Stairway to Scala - Flight 3

Classes and objects

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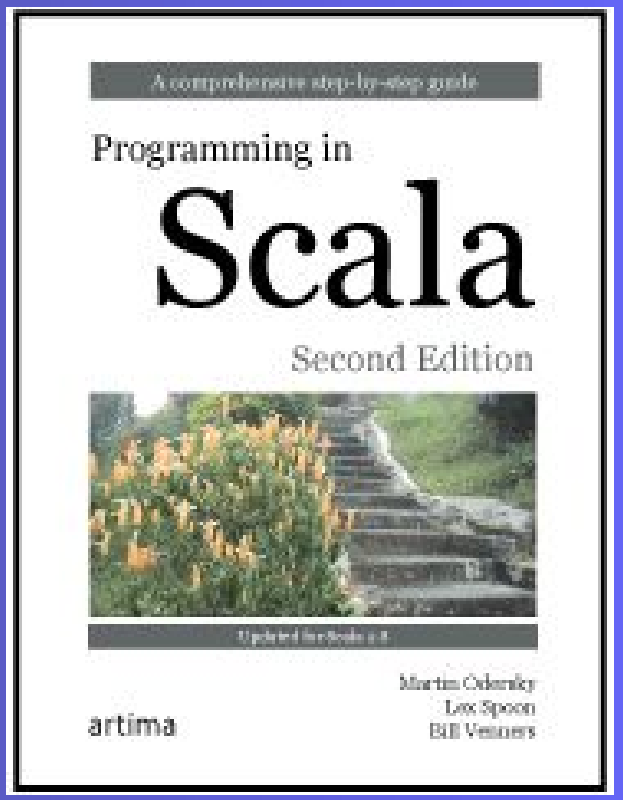

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Flight 3 goal

Introduce Classes, Methods, Constructors, Companion Objects, Operators, Fields, Self References, Overloaded Methods and Implicit Conversion (Chapters 4 and 6)

Defining a class

```
class ChecksumAccumulator {

  private var sum = 0

  def add(b: Byte): Unit = {
    sum += b
  }

  def checksum(): Int = {
    return ~(sum & 0xFF) + 1
  }
}
```

A more concise class definition

```
// In file ChecksumAccumulator.scala
class ChecksumAccumulator {
  private var sum = 0
  def add(b: Byte): Unit = sum += b
  def checksum(): Int = ~(sum & 0xFF) + 1
}
```

A companion object

```
// In file ChecksumAccumulator.scala
import scala.collection.mutable

object ChecksumAccumulator {
  private val cache = mutable.Map.empty[String, Int]
  def calculate(s: String): Int =
    if (cache.contains(s))
      cache(s)
    else {
      val acc = new ChecksumAccumulator
      for (c <- s)
        acc.add(c.toByte)
      val cs = acc.checksum()
      cache += (s -> cs)
      cs
    }
}
```

Using a singleton object

```
ChecksumAccumulator.calculate("Every value is an object.")
```

A Scala application

```
// In file Summer.scala
import ChecksumAccumulator.calculate

object Summer {
  def main(args: Array[String]): Unit = {
    for (arg <- args)
      println(arg + ": " + calculate(arg))
  }
}
```

A Scala application

```
// In file Summer.scala
import ChecksumAccumulator.calculate

object Summer extends App {
  for (arg <- args)
    println(arg + ": " + calculate(arg))
}
```

Compiling and running

```
$ scalac ChecksumAccumulator.scala Summer.scala

$ fsc ChecksumAccumulator.scala Summer.scala

$ scala Summer of love
of: -213
love: -182
```

The primary constructor

```
class Rational(n: Int, d: Int)
```

```
public class Rational { // This is Java
  final private int n;
  final private int d;
  public Rational(int n, int d) {
    this.n = n;
    this.d = d;
  }
}
```

