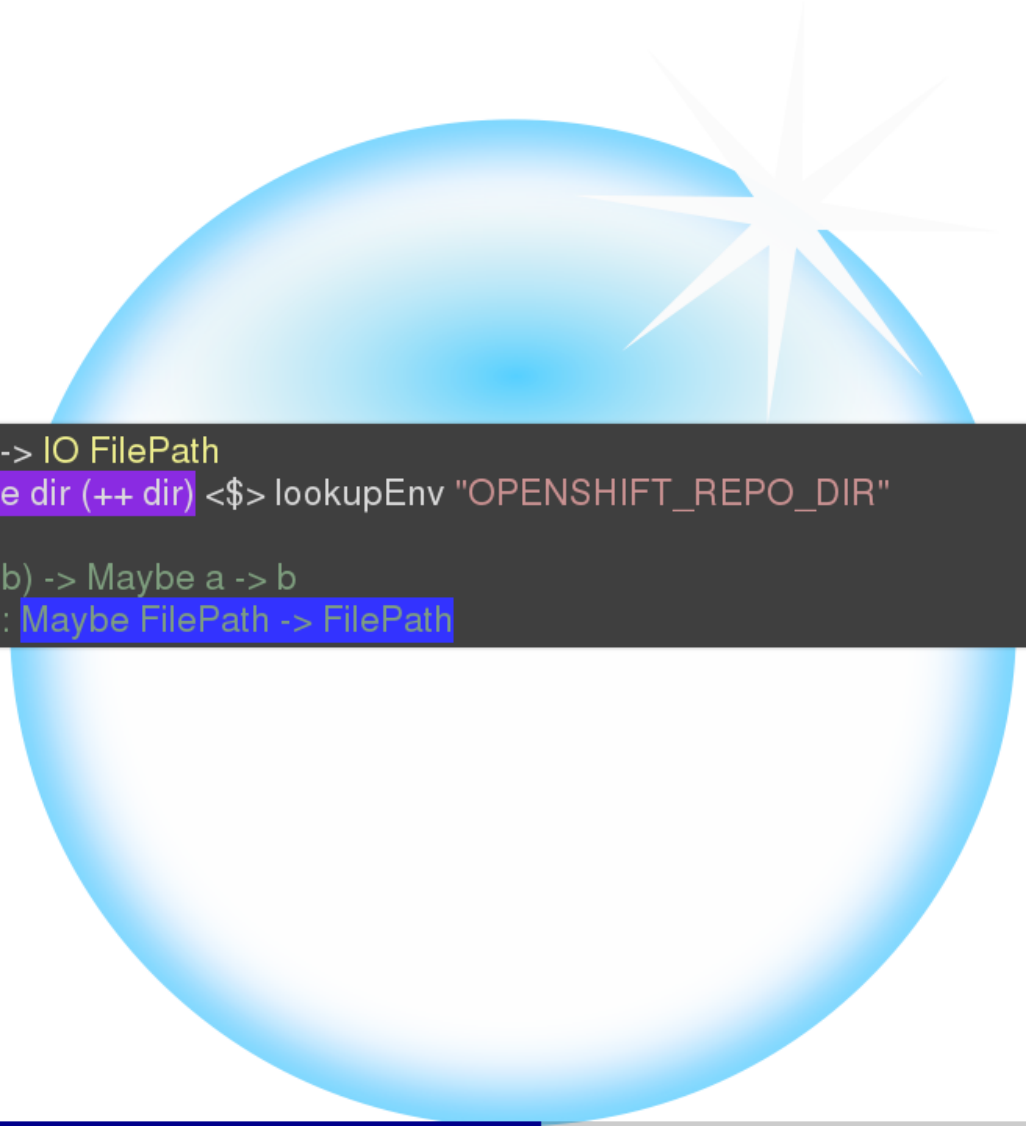

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-- maybe dir (++ dir) :: Maybe FilePath -> FilePath
```

Closure

WHAT: An instance of a function together with the environment in which it was created

WHY: Allows functions to access variables from their context even when it no longer exists; can make code more concise

```
ghci> (\ch n -> (\str -> take n (repeat ch) ++ str)) 'a' 5 "ha"
```

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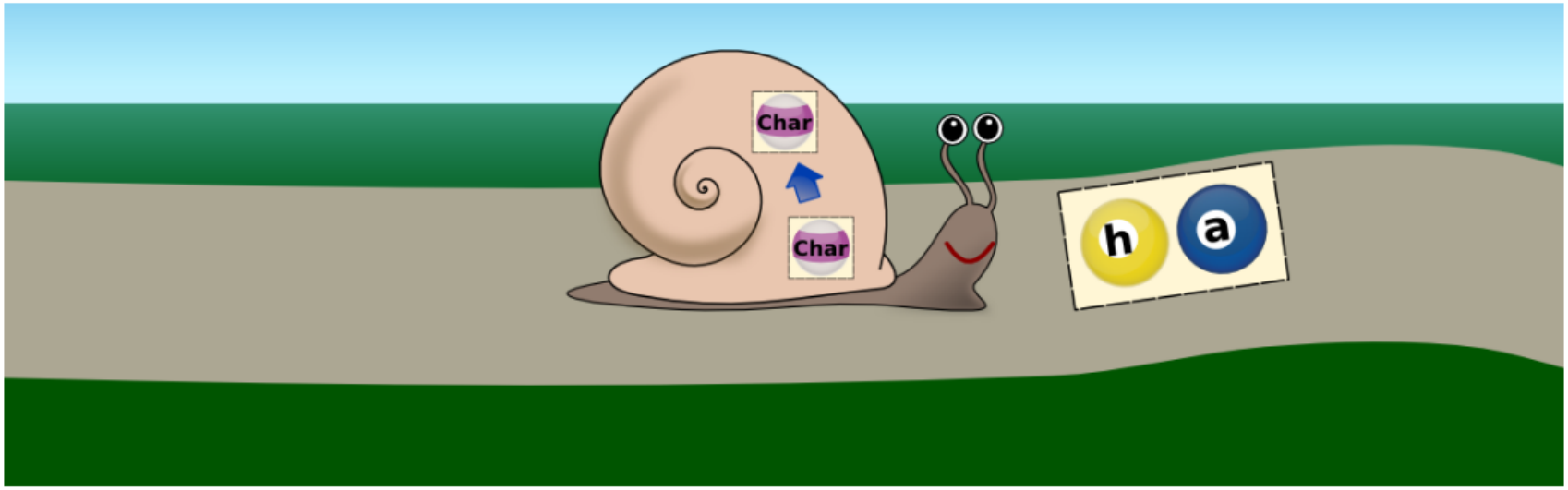

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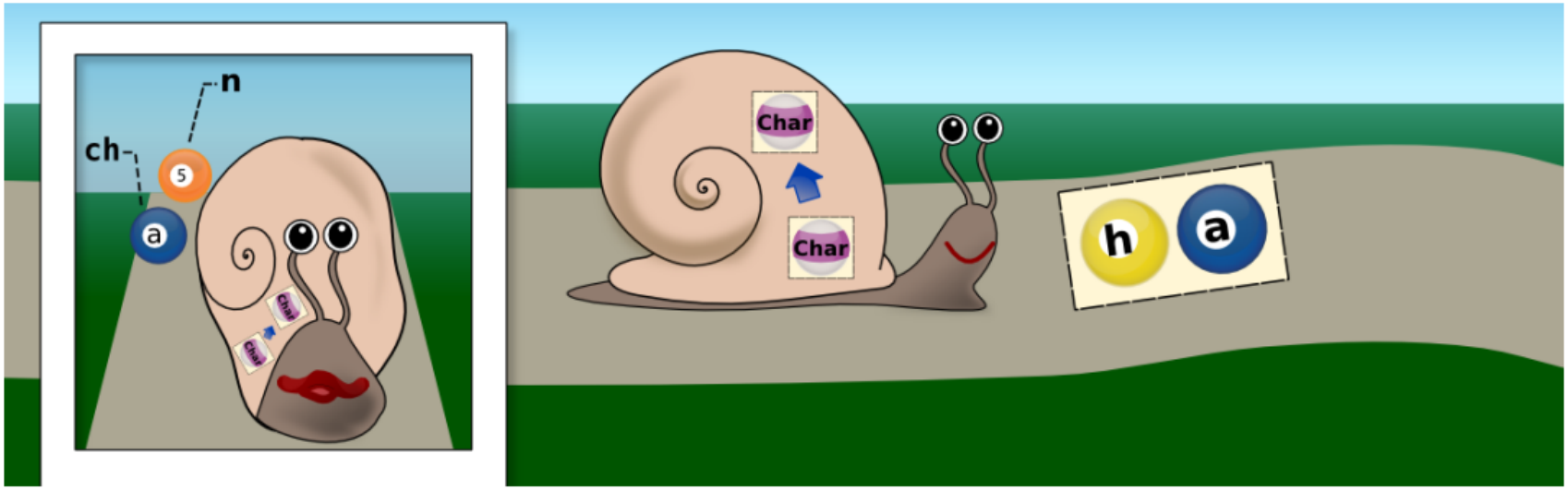

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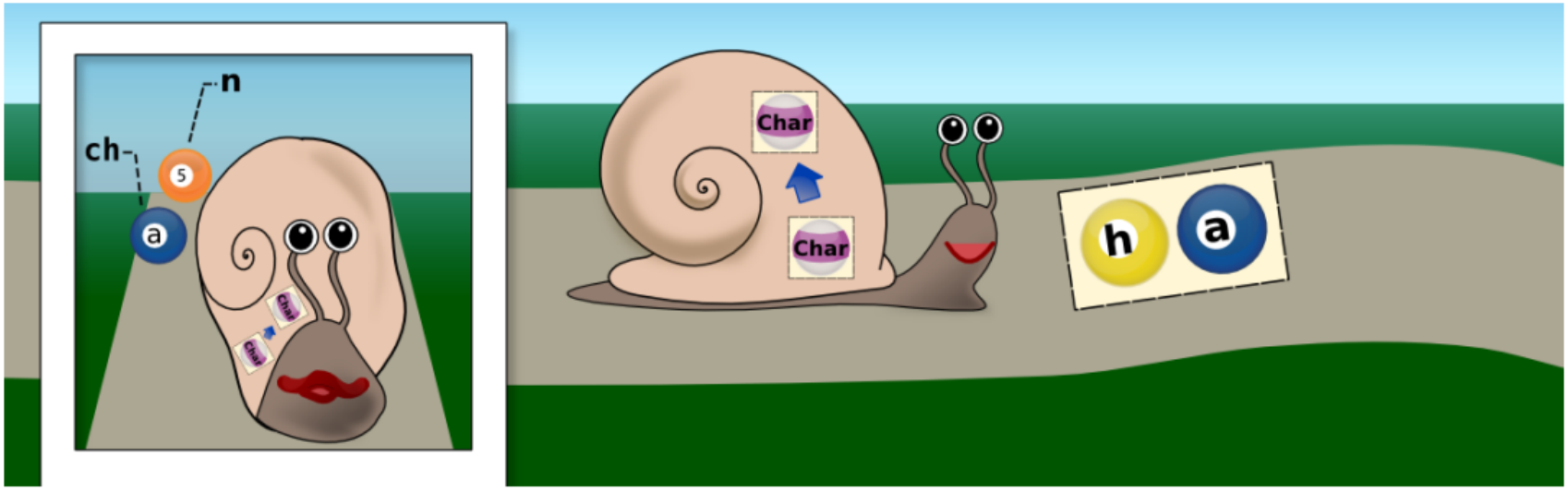

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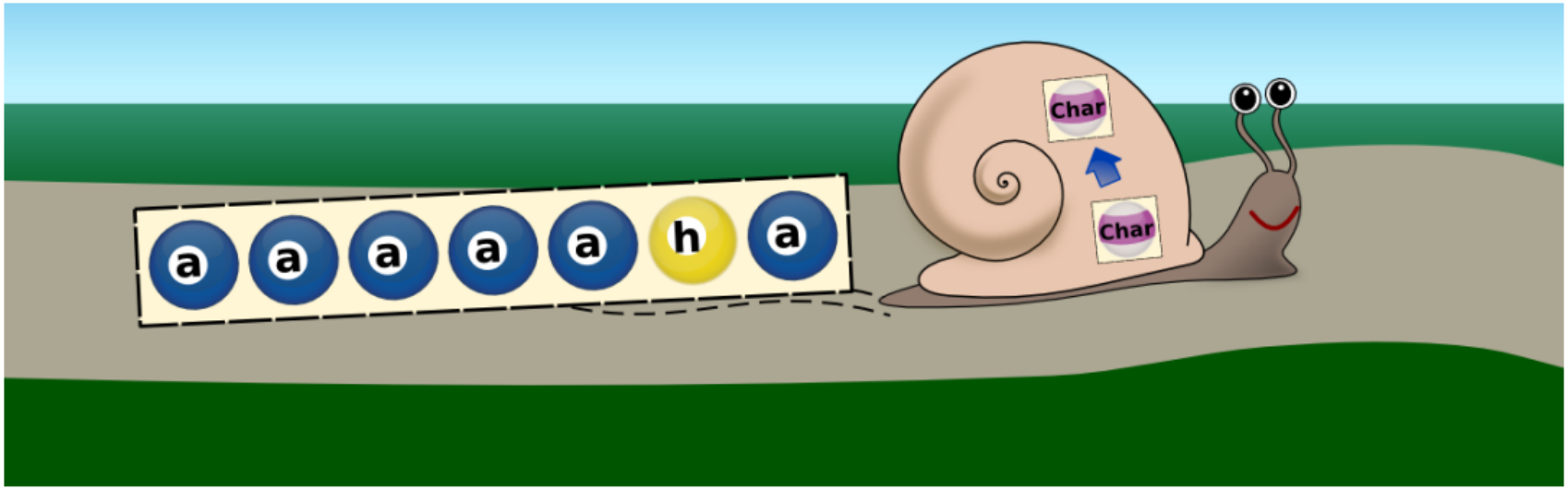


(\defs -> liftIO (shuffled defs) >>= (\sdefs -> renderGame (ws^.name) defs sdefs))


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Functor

WHAT: Structure that can be mapped over

WHY: Identify common pattern; use abstraction to reduce code duplication

```
ghci> :info Functor
class Functor f where
  fmap :: (a -> b) -> f a -> f b
  ...
```

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```
interface Functor<F> {
  <A, B> F<B> fmap(Function<A, B> f, F<A> a);
  ...
}
```

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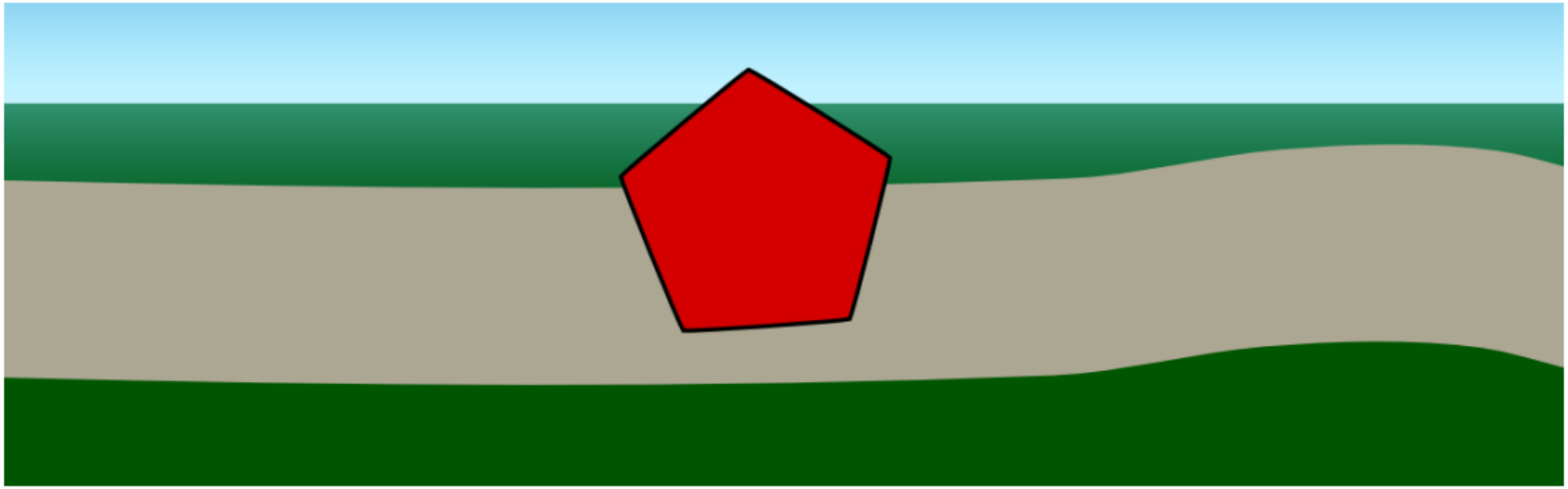

