Stairway to Scala - Flight 12

Case classes and pattern matching

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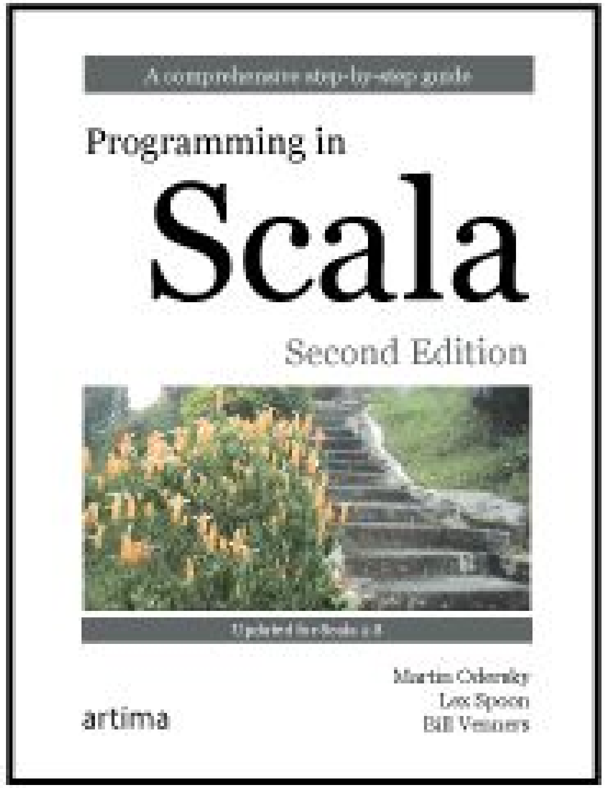

A comprehensive step-by-step guide

Programming in

Scala

Second Edition

Updated for Scala 2.8

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Flight 12 goal

Learn about case classes, match expressions, and patterns.

Defining case classes

```
abstract class Expr
case class Var(name: String) extends Expr
case class Number(num: Double) extends Expr
case class UnOp(operator: String, arg: Expr) extends Expr
case class BinOp(operator: String,
    left: Expr, right: Expr) extends Expr
```

What you get:
1. A factory method

```
scala> val v = Var("x")
v: Var = Var(x)

scala> val op = BinOp("+", Number(1), v)
op: BinOp = BinOp(+,Number(1.0),Var(x))
```

What you get:

2. Parametric fields

```
scala> v.name
res0: String = x

scala> op.left
res1: Expr = Number(1.0)
```

What you get:

3. equals/hashCode/toString

```
scala> println(op)
BinOp(+,Number(1.0),Var(x))

scala> op.right == Var("x")
res3: Boolean = true
```

What you get:
4. copy

```
scala> op.copy(operator = "-")
res4: BinOp = BinOp(-,Number(1.0),Var(x))
```

Simplifying expressions

```
def simplifyTop(expr: Expr): Expr = expr match {
  case UnOp("-", UnOp("-", e))  => e   // Double negation
  case BinOp("+", e, Number(0)) => e   // Adding zero
  case BinOp("*", e, Number(1)) => e   // Multiplying by one
  case _ => expr
}

scala> simplifyTop(UnOp("-", UnOp("-", Var("x"))))
res4: Expr = Var(x)
```

Wildcard patterns

```
expr match {
  case BinOp("+", _, _) =>
     println(expr + "is a binary addition")
  case BinOp(_, _, _) =>
     println(expr + "is a binary operation")
  case _ =>
     println("It's something else")
}
```

Constant patterns

```
def describe(x: Any) = x match {
  case 5 => "five"
  case true => "truth"
  case "hello" => "hi!"
  case Nil => "the empty list"
  case _ => "something else"
}
```

Variable patterns

```
def describe(x: Any) =
  x match {
    case 0 => "zero"
    case somethingElse => s"not zero: $somethingElse