

Scala solution

How to make your Scala controll effects a-la Haskell

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Introduction

<https://github.com/folone/funclub-words>

Note: I intentionally made it more "interesting" to show more neat scalaz stuff

I won't cover everything though. If something seems strange, please ask.

Core

Main functions

```
wordCount :: String → Map (String , Int)  
acceptedChars :: Char → Boolean
```

Helper functions

```
time :: (a → IO b) → IO b  
close :: Closeable a ⇒ a → IO ()
```

Core

```
def acceptedChars(c: Char) = {  
  val sum: (((Boolean, Boolean), Boolean)) =>  
    Boolean = _ match {  
      case ((a, b), c) => a || b || c  
    }  
  val fun = ((_: Char).isLetterOrDigit) &&&  
    ((_: Char).isWhitespace) &&&  
    ((_: Char) == '-')  
  (fun >>> sum)(c)  
}
```

<http://www.haskell.org/arrows/index.html>

Core

```
def wordCount(text: String): Map[String, Int] =  
  text.filter(acceptedChars)  
    // split words  
    .toLowerCase.split("\\W").toList  
  // Optionally parallelize  
  .par  
  // group  
  .groupBy(identity)  
  // calculate group sizes  
  .map { case(key, value) =>  
    key.trim → value.length  
  }  
  // Get results from parallel computation  
  .seq
```

Typeclass instances

```
val N = 10
implicit val mapInstances = new Show[List[(String,
  override def shows(l: List[(String, Int))] =
    l.filterNot(_._1.isEmpty)
      .sortBy(_._2)
      .take(N)
      .foldLeft("") { case(acc, (key, value)) =>
        acc + "\n" + key + ": " + value
      }
}]
```

Executing

```
// function :: String → IO String
def mainIO(path: String) =
  for {
    result ← time(function(path))
    _ ←      putStrLn(result)
  } yield ()

def main(args: Array[String]) = {
  val path    = args(0)
  // Yuck!
  mainIO(path).unsafePerformIO()
}
```

Executing

```
package info.folone.words
import scalaz._, Scalaz._
object Main {
  def main(args: Array[String]) {
    val path = args(0)
    val action = WordsMemory.mainIO _ |+|
                WordsStream.mainIO _ |+|
                WordMachine.mainIO _

    // Yuck!
    action(path).unsafePerformIO()
  }
}
```


All set

Let's see how far we can push this solution.

First attempt

```
def wholeFile(path: String): IO[String] =  
  IO { Source.fromFile(path) }.bracket(close) {  
    source =>  
      IO {  
        val text    = source.mkString  
        val result = wordCount(text)  
        result.toList.shows  
      }  
    }  
}
```

First attempt

Works fine, but eats all the heap on a large enough file.

Second attempt

```
def byLine(path: String): IO[String] =  
  IO { Source.fromFile(path) }.bracket(close) {  
    source =>  
      IO {  
        val stream = source.getLines.toStream  
        val result = stream.map(wordCount)  
          .foldLeft(Map.empty[String, Int]) {  
            case (acc, v) => acc |+| v  
          }  
        result.toList.shows  
      }  
    }  
  }
```

Second attempt

Just what is this $|+|$?

Typeclasses

```
instance Show [(String, Int)] where ...  
instance Show Monoid b ⇒ Map a b where ...
```

<http://debasishg.blogspot.de/2010/06/scala-implicits-type-classes-here-i.html>

Monoids

$$(S, \otimes, 1)$$

$$\forall a, b \in S : a \otimes b \in S$$

$$\forall a, b, c \in S : (a \otimes b) \otimes c = a \otimes (b \otimes c)$$

$$\forall a \in S : 1 \otimes a = a \otimes 1 = a$$

<http://apocalisp.wordpress.com/2010/06/14/on-monoids/>

Second attempt

Pretty good, but can we do better?

Scala machines

(<https://github.com/runarorama/scala-machines>)

<https://dl.dropbox.com/u/4588997/Machines.pdf>

Gave similar performance on a by-line basis.

Thought, three times faster if we provide a Process to split it by words and then monoidally merge single-element Maps.

Iteratees – same as Stream

```
def wordFreq(path: String) =  
  getFileLines(new File(path),  
    id outmap wordCount) execute
```

Iteratees – 3x faster

```
def splitWords(text: String): List[String] =  
  text.filter(acceptedChars)  
    .toLowerCase.split("\\W").toList
```

```
val words: Process[String, String] = (for {  
  s ← await[String]  
  _ ← traversePlan_(splitWords(s))(emit)  
} yield ()) repeatedly
```

```
def wordCount(path: String) =  
  getFileLines(new File(path),  
    (id split words) outmap (  
      _.fold(1 => (1, Map.empty[String, Int]),  
            w => (0, Map(w -> 1))))).execute
```



Wordcounting software

Scoobi <http://nicta.github.com/scoobi/>

Spark <http://spark-project.org/>

Scalding <https://github.com/twitter/scalding/wiki/Type-safe-api-reference>

Wordcounting

I did not have time to try to use those. But turns out, this code should work for these "as is".

That's it

Questions?