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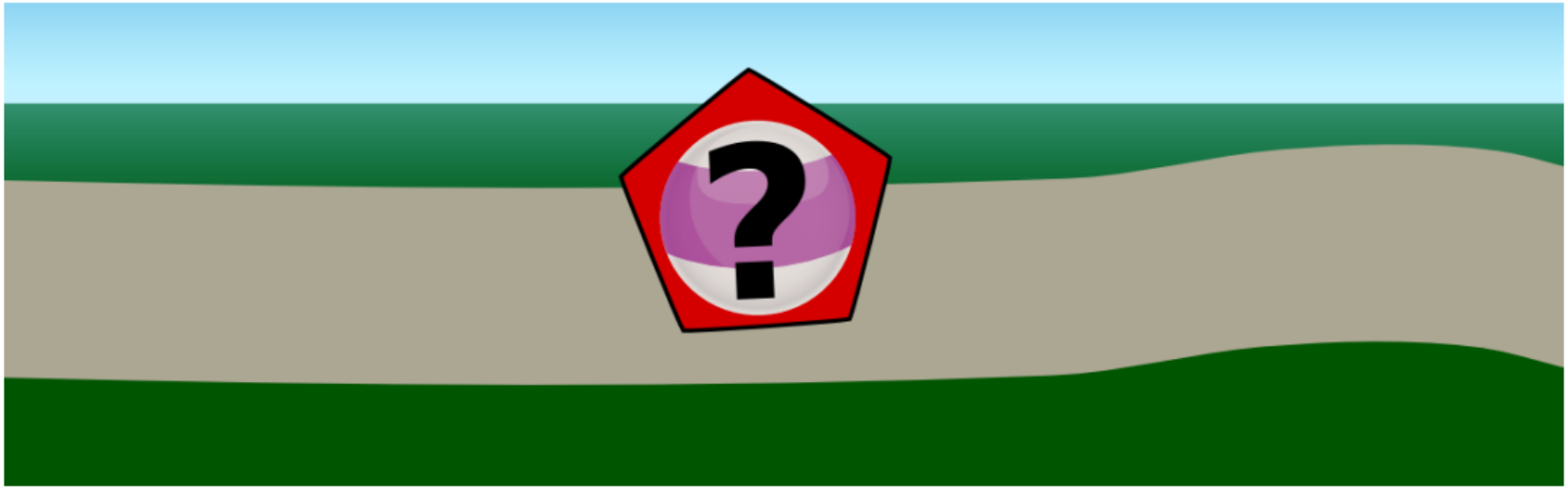

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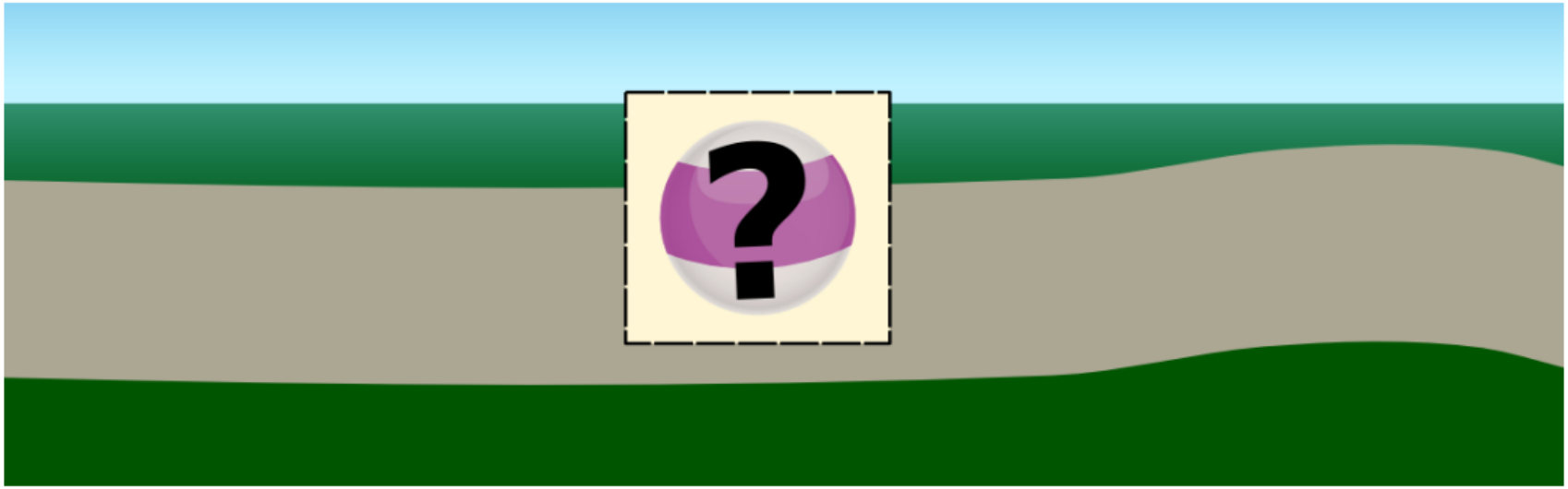

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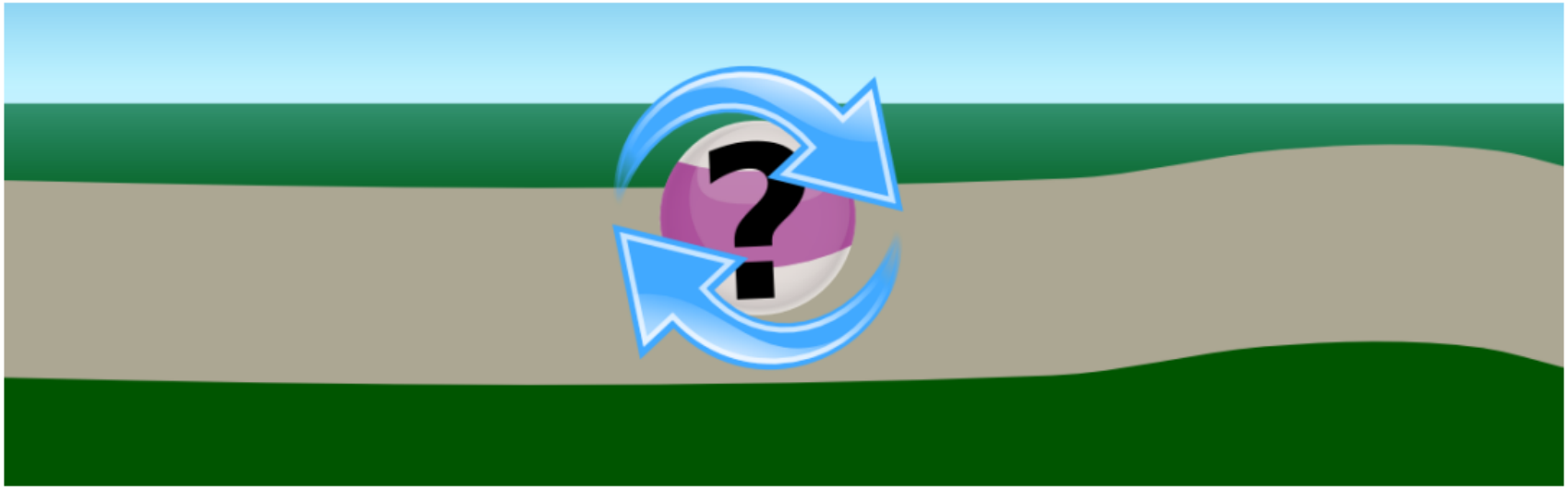

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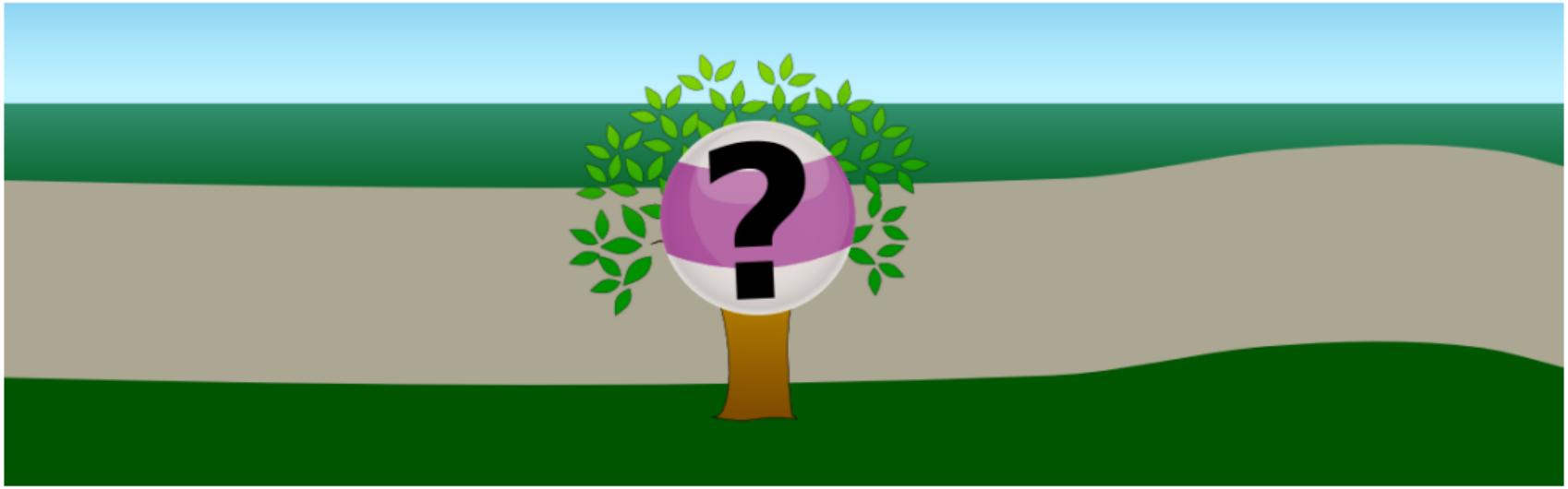

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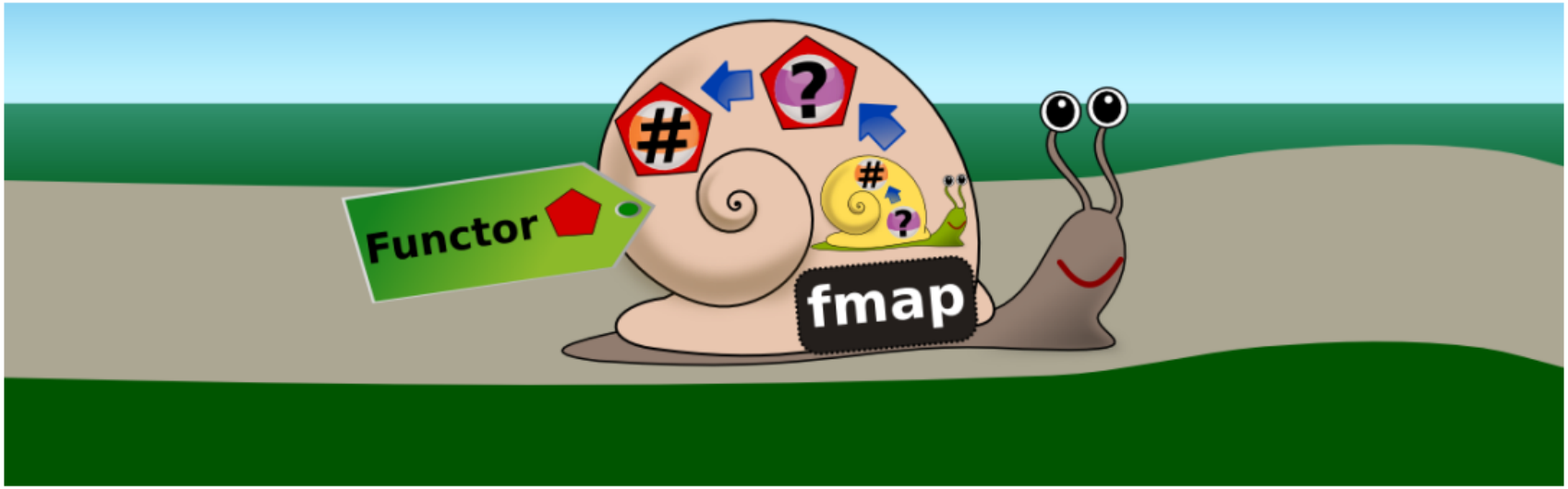

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ghci> :info Functor
class Functor f where
  fmap :: (a -> b) -> f a -> f b
  ...
ghci> fmap (*2) [1,2,3]
[2,4,6]
```

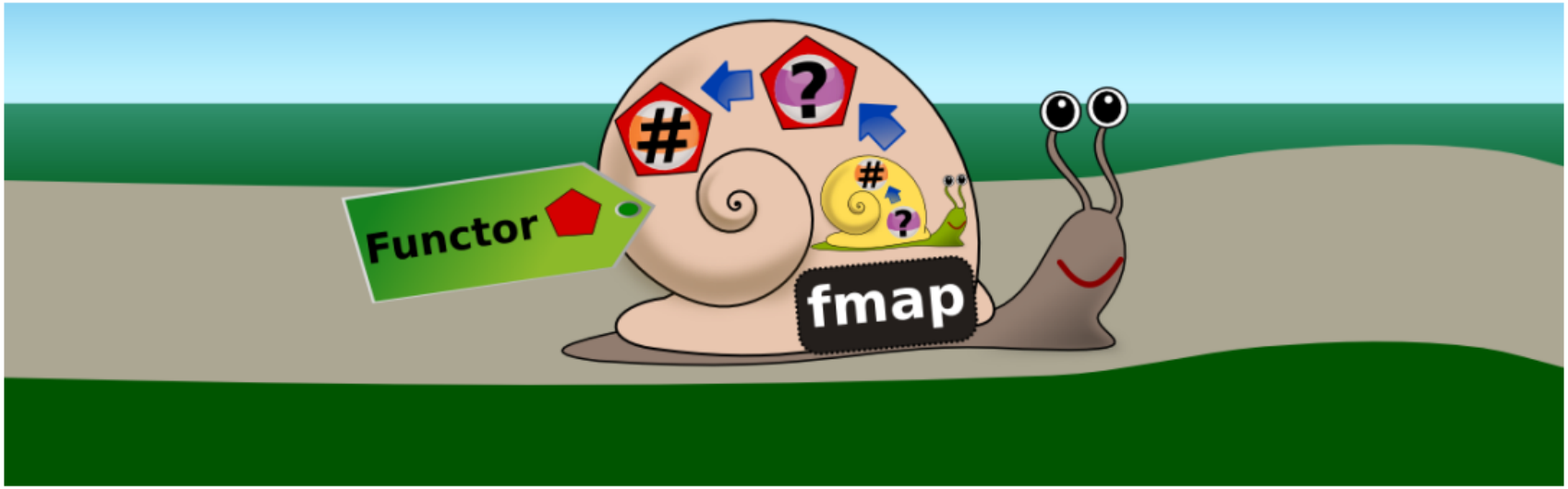

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ghci> :info Functor
class Functor f where
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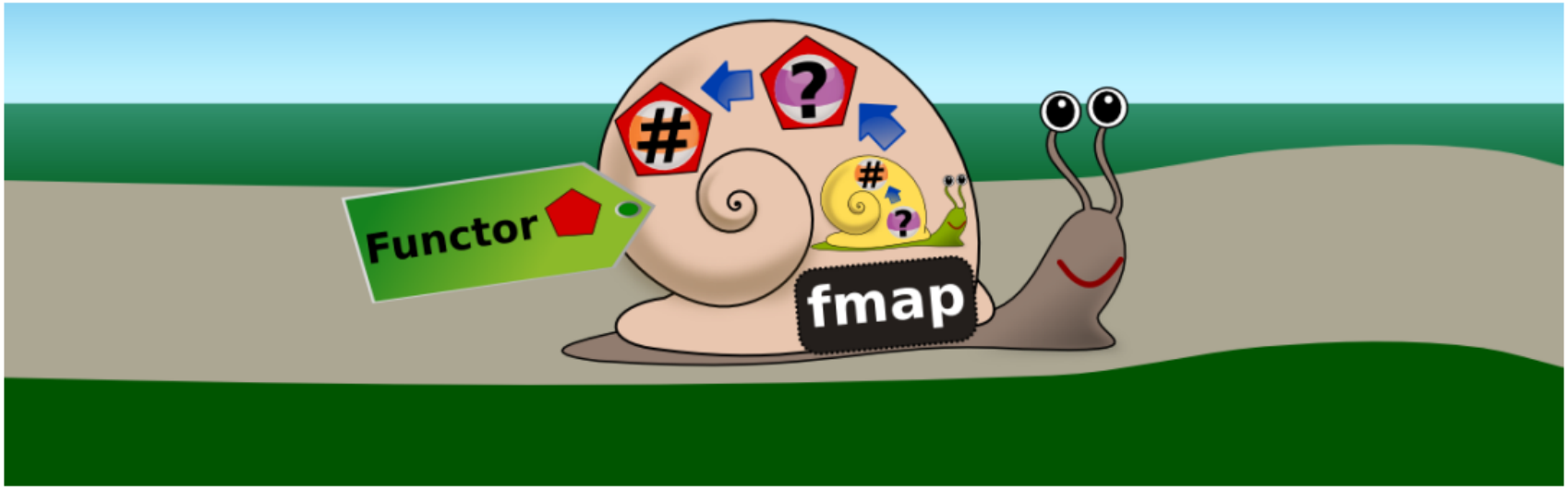
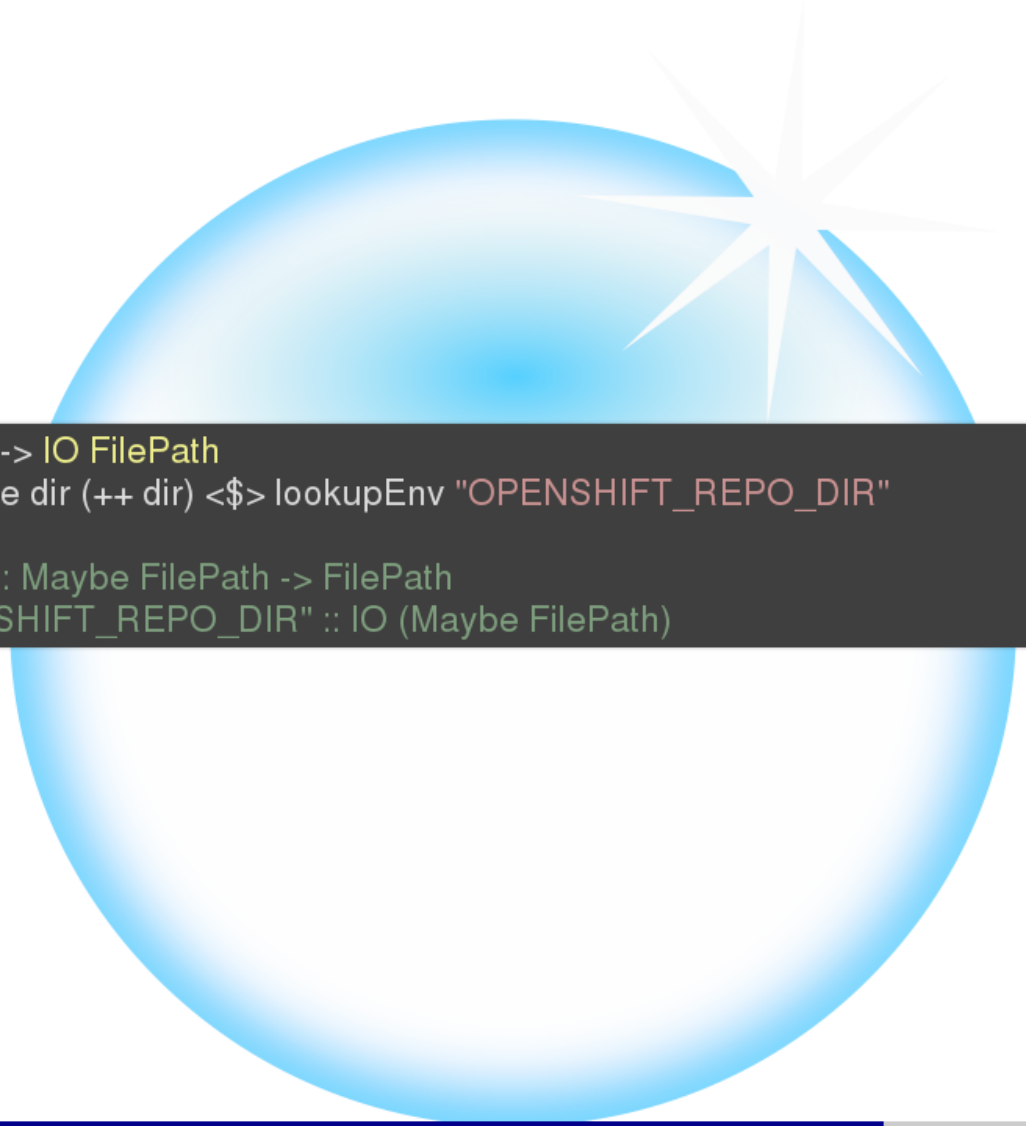
  ...
ghci> fmap (*2) [1,2,3]
[2,4,6]
ghci> fmap reverse getLine
foo
"oof"
```





