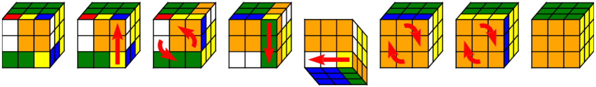
Lenses und Zauberwürfel

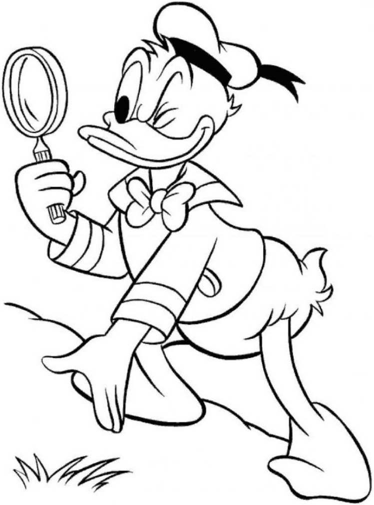


Tim Baumann

Curry Club Augsburg
13. August 2015

Wo kann ich mehr über `lens` erfahren?

- **Das Lens-Wiki:** `https://github.com/ekmett/lens/wiki`
- Blogserie “Lens over Tea” `http://artyom.me/lens-over-tea-1`
- Vortrag von Simon Peyton Jones bei Skills Matter
- Vortrag von Edward Kmett:
  “The Unreasonable Effectiveness of Lenses for Business Applications”
- Blogpost: “Program imperatively using Haskell lenses”
- School of Haskell: “A Little Lens Starter Tutorial”
- Cheat Sheet für `Control.Lens`:
  `https://github.com/anchor/haskell-cheat-sheets`



`http://timbaumann.info/lens`
`https://github.com/timjb/presentations/tree/gh-pages/lens`

Plated

Plated

```haskell
data Inline
  = Str String
  | Emph [Inline]
  | Math MathType String
  | Link [Inline] Target
  | Image [Inline] Target
    ...
  deriving (..., Typeable, Data, Generic)

data Block
  = Para [Inline]
  | BlockQuote [Block]
  | BulletList [[Block]]
  | Header Int Attr [Inline]
    ...
  deriving (..., Typeable, Data, Generic)

data Pandoc = Pandoc Meta [Block]
  deriving (..., Typeable, Data, Generic)
```

Anwendung: Ausnahmebehandlung

```
class (Typeable e, Show e) => Exception e where ...
data SomeException = forall e. Exception e => SomeException e
handle :: Exception e => (e -> IO a) -> IO a -> IO a

handle (\(exc :: AssertionFailed) -> return "caught")
       (assert (2+2 == 3) (return "uncaught"))
⇝ "caught"

handle (\(exc :: AssertionFailed) -> return "caught")
       (assert (2+2 == 4) (return "works"))
⇝ "works"
```

Es ist doof, dass man das Argument im Exception-Handler mit einem Typ annotieren muss. Doch zum Glück gibt es `Control.Exception.Lens`!

Anwendung: Ausnahmebehandlung

```
import Control.Exception.Lens
catching :: MonadCatch m => Prism' SomeException a
         -> m r -> (a -> m r) -> m r

catching _AssertionFailed (assert (2+2 == 3) (return "uncaught"))
                          (const (return "caught"))
⇝ "caught"

catching _AssertionFailed (assert (2+2 == 4) (return "works"))
                          (const (return "caught"))
⇝ "works"
```

In `Control.Exception.Lens` sind ganz viele `Prisms` vordefiniert:

```
_IndexOutOfBounds  :: Prism' SomeException String
_StackOverflow     :: Prism' SomeException ()
_UserInterrupt     :: Prism' SomeException ()
_DivideByZero      :: Prism' SomeException ArithException
_AssertionFailed   :: Prism' SomeException String
-- (usw)
```

Anwendung: Defaultparameter

Angenommen, wir schreiben eine HTTP-Library (Beispiel geklaut von Oliver Charles)

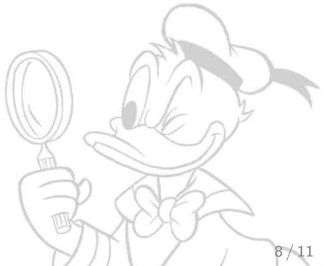
```haskell
data HTTPSettings = HTTPSettings
  { _httpKeepAlive :: Bool
  , _httpCookieJar :: CookieJar
  } deriving (Show, ...)
makeLenses ''HTTPSettings

defaultHTTPSettings :: HTTPSettings
defaultHTTPSettings = HTTPSettings True emptyCookieJar

httpRequest :: HTTPSettings -> HTTPRequest -> IO Response
instance Default HTTPSettings where
  def = defaultHTTPSettings

httpRequest
  (def & httpKeepAlive .~ True
       & httpCookieJar .~ myCookieJar)
  aRequest
```

Kritik: `Default` ist eine gesetzlose Typklasse!



Anwendung: Defaultparameter

Angenommen, wir schreiben eine HTTP-Library (Beispiel geklaut von Oliver Charles)

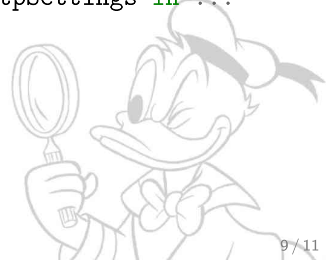
```
data HTTPSettings = HTTPSettings
  { _httpKeepAlive :: Bool
  , _httpCookieJar :: CookieJar
  } deriving (Show, ...)
makeLenses ''HTTPSettings

defaultHTTPSettings :: HTTPSettings
defaultHTTPSettings = HTTPSettings True emptyCookieJar

httpRequest :: State HTTPSettings a -> HTTPRequest -> IO Response
httpRequest mkState req =
  let config = execState mkConfig defaultHttpSettings in ...

httpRequest
  (do httpKeepAlive .= True
      httpCookieJar .= myCookieJar)
  aRequest
```

Besser!



Traversal1

Ein `Traversal1 s a` ist ein `Traversal s a`, dass immer mindestens über ein a iteriert. Dies lässt sich mit der Typklasse `Apply` umsetzen:

```
type Traversal1 s t a b = ∀ f. Apply f => (a -> f b) -> s -> f t
type Traversal1' s a = Traversal1 s s a a

class Functor f => Apply f where
  (<.>) :: f (a -> b) -> f a -> f b
```

Zur Erinnerung:

```
type Traversal s t a b = ∀ f. Applicative f => (a -> f b) -> s -> f t
type Traversal' s a = Traversal s s a a

class Functor f => Applicative f where
  (<*>) :: f (a -> b) -> f a -> f b
  pure :: a -> f a
```

Fold1

Analog gibt es auch `Fold1`:

```
type Fold1 s a = ∀ f. (Contravar't f, Apply  f) => (a -> f a) -> s -> f s
               ≅ ∀ m. Semigroup m => (a -> m) -> s -> m

type Fold  s a = ∀ f. (Contravar't f, App've f) => (a -> f a) -> s -> f s
               ≅ ∀ m. Monoid m => (a -> m) -> s -> m
```

Es gilt also:

$$\frac{\text{Apply}}{\text{Applicative}} \approx \frac{\text{Semigroup}}{\text{Monoid}}$$