The primary constructor (cont.)

```
class Rational(n: Int, d: Int) {
  println("Debug: Created " + n + "/" + d)
}
```

```
scala> new Rational(1, 2)
Debug: Created 1/2
res0: Rational = Rational@90110a
```

Overriding toString

```
class Rational(n: Int, d: Int) {
  override def toString() = n + "/" + d
}

scala> val x = new Rational(1, 2)
x: Rational = 1/2
```

Checking preconditions

```
class Rational(n: Int, d: Int) {
  require(d != 0, "zero denominator")
  override def toString = n + "/" + d
}
```

Can only access class parameters on this instance

```
class Rational(n: Int, d: Int) { // This won't compile
  require(d != 0, "zero denominator")
  override def toString = n + "/" + d
  def add(that: Rational): Rational =
    new Rational(n * that.d + that.n * d, d * that.d)
}
```

```
<console>:11: error: value d is not a member of Rational new
Rational(n * that.d + that.n * d, d * that.d) ^ <console>:11: error:
value d is not a member of Rational new Rational(n * that.d + that.
n * d, d * that.d)
^
```

Adding fields

```
class Rational(n: Int, d: Int) {
  require(d != 0)
  val numer: Int = n
  val denom: Int = d
  override def toString = numer +"/"+ denom
  def add(that: Rational): Rational =
    new Rational(
      numer * that.denom + that.numer * denom,
      denom * that.denom
    )
}
```

Or… Parametric fields

```
class Rational(val n: Int, val d: Int) {  // val makes 'em public
  require(d != 0)
  override def toString = s"$n/$d"
  def add(that: Rational): Rational =
      new Rational(
        n * that.d + that.n * d,
        d * that.d
      )
}
```

Self references

```
def max(that: Rational) =
  if (this.lessThan(that)) that else this
```

Auxiliary constructors

```
class Rational(val n: Int, val d: Int) {
  require(d != 0)
  def this(n: Int) = this(n, 1) // auxiliary constructor
  override def toString = s"$n/$d"
  def add(that: Rational): Rational =
      new Rational(
        n * that.d + that.n * d,
        d * that.d
      )
}
```

Defining operators

```
class Rational(val n: Int, val d: Int) {
  require(d != 0)
  def this(n: Int) = this(n, 1) // auxiliary constructor
  override def toString = s"$n/$d"
  def +(that: Rational): Rational =
      new Rational(
        n * that.d + that.n * d,
        d * that.d
      )
}
```

Defining operators

```
scala> val x = new Rational(1, 2)
x: Rational = 1/2
scala> val y = new Rational(2, 3)
y: Rational = 2/3
scala> x + y
res8: Rational = 7/6
```

Overloading methods

```
class Rational(val n: Int, val d: Int) {
  require(d != 0)
  def this(n: Int) = this(n, 1) // auxiliary constructor
  override def toString = s"$n/$d"
  def + (that: Rational): Rational =
      new Rational(
        n * that.d + that.n * d,
        d * that.d
      )
  def + (i: Int): Rational =
      new Rational(n + i * d, d)
}
```

Using overloaded methods

```
scala> val x = new Rational(2, 3)
x: Rational = 2/3
scala> x + x
res13: Rational = 12/9
scala> x + 1
res14: Rational = 5/3
```

What about the other way around?

```
scala> 2 + x
<console>:8: error: overloaded method value + with alternatives:
  (Double)Double <and>
  (Float)Float <and>
  (Long)Long <and>
  (Int)Int <and>
  (Char)Int <and>
  (Short)Int <and>
  (Byte)Int <and>
  (java.lang.String)java.lang.String
 cannot be applied to (Rational)
       2 + x
         ^
```

Implicit conversions

```
scala> implicit def intToRational(x: Int) = new Rational(x)

scala> val r = new Rational(2,3)
r: Rational = 2/3

scala> 2 + r
res16: Rational = 8/3
```

intToRational(2) + r

Exercises for Flight 3