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staticPath dir = maybe dir (++ dir) <$> lookupEnv "OPENSHIFT_REPO_DIR"

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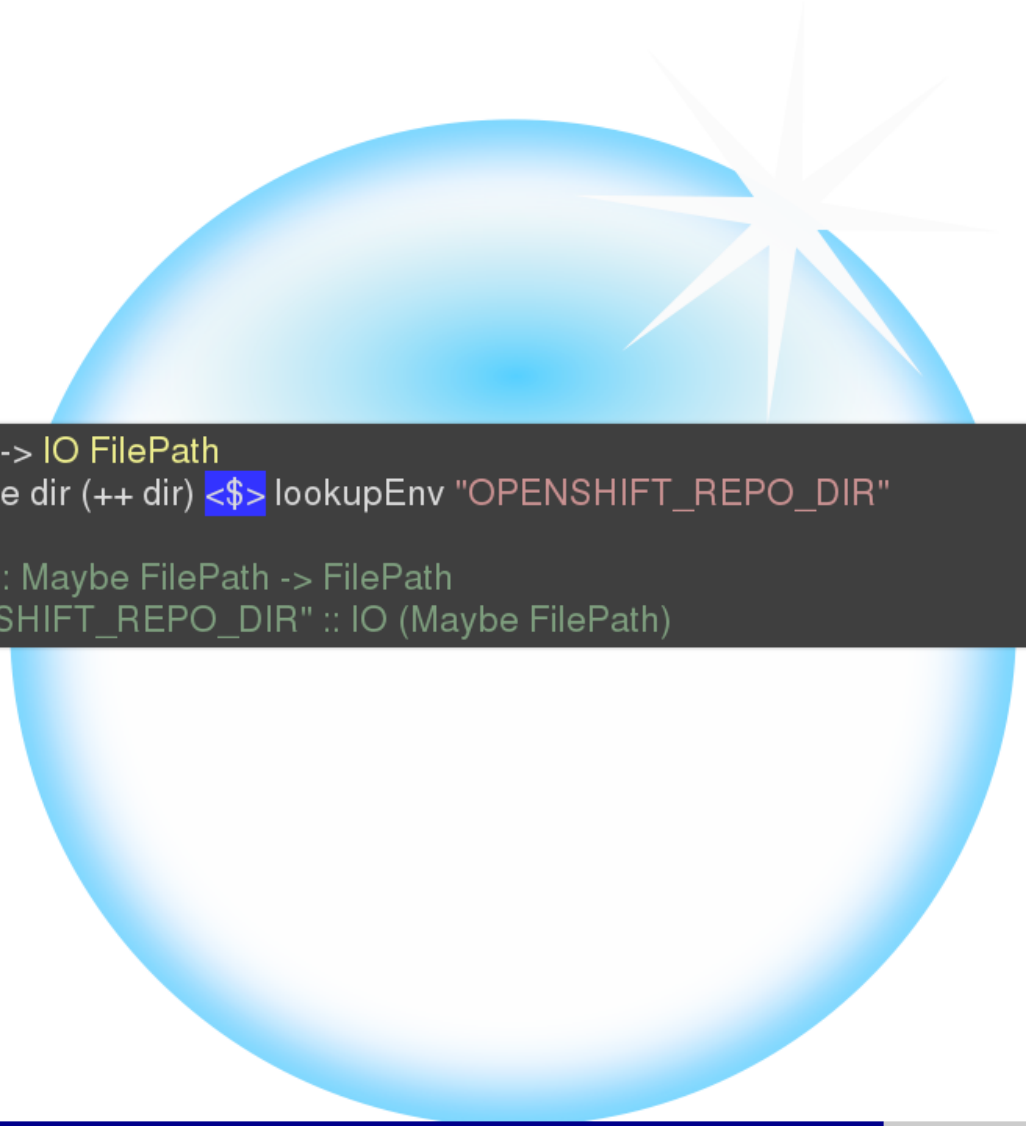

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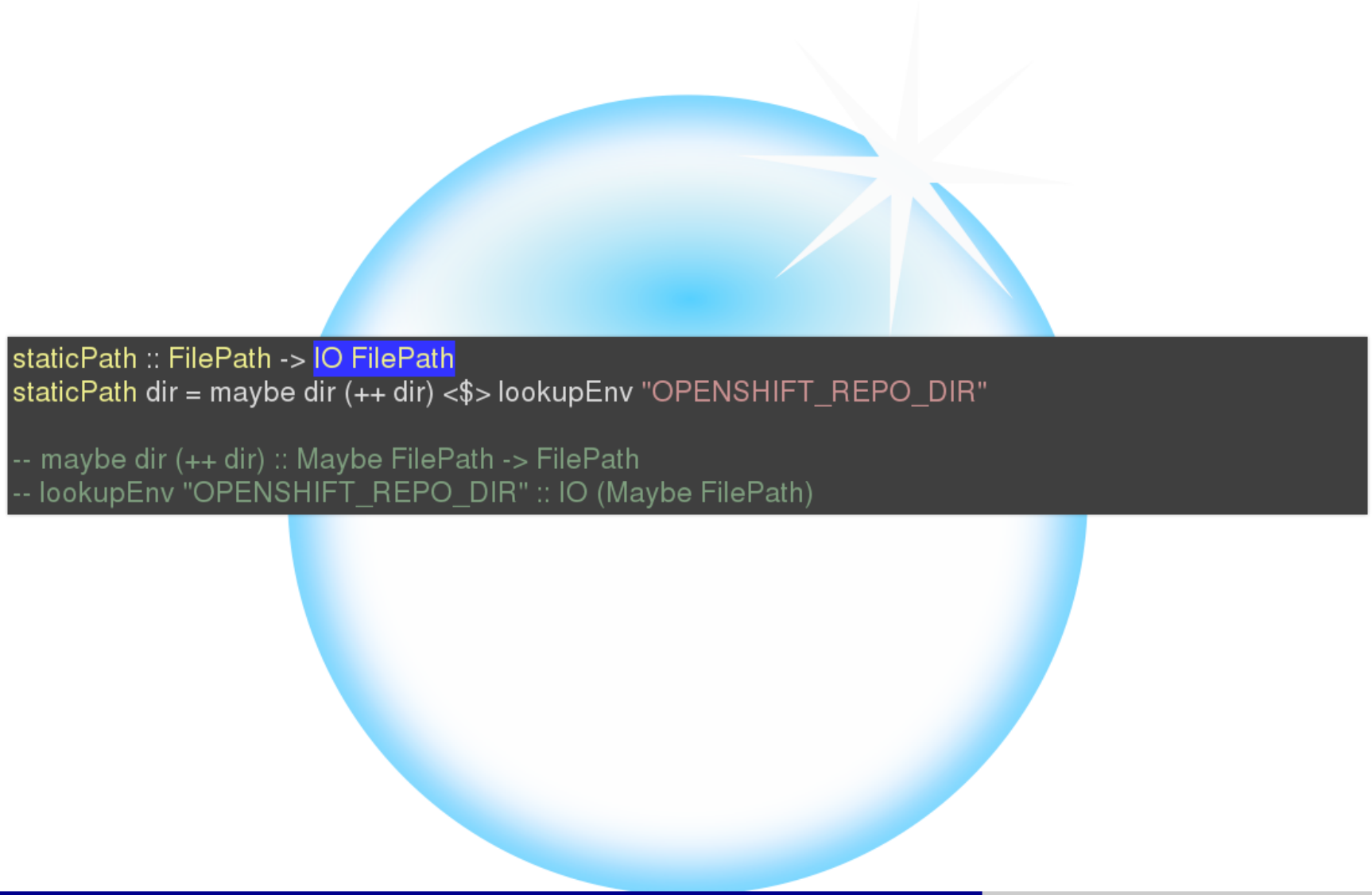
staticPath :: FilePath -> IO FilePath
staticPath dir = maybe dir (++ dir) <$> lookupEnv "OPENSHIFT_REPO_DIR"
-- maybe dir (++ dir) :: Maybe FilePath -> FilePath
-- lookupEnv "OPENSHIFT_REPO_DIR" :: IO (Maybe FilePath)

Monad

WHAT: Structure that puts values in a computational context and implements functions that facilitate the chaining of these computations

WHY: A large number of very useful functions can be written once for any type that fits the pattern

```
ghci> :info Monad
class Monad m where
  return :: a -> m a
  (>>=) :: m a -> (a -> m b) -> m b
  ...
```

```
ghci> :info Monad
class Monad m where
  return :: a -> m a
  (>>=) :: m a -> (a -> m b) -> m b
  ...
```

```
interface Monad<M> {
  <A, B> M<B> bind(M<A> m, Function<A, M<B>> f);
  <A> M<A> return(A a);
  ...
}
```

```
ghci> :info Monad
class Monad m where
  return :: a -> m a
  (>>=) :: m a -> (a -> m b) -> m b
  ...
```

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interface Monad<M> {
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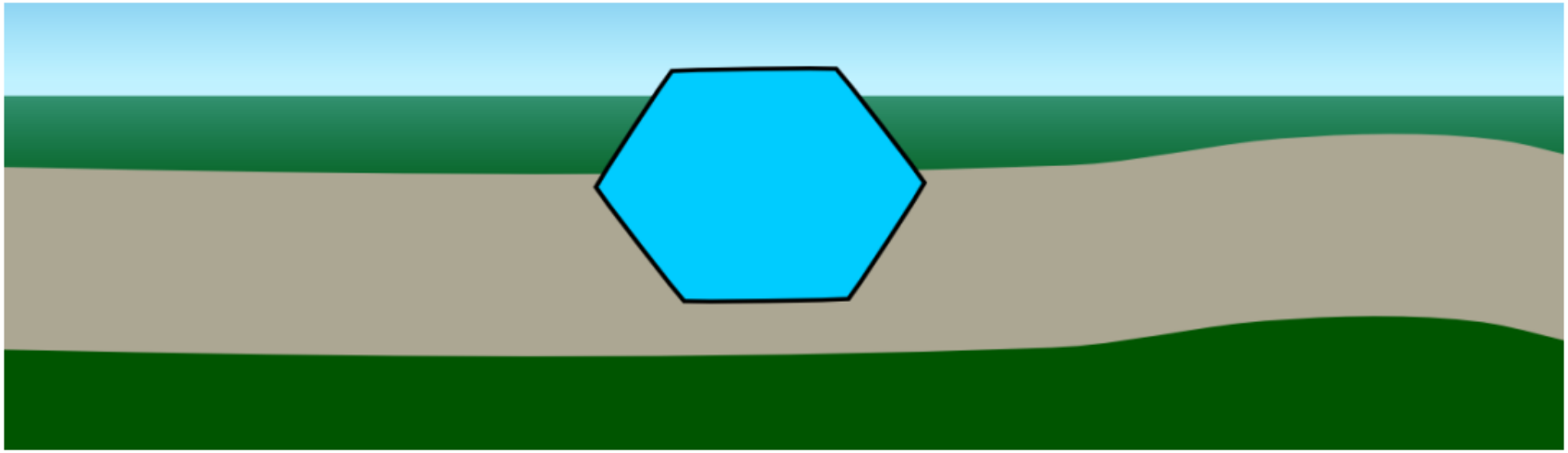

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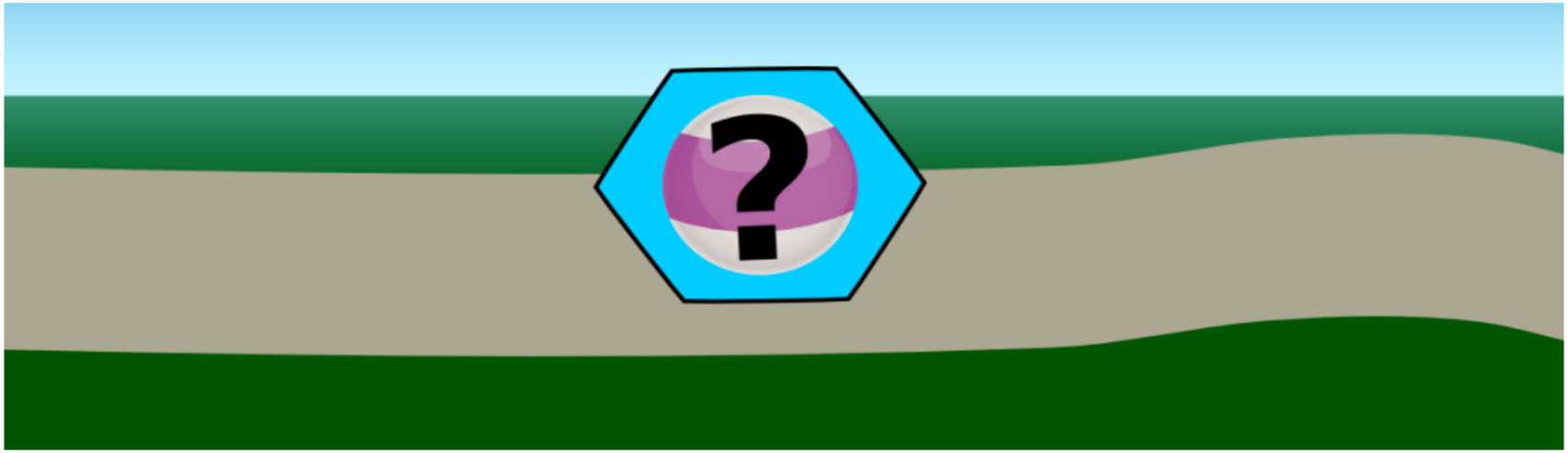

