Determining the type of an expression

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Problem

How can I find out the type of an expression or a subexpression?

Solution

Type of expressions

You can start the interactive environment of Hugs or GHC (GHCi) and use the `:type` directive:

```
Prelude> :type map fromEnum "Text"
map fromEnum "Text" :: [Int]
```

If the expression is a top-level binding in a module, you can use the `:info` directive.

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

Using `:browse Modulename` you can show the types of all top-level variables. This way you can write many functions in a module without a type signature, find them out and add them afterwards. But be warned that due to the Monomorphism restriction the automatically infered signatures are not always the ones you want.

Type of subexpressions

Say, you have the expression `map f "Text" == [1,2,3]` and you want to find out of what type the `f` must be. This is also possible, just type

```
Prelude> :type \ f -> map f "Text" == [1,2,3]
\f -> map f "Text" == [1,2,3] :: Num a => (Char -> a) -> Bool
```

Here `Bool` is the type of `map f "Text" == [1,2,3]` and `Num a => (Char -> a)` is the type of `f`.

Now imagine, that the function `f` cannot be chosen freely, but is an instantiation of a polymorphic function. E.g. of what concrete type is `id` in `map id "Text"`?

```
Prelude> :type \ f -> map (id `asTypeOf` f) "Text"
\f -> map (asTypeOf id f) "Text" :: (Char -> Char) -> [Char]
```

Using Data.Typeable

Say you'd like to catch a specific exception that is thrown, but you don't know which one it is. In the repl, you can catch SomeException and use `Data.Typeable.typeOf` on the value inside SomeException:

```
λ> import Data.Typeable
λ> let catcher (SomeException e) = print (typeOf e)
λ> let failer = openFile "foo" WriteMode >> openFile "foo" WriteMode >> print "opened twice"
λ> catch failer catcher
IOException
```

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