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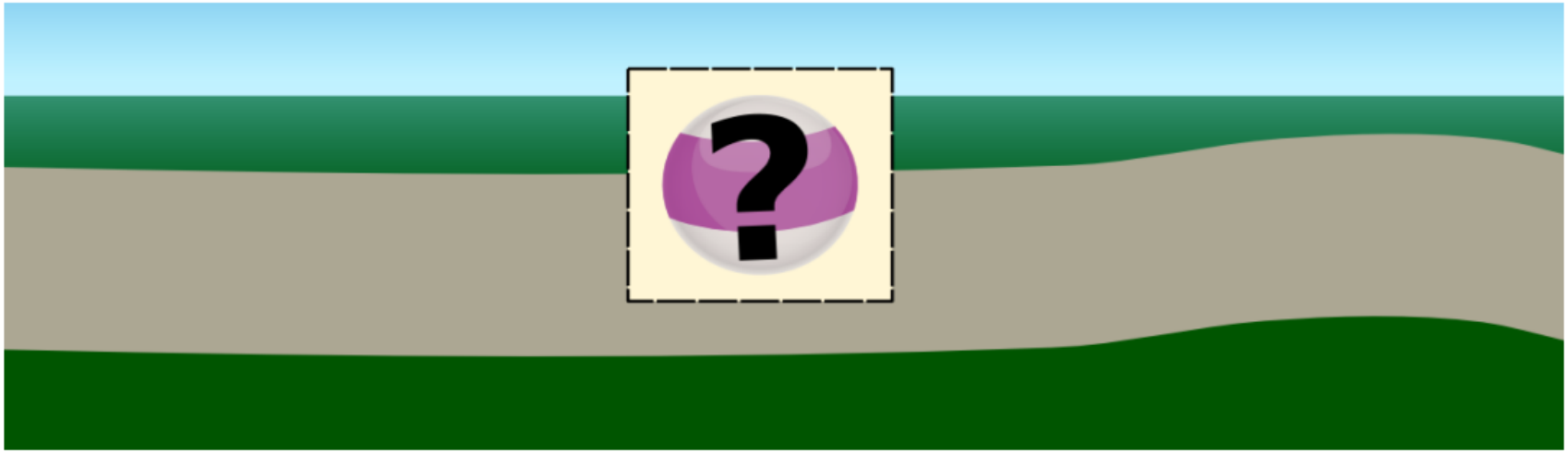

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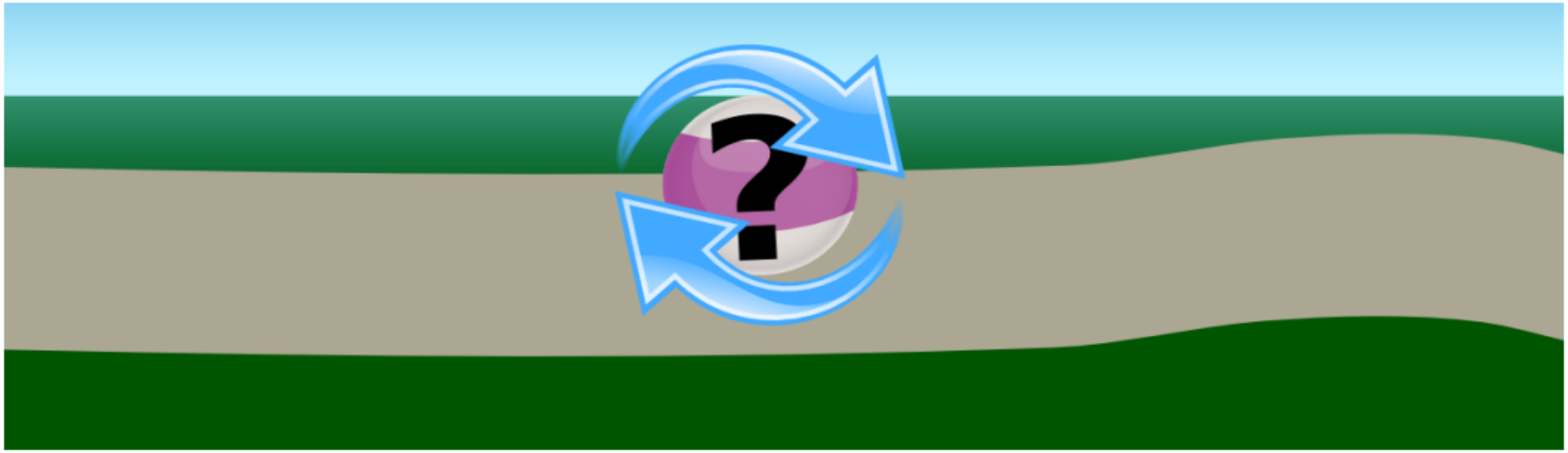

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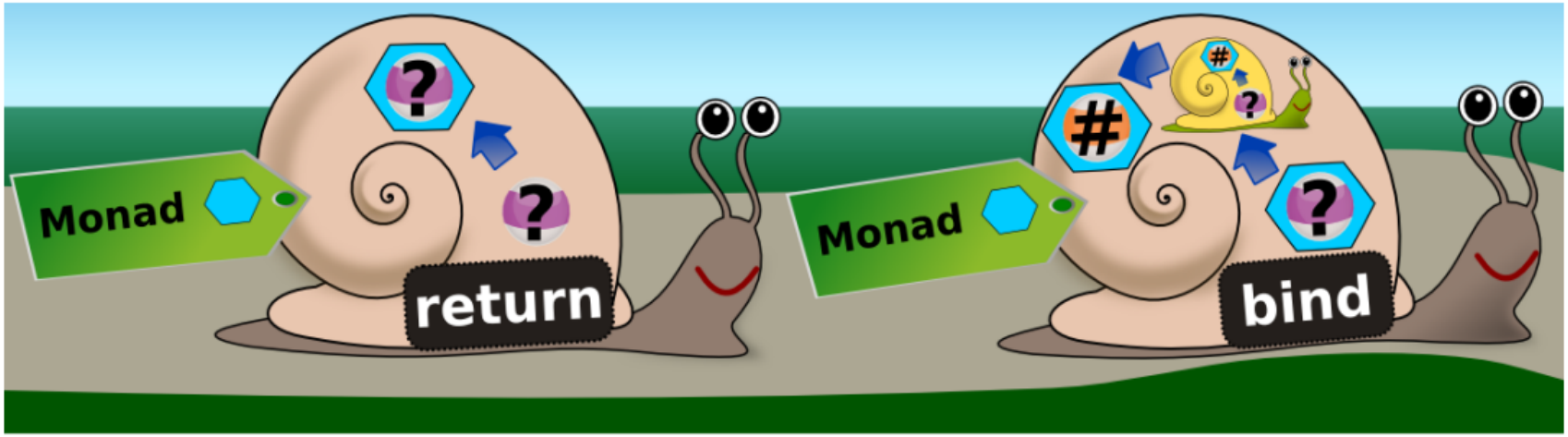

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ghci> :info Monad
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ghci> ["walk","nap","fight"] >>= (\t -> return ("cat" ++ t))
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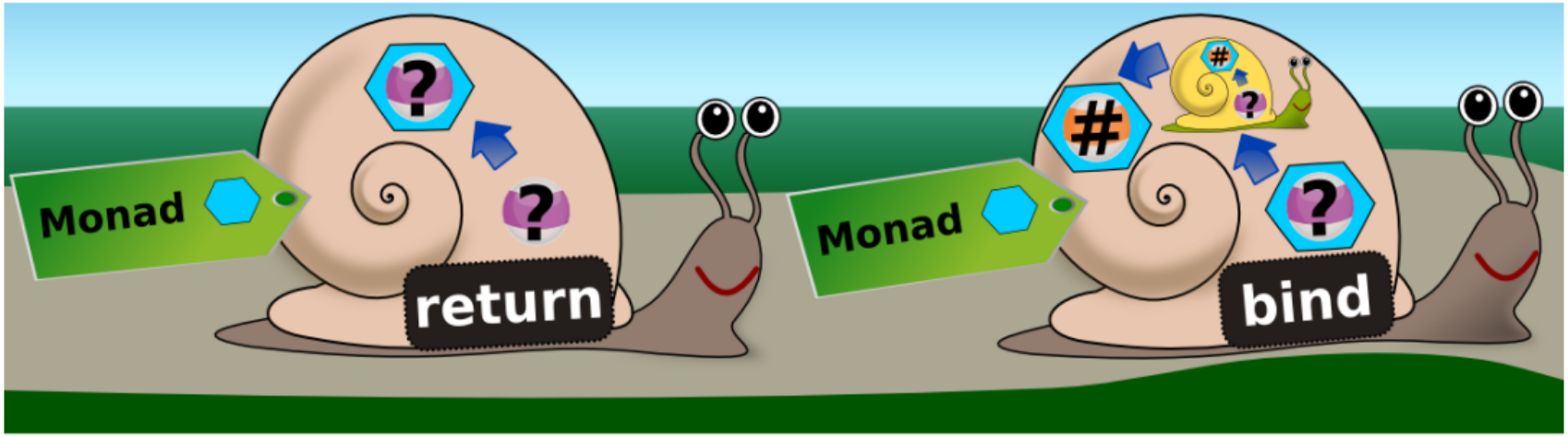

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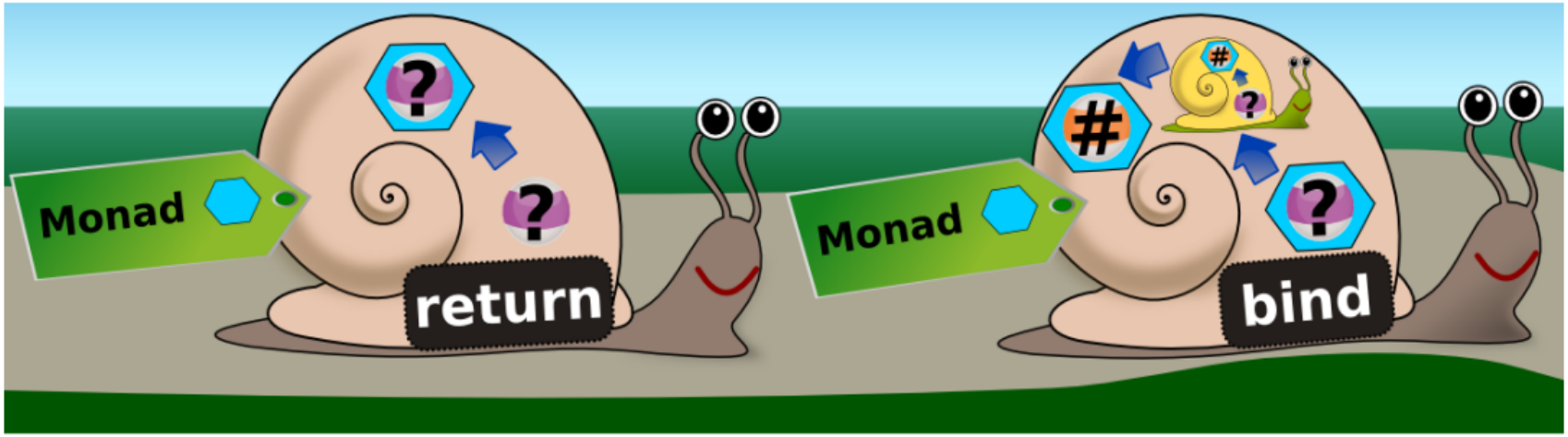

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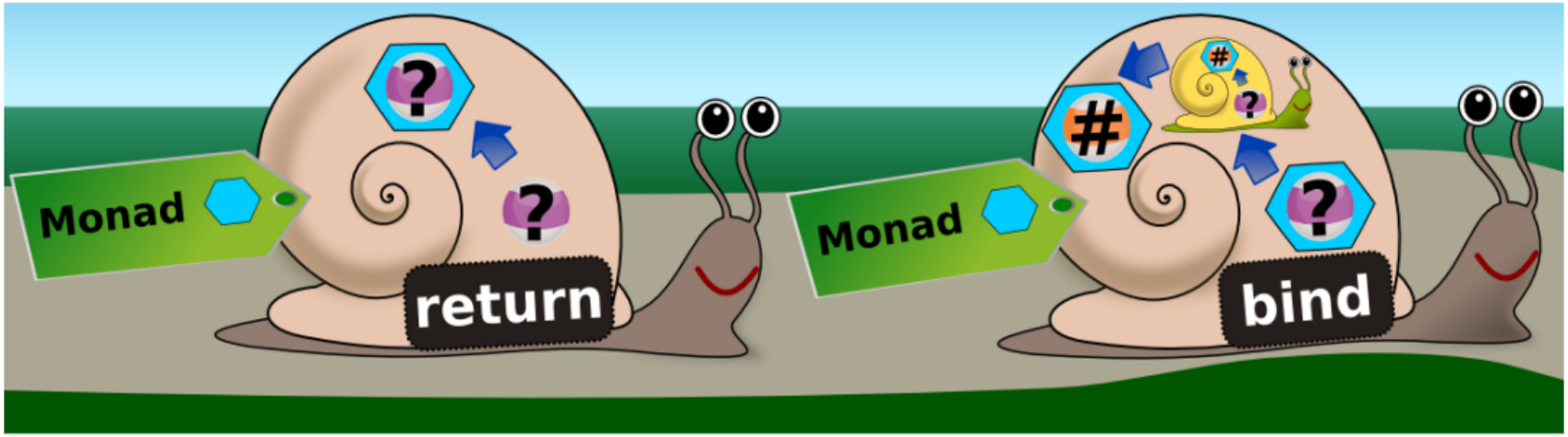

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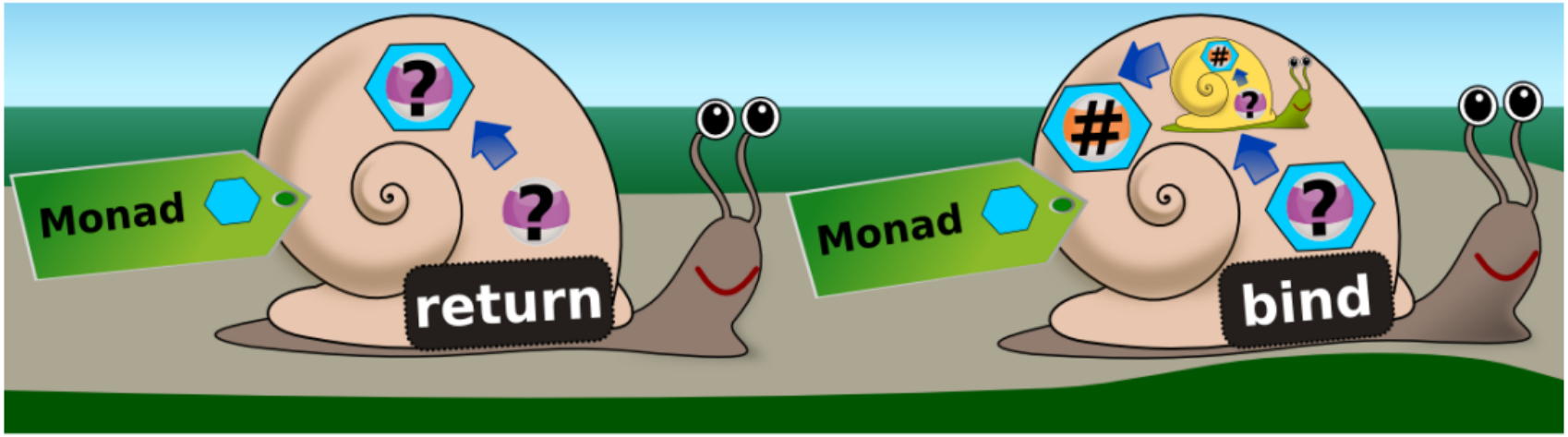

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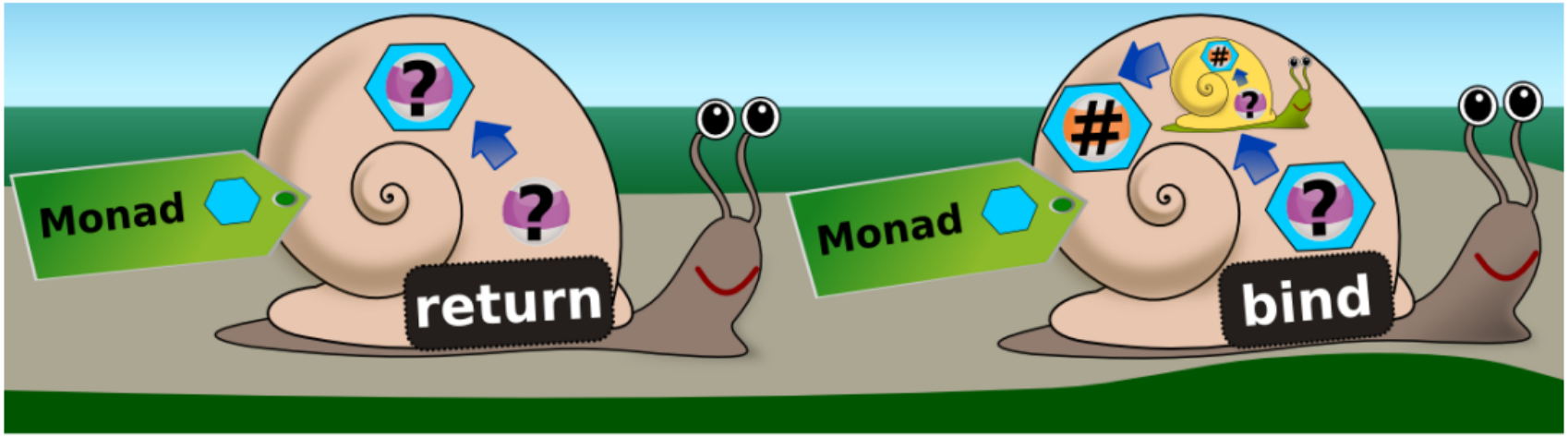

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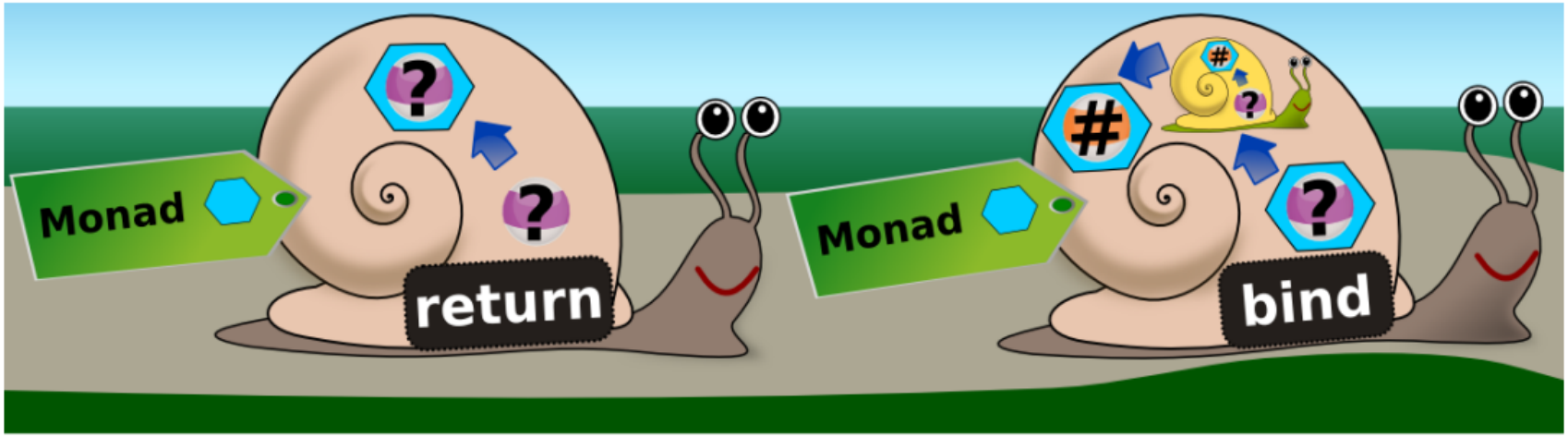

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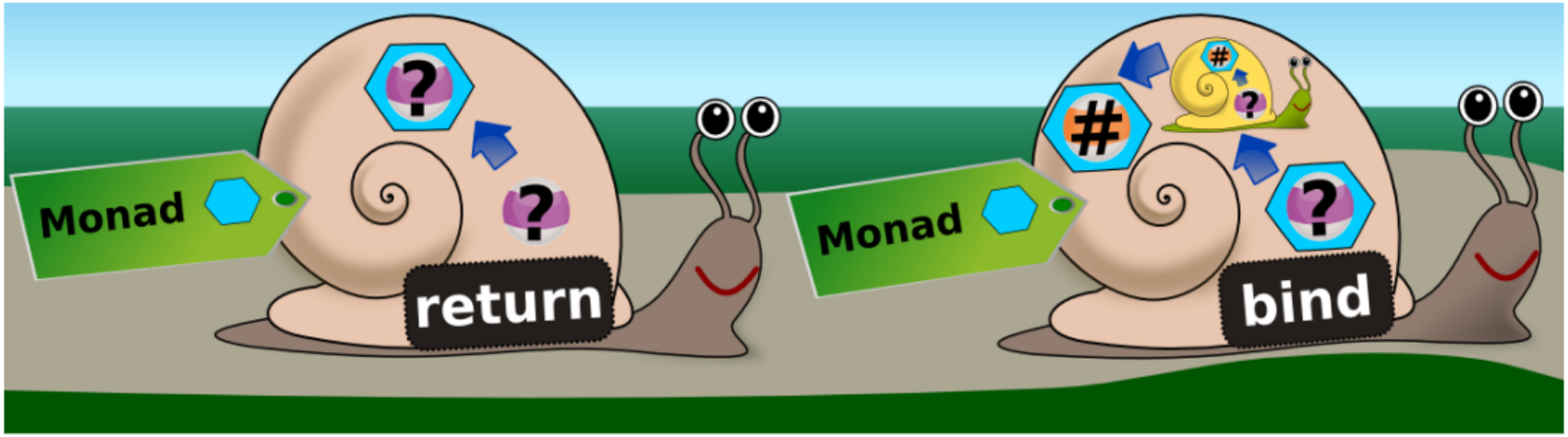

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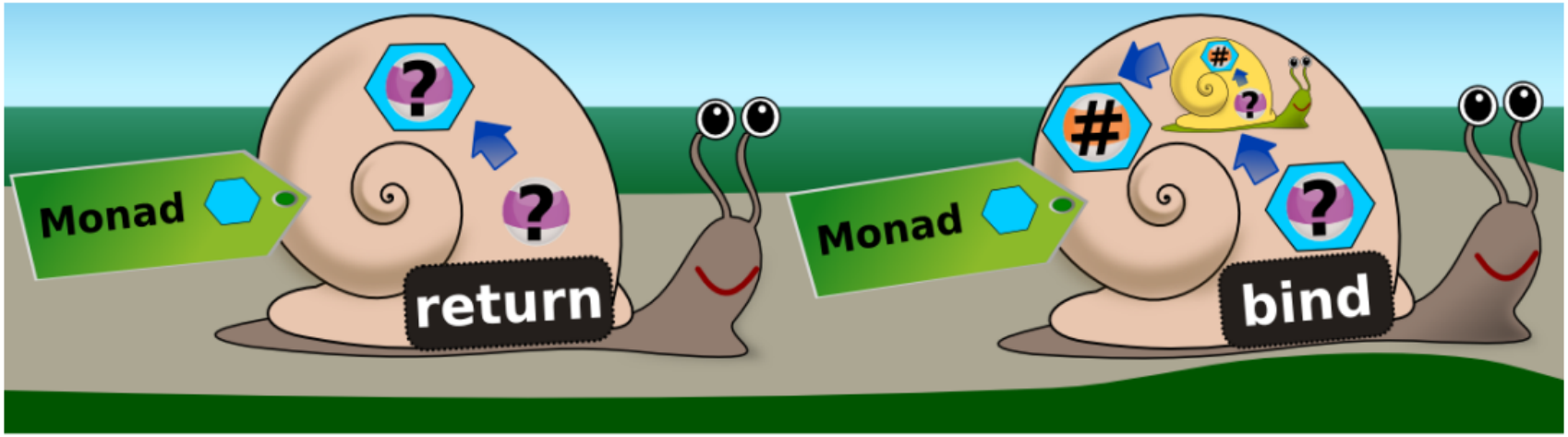

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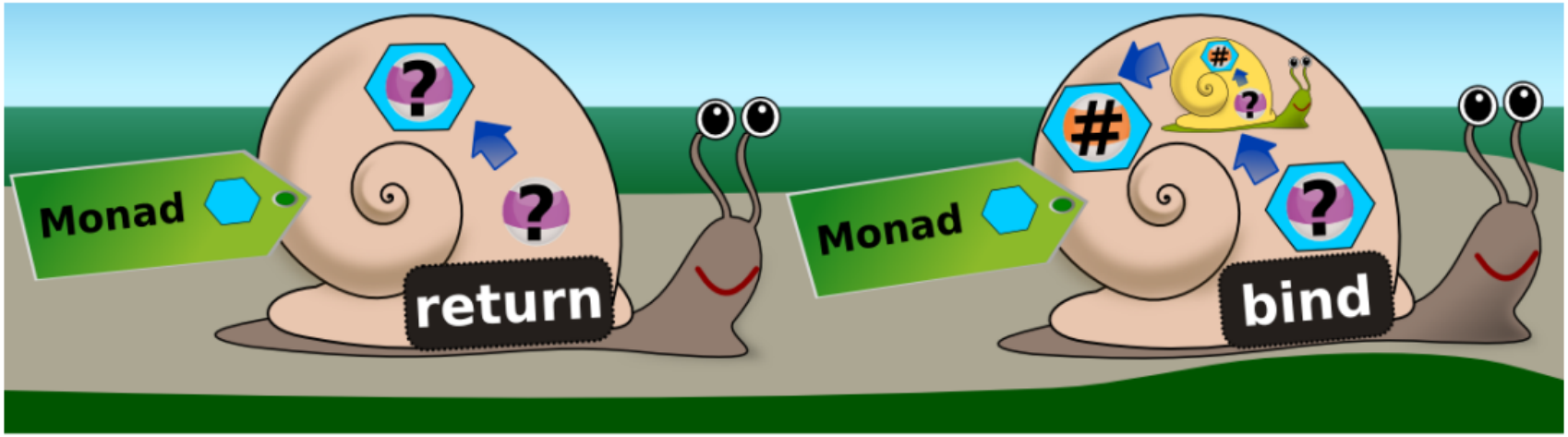

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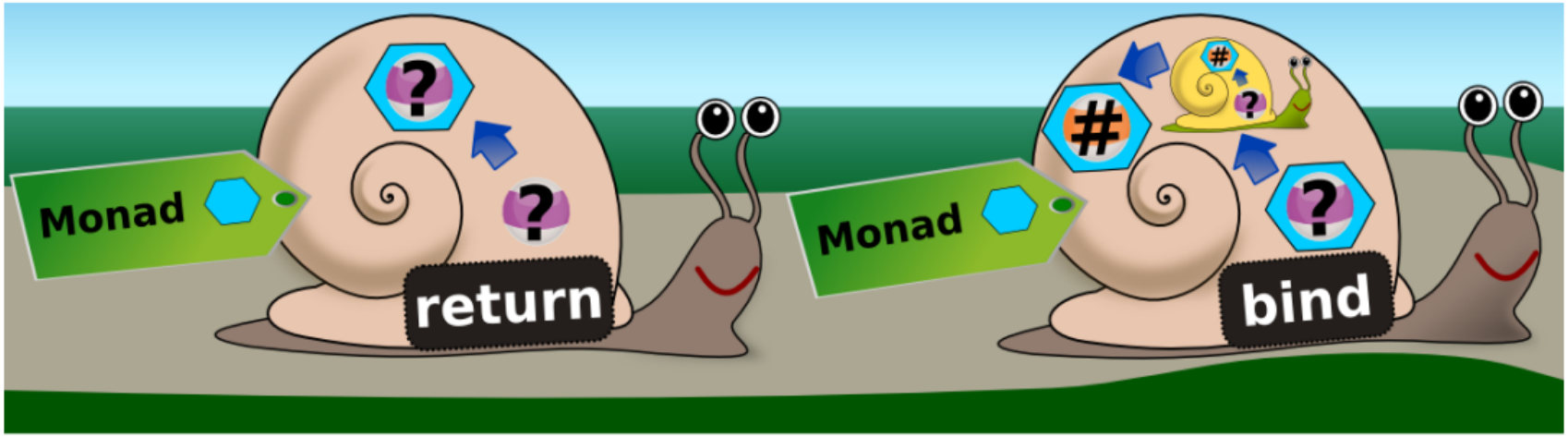

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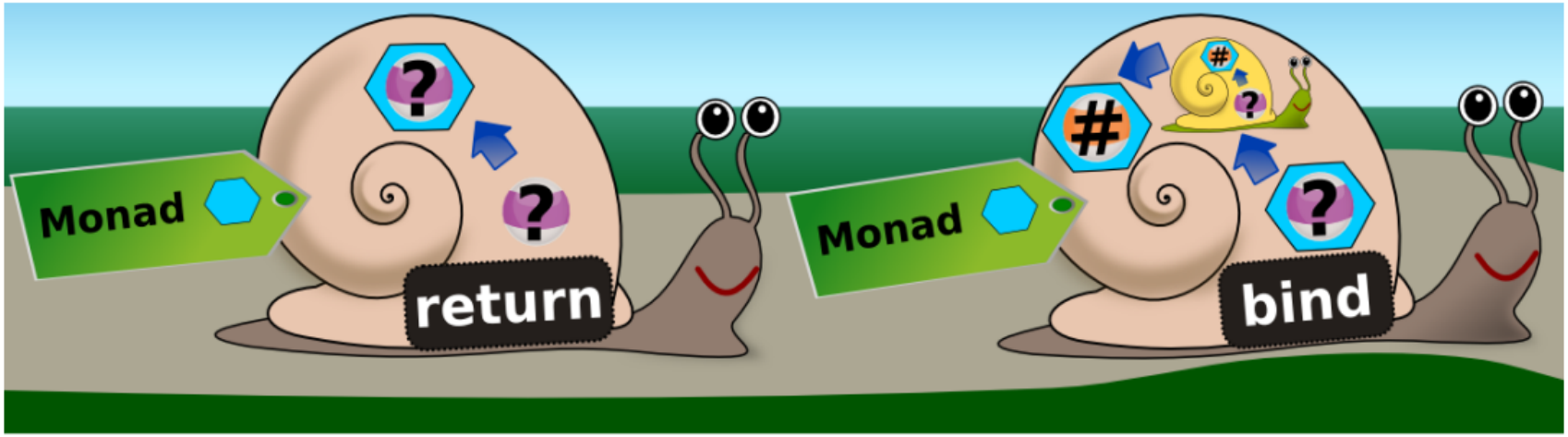

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  return :: a -> m a
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ghci> ["walk","nap","fight"] >>= (\t -> return ("cat" ++ t))
["catwalk","catnap","catfight"]
ghci> ["walk","nap","fight"] >>= (\t -> ["cat","dog"] >>= (\a -> return (a ++ t)))
["catwalk","dogwalk","catnap","dognap","catfight","dogfight"]
```

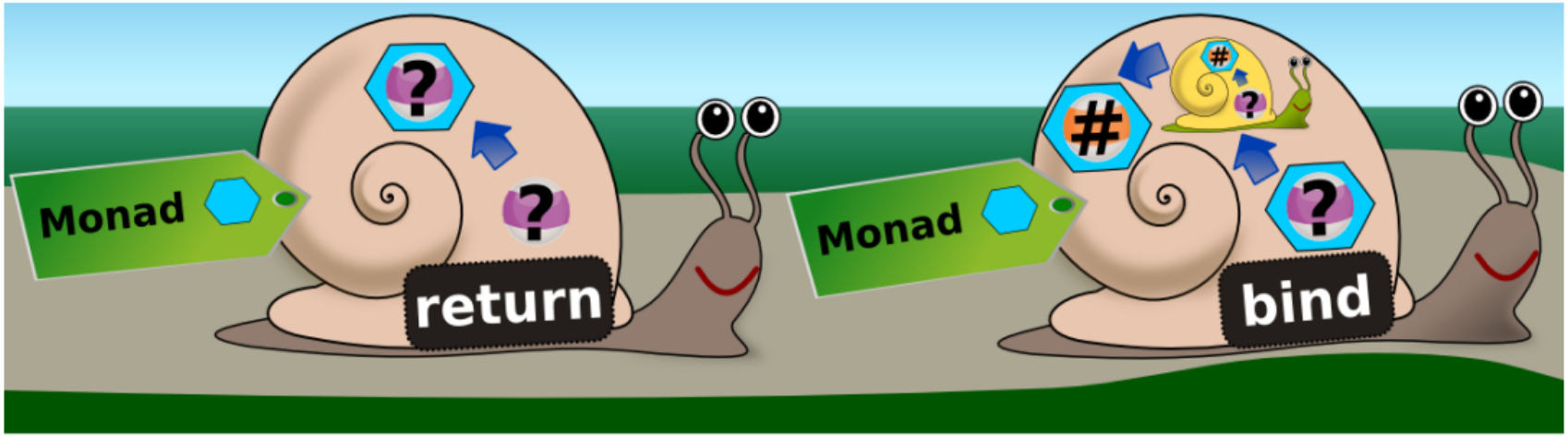


dbConn :: IO Connection
dbConn = dbConnInfo >>= connect

```
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```
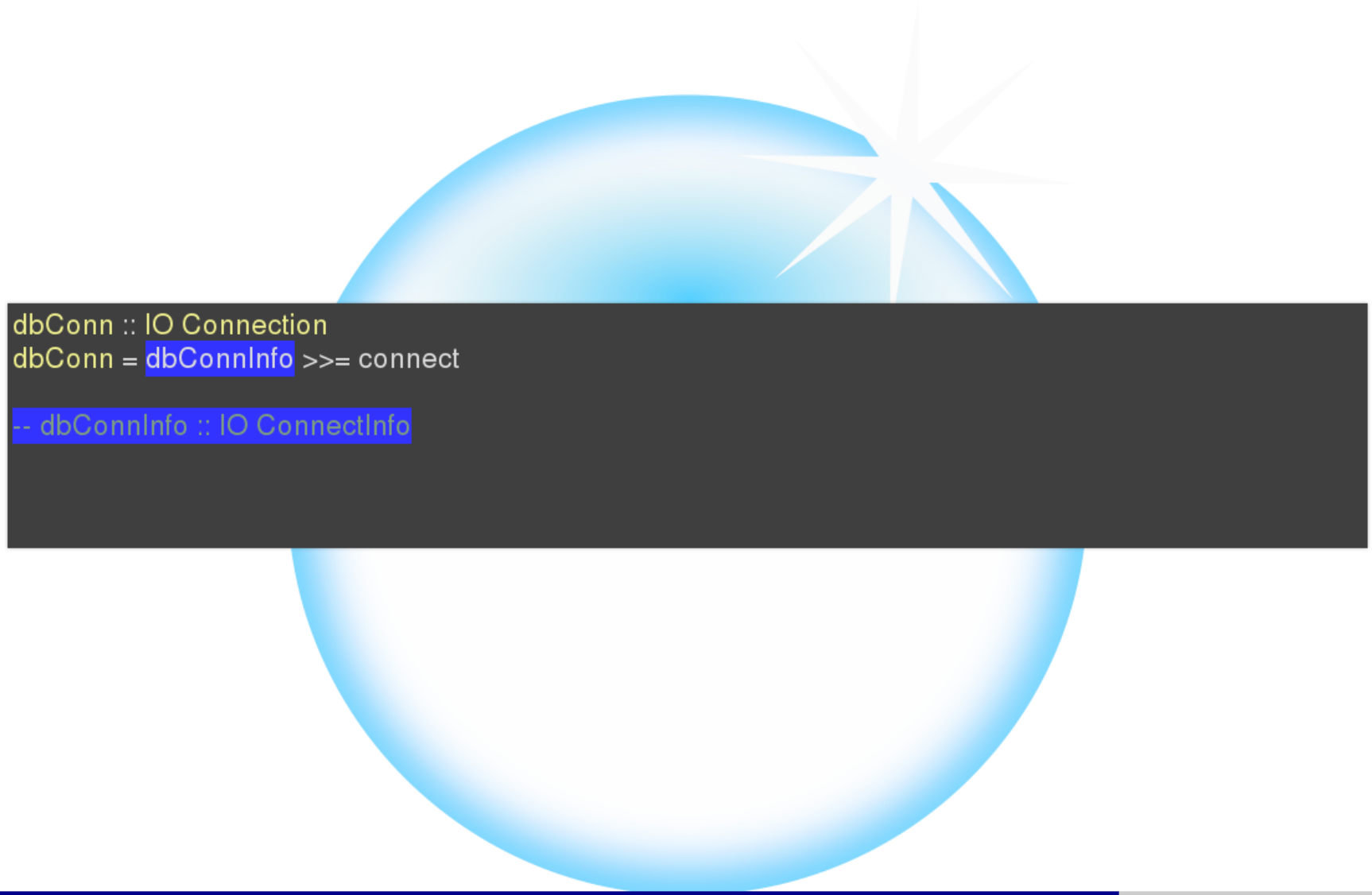
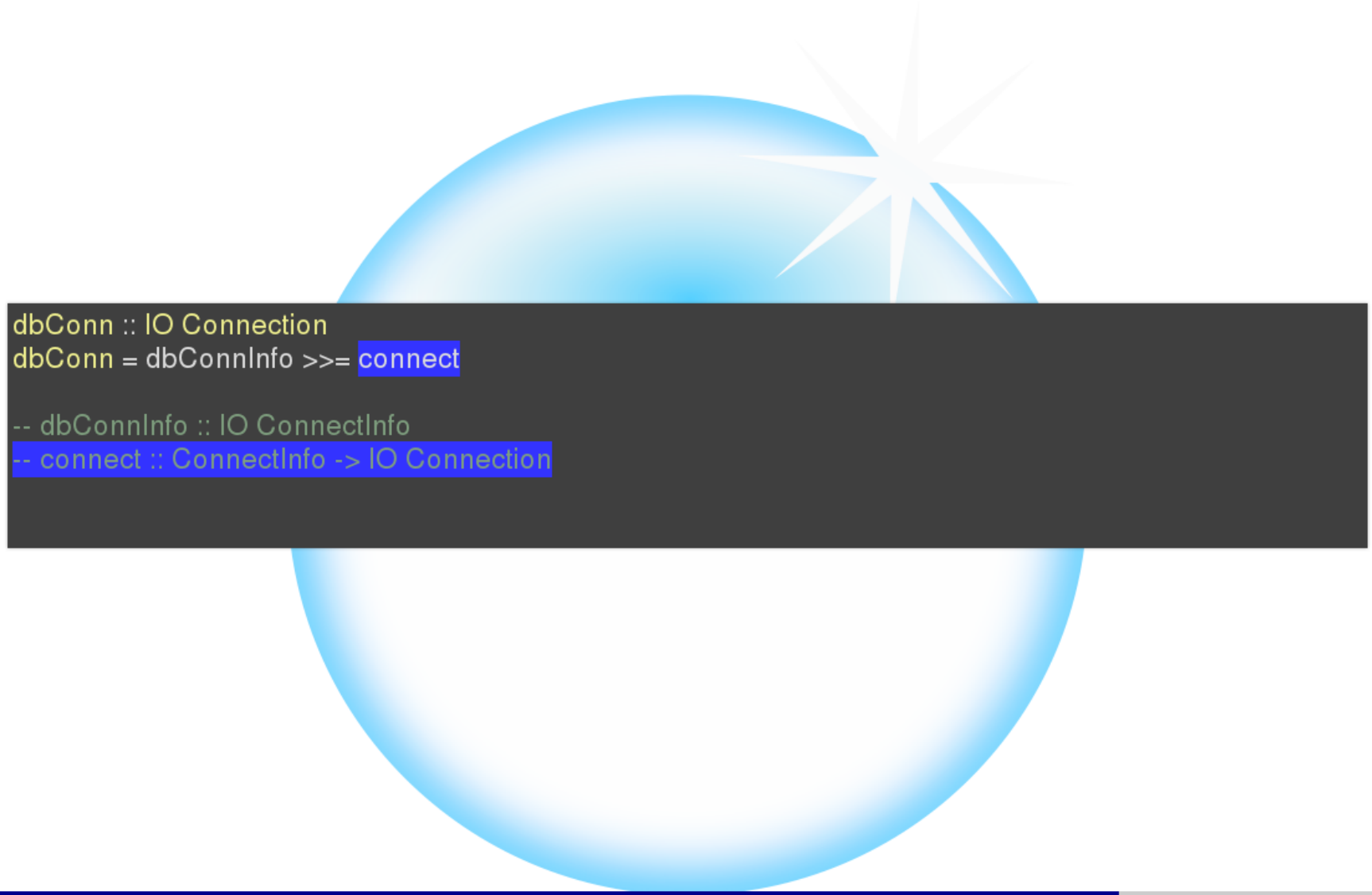
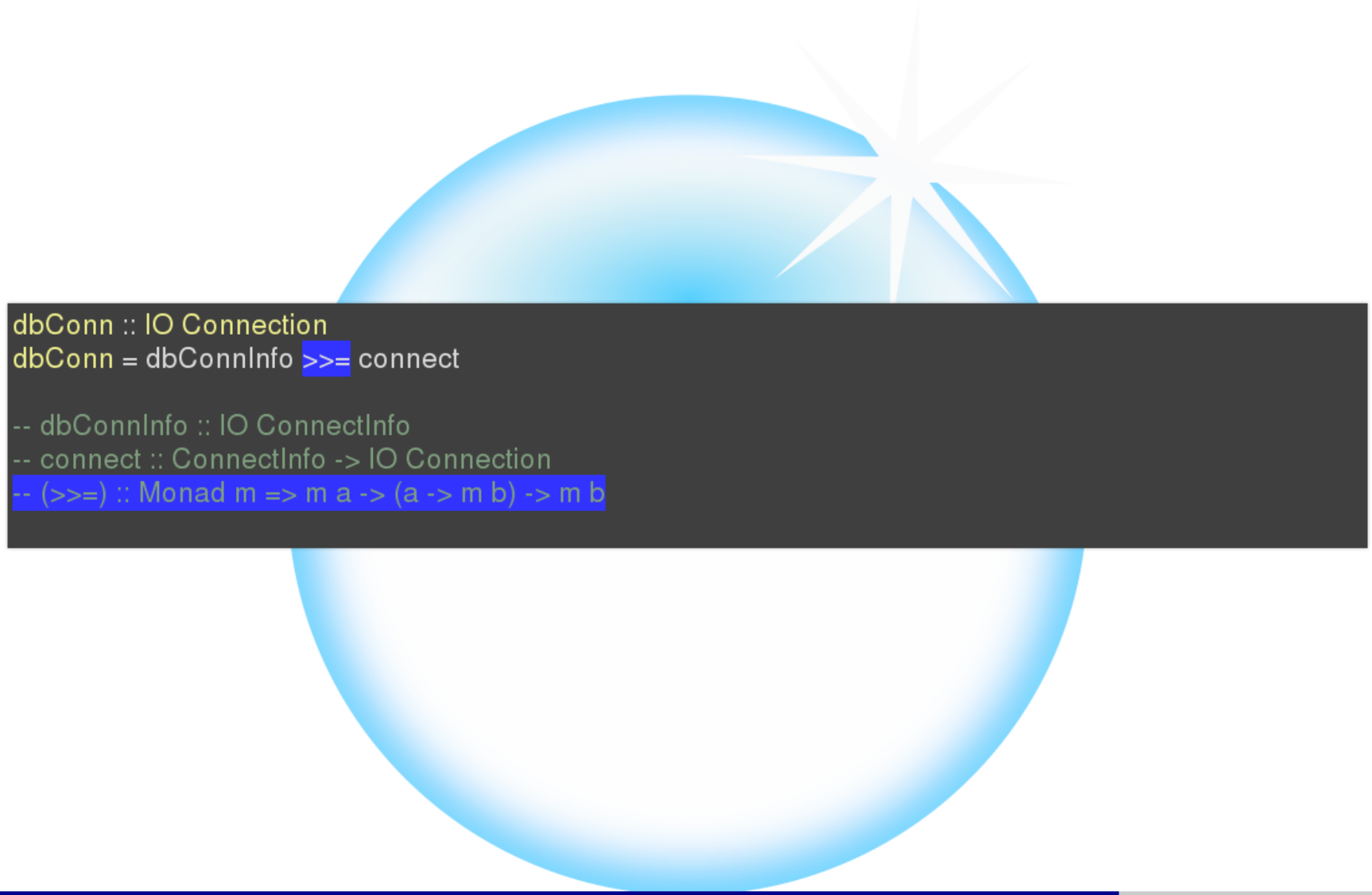


dbConn :: IO Connection
dbConn = dbConnInfo >>= connect
-- dbConnInfo :: IO ConnectInfo


dbConn :: IO Connection
dbConn = dbConnInfo >>= connect
-- dbConnInfo :: IO ConnectInfo
-- connect :: ConnectInfo -> IO Connection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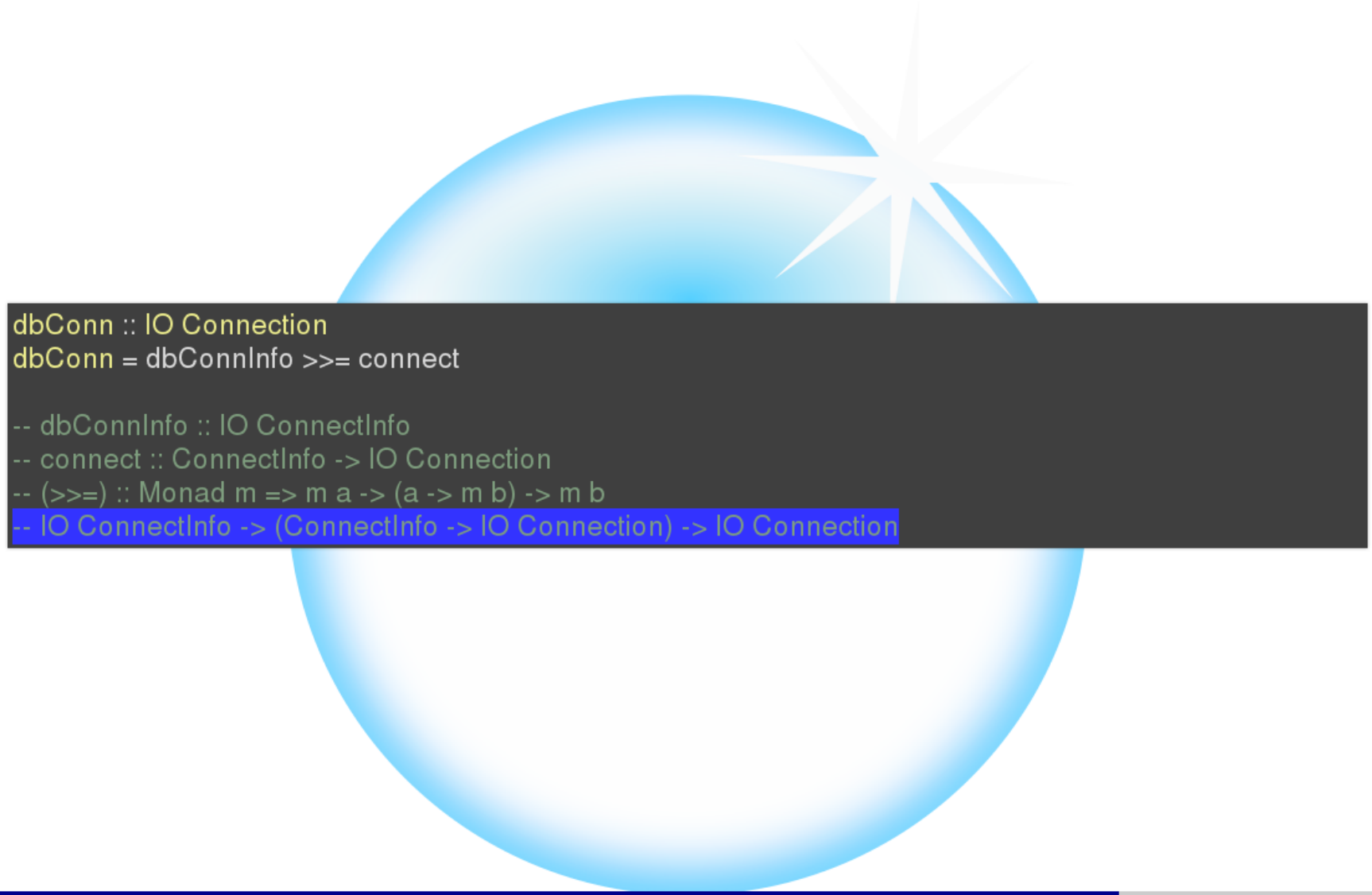
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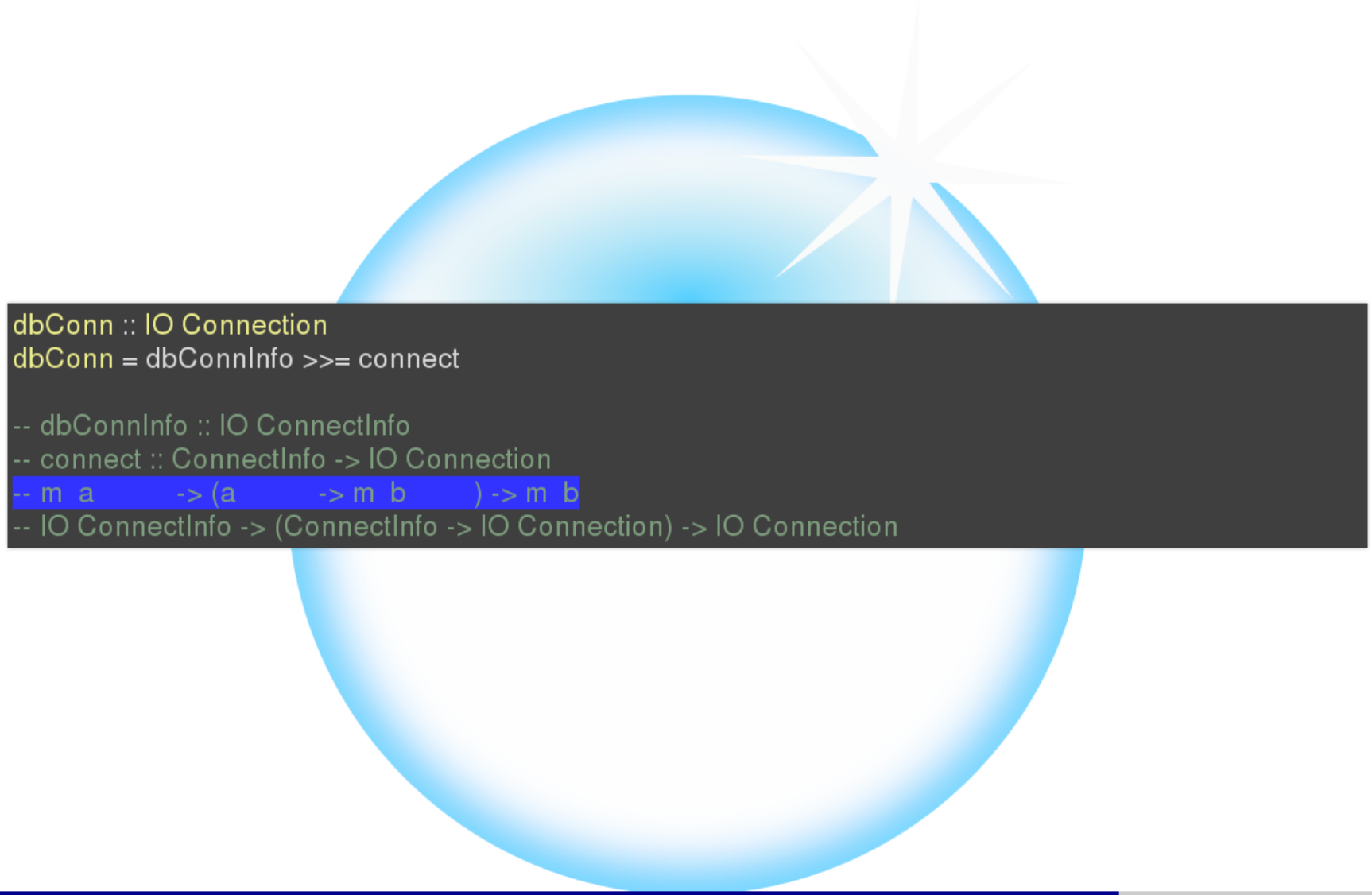
dbConn :: IO Connection
dbConn = dbConnInfo >>= connect
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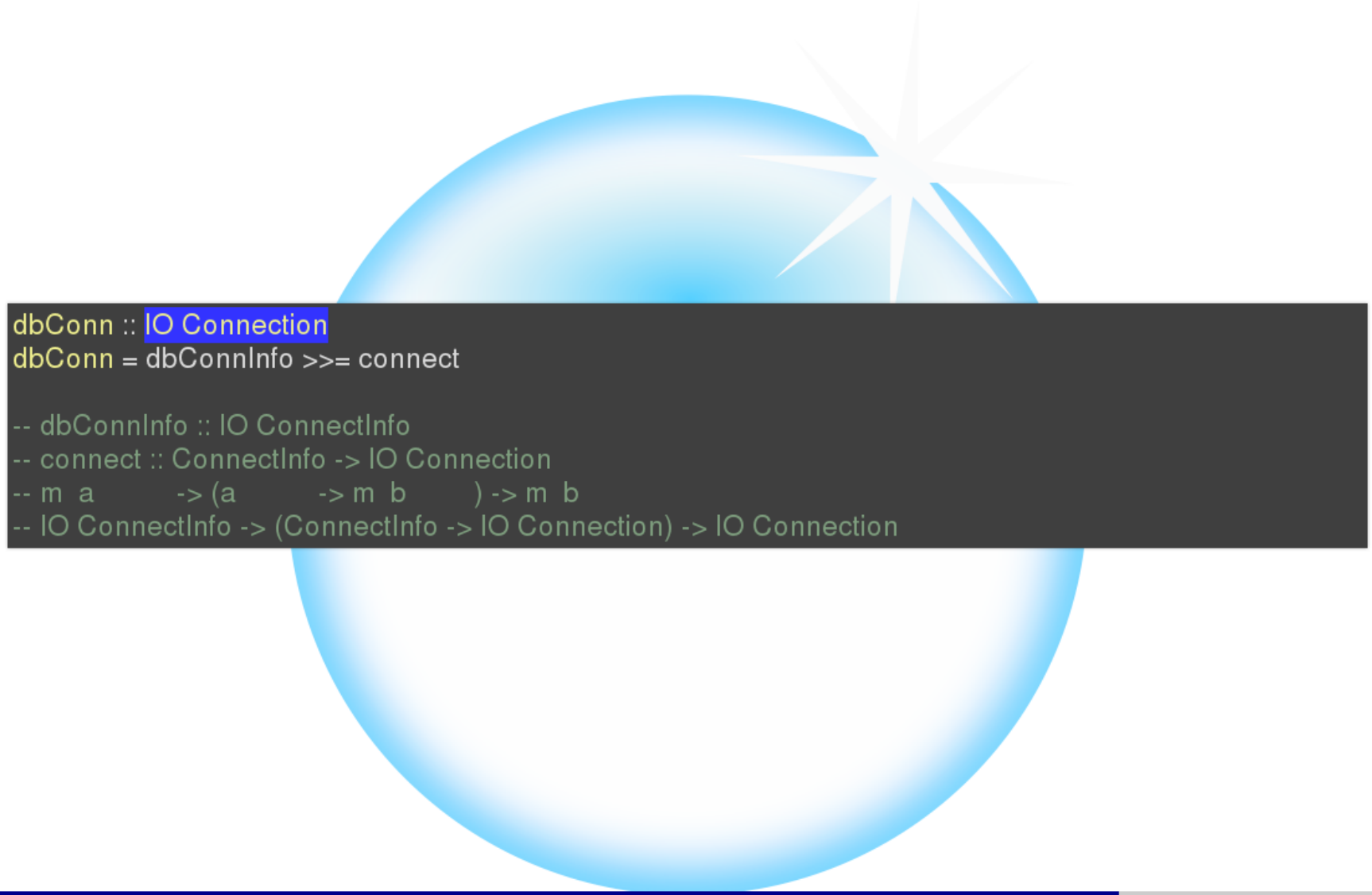
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Lens

WHAT: Data structure for accessing and mutating values in a data type

WHY: Provides concise, functional way of drilling down into data types to get or set

```haskell
-- data Lens target field =
--     Lens {
--         get :: target -> field,
--         set :: target -> field -> target
--     }
```

```
-- data Lens target field =
--     Lens {
--         get :: target -> field,
--         set :: target -> field -> target
--     }
ghci> :info Lens
type Lens s t a b = Functor f => (a -> f b) -> s -> f t
...
```

```
-- dog = Dog { _name = Name { _firstName = "Scooby", _lastName = "Da" } }
-- cat = Cat { _archEnemy = dog }
-- mouse = Mouse { _food = "cheddar" }
```

```
-- dog = Dog { _name = Name { _firstName = "Scooby", _lastName = "Da" } }
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ghci> cat^.archEnemy^.name^.firstName
```

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-- dog = Dog { _name = Name { _firstName = "Scooby", _lastName = "Da" } }
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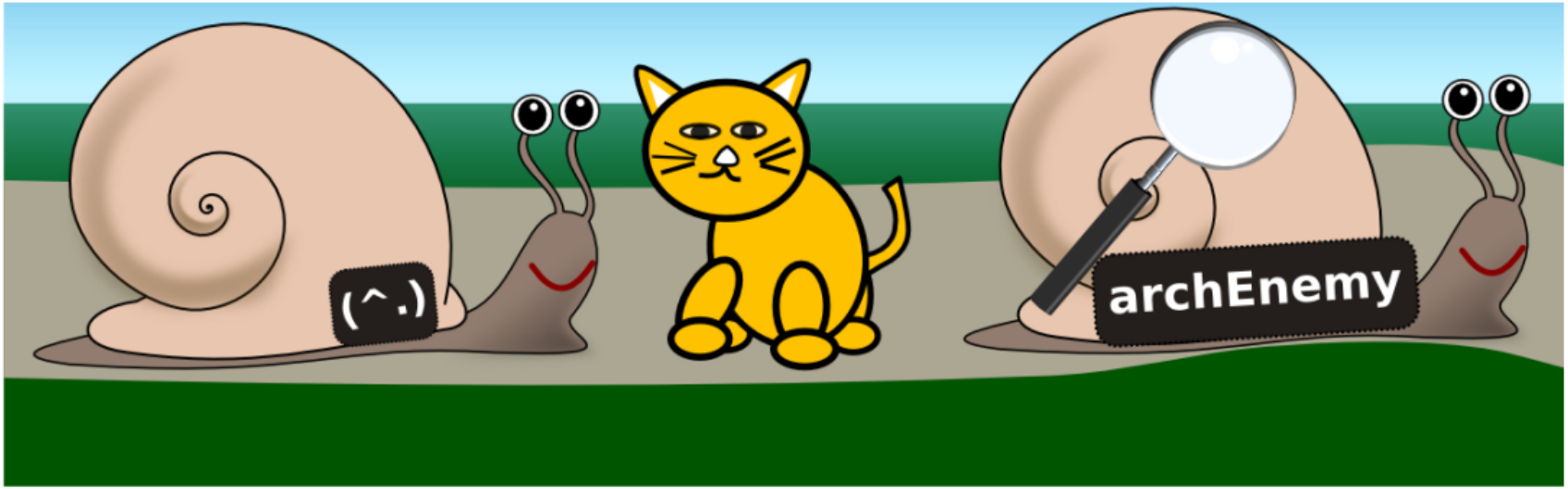

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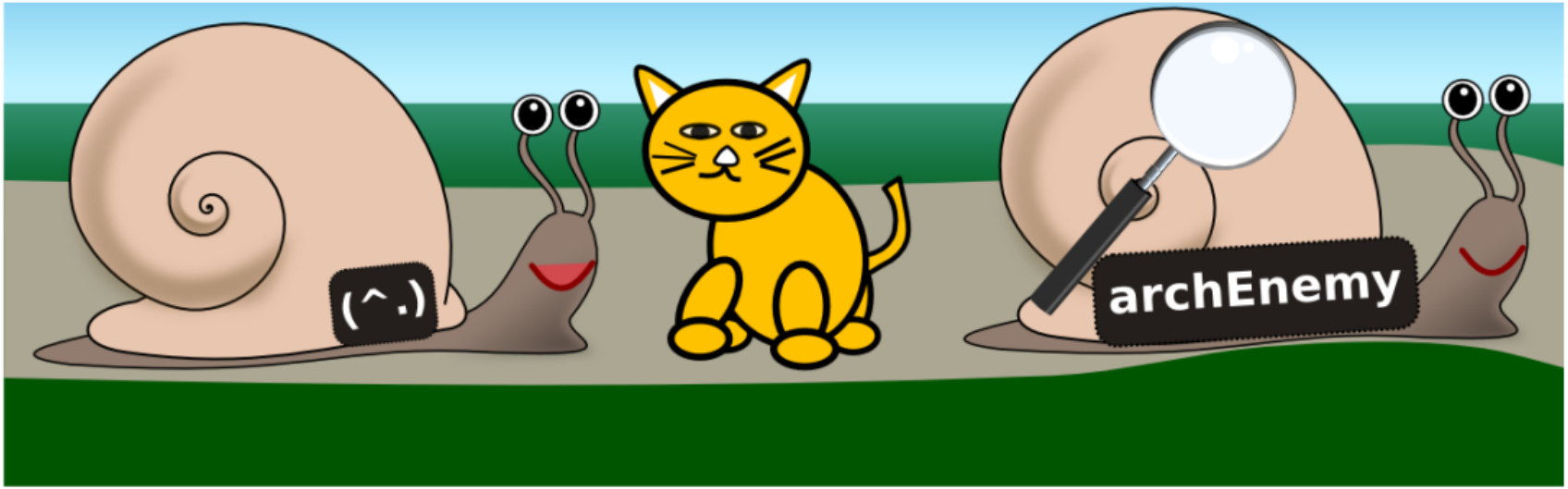

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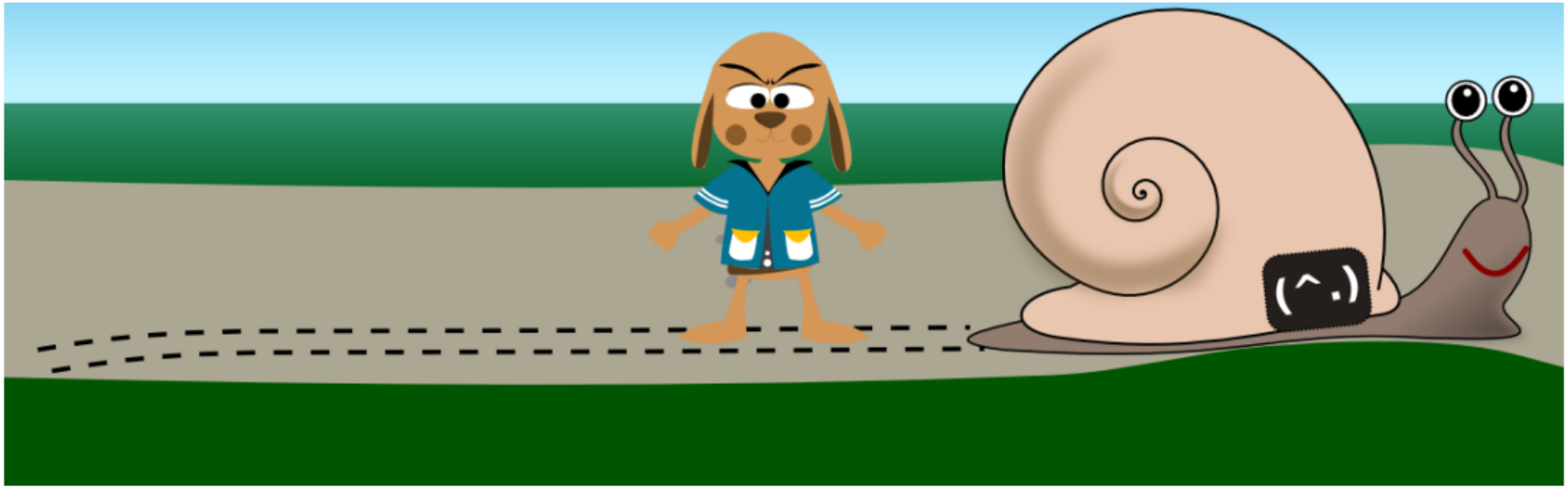

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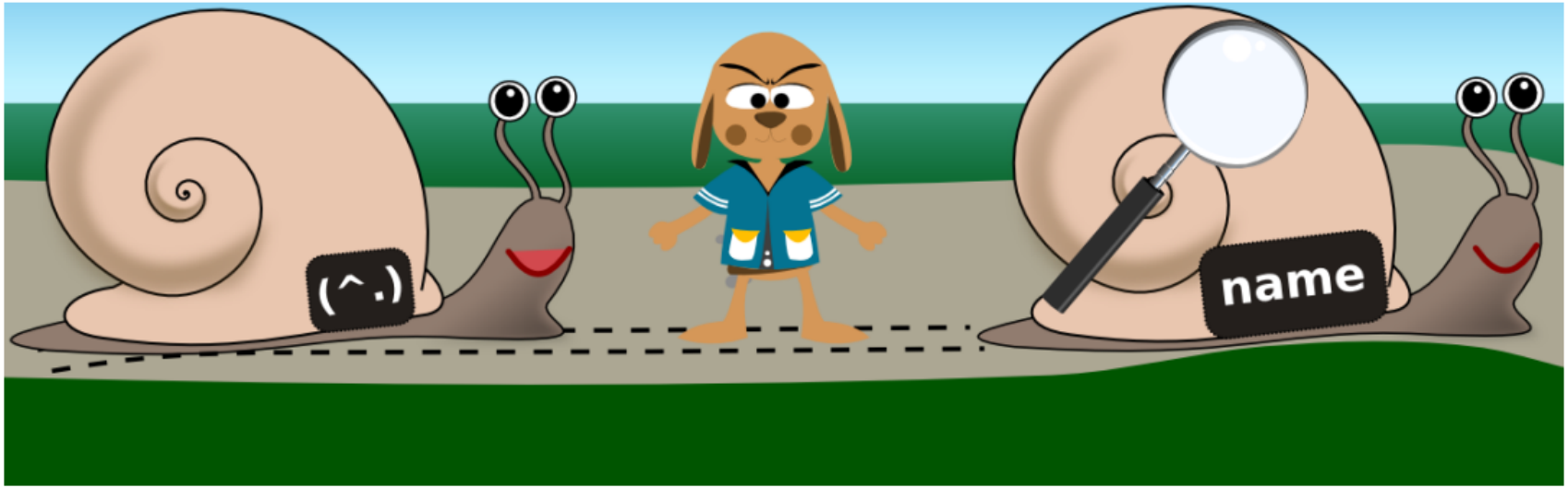

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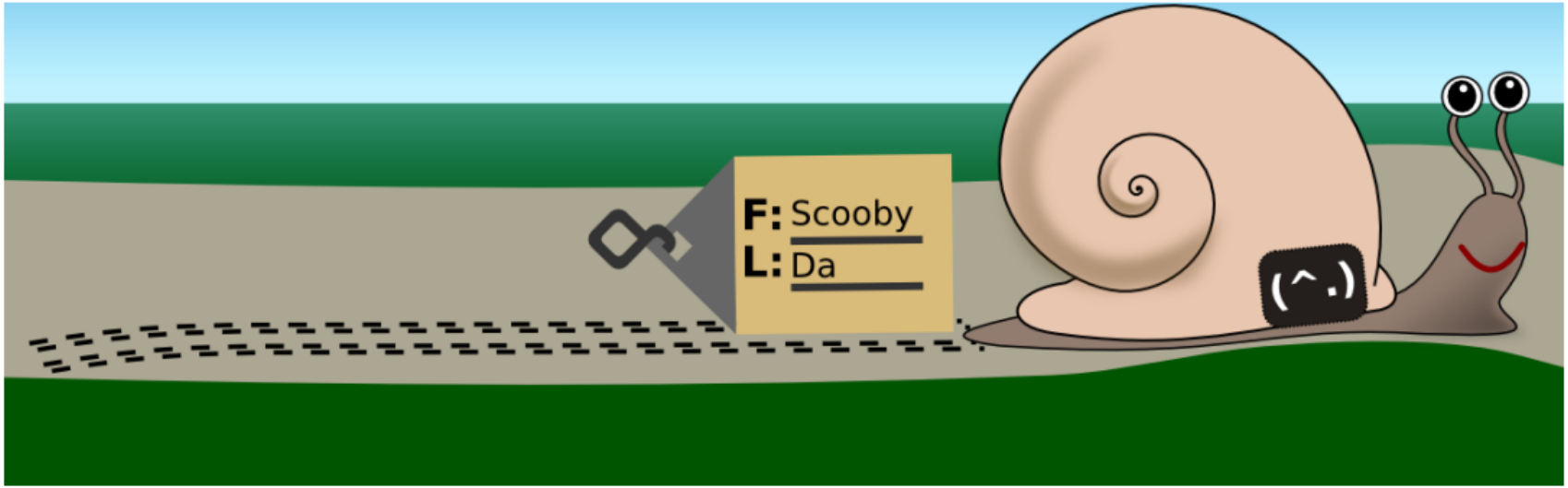

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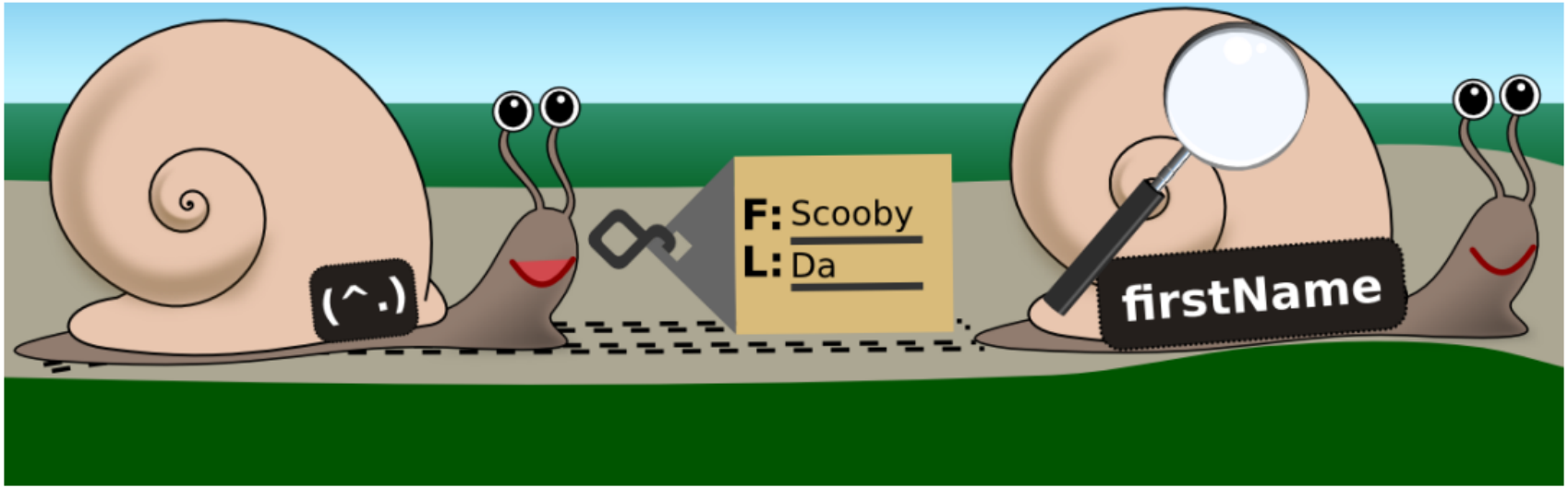

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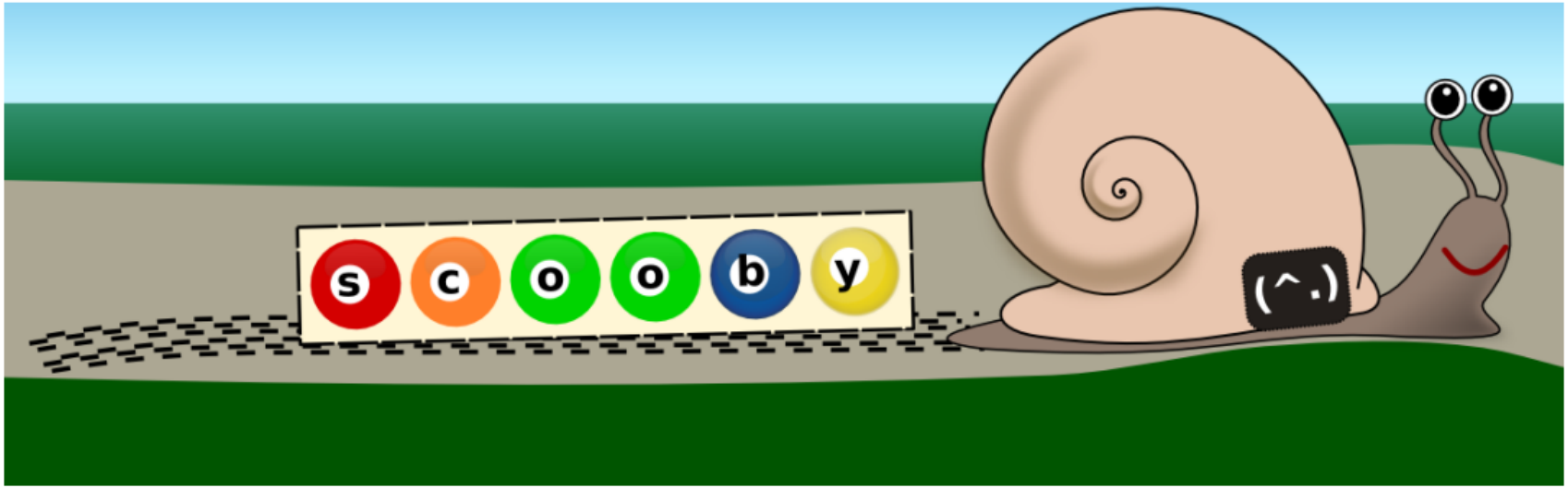

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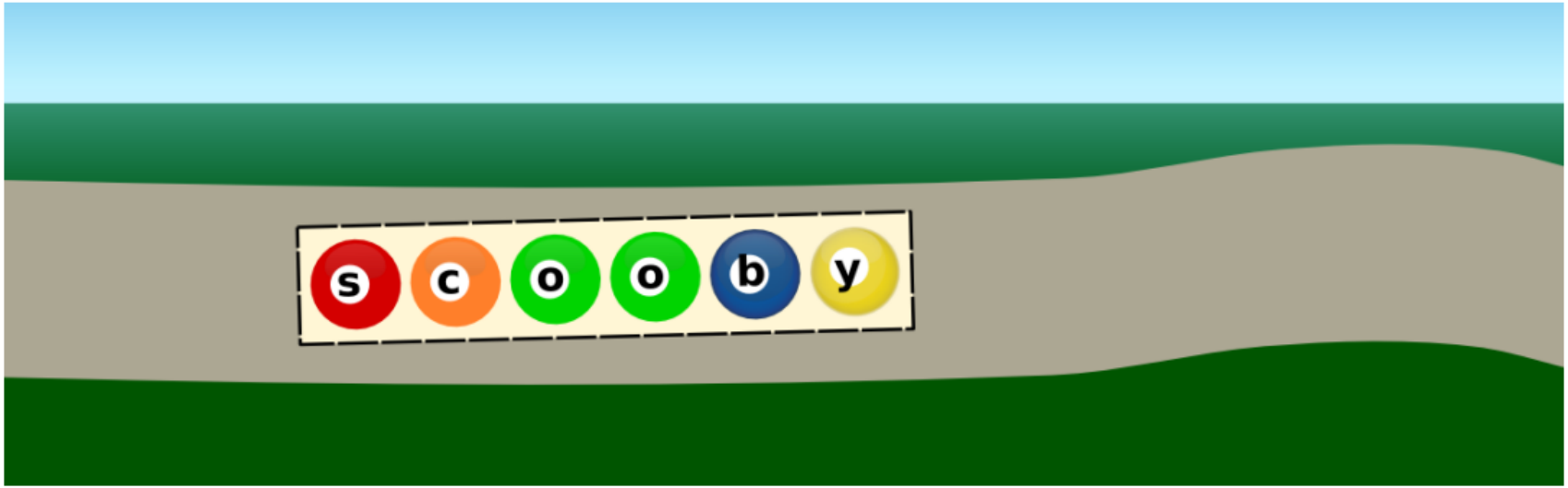
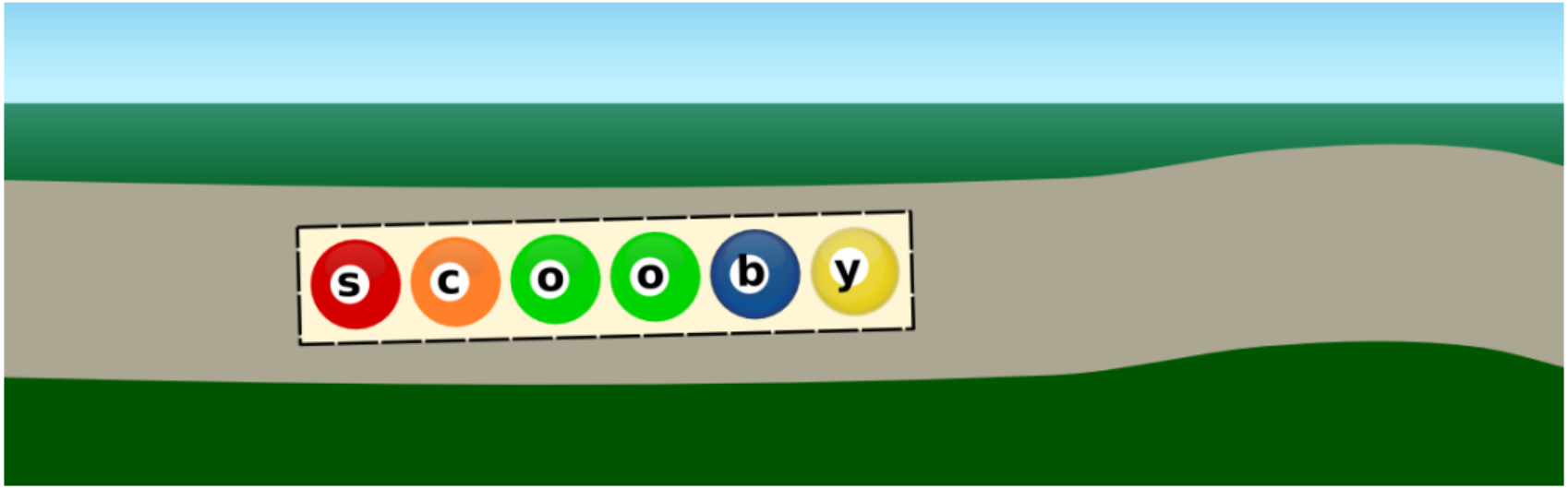
"Scooby"
```



```
-- dog = Dog { _name = Name { _firstName = "Scooby", _lastName = "Da" } }
-- cat = Cat { _archEnemy = dog }
-- mouse = Mouse { _food = "cheddar" }

ghci> cat^.archEnemy^.name^.firstName
"Scooby"
ghci> set archEnemy mouse cat
```



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ghci> cat^.archEnemy^.name^.firstName
"Scooby"
ghci> set archEnemy mouse cat
Cat {_archEnemy = Mouse {_food = "cheddar"}}
```

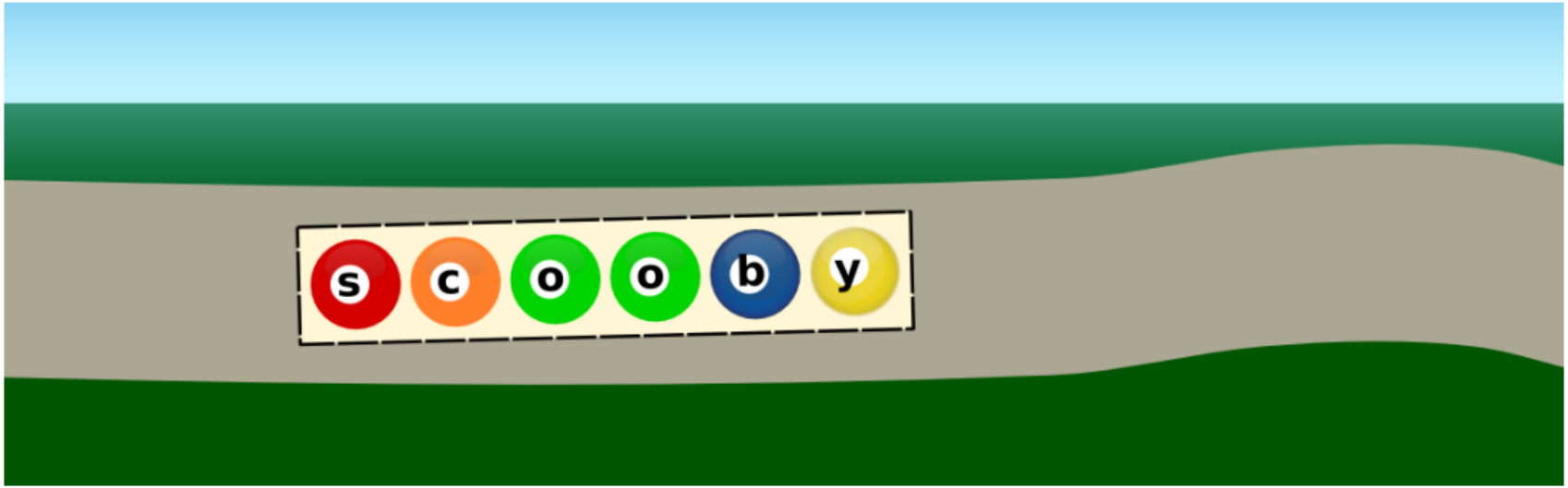

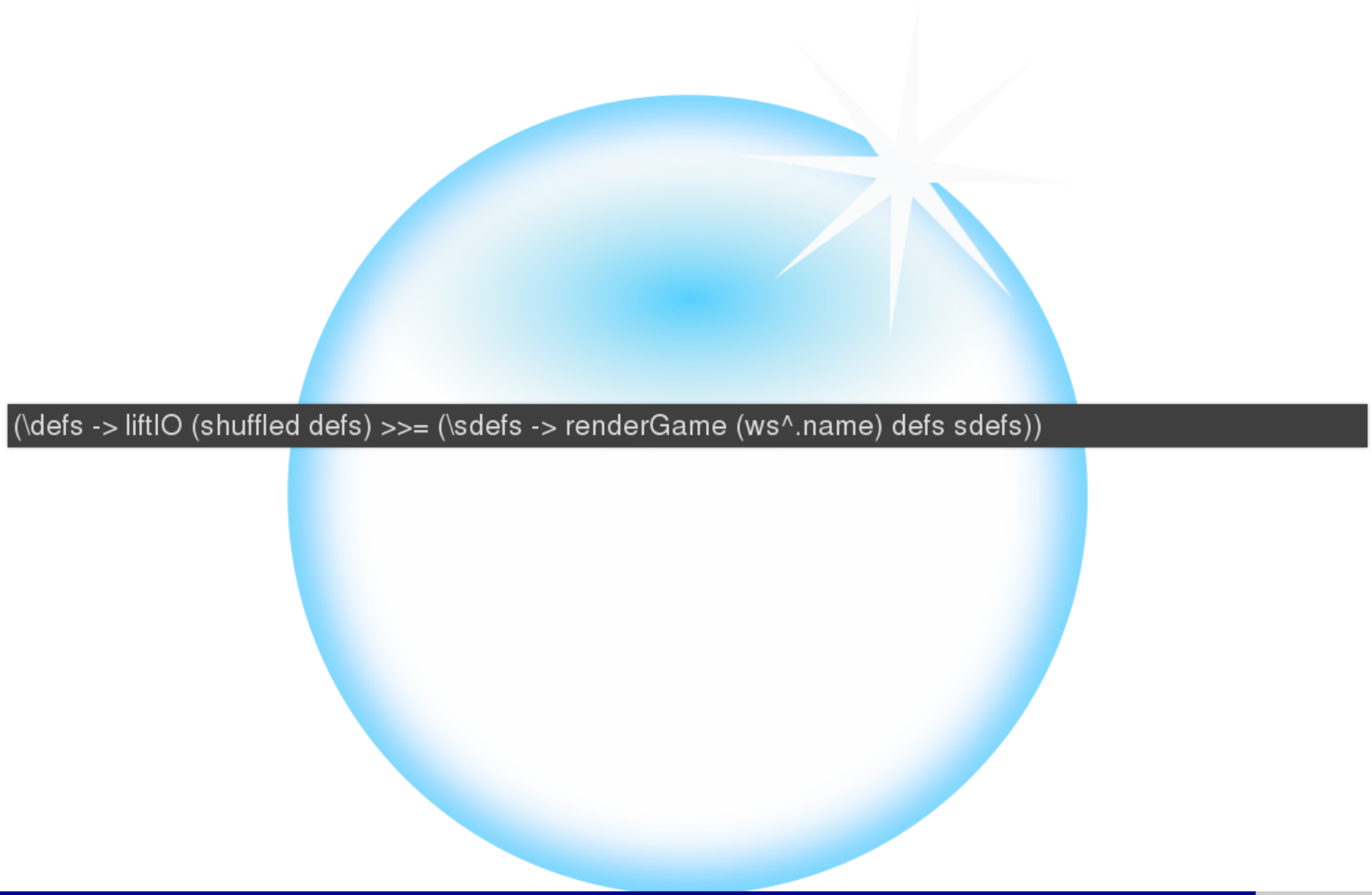
(\defs -> liftIO (shuffled defs) >>= (\sdefs -> renderGame (ws^.name) defs sdefs))


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Conclusion

References, Resources, and Credits

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Image Credits

- Book Snake [cropped] (Alan Levine, CC BY-SA 2.0)
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Coder Decoder

http://decoder.codemiller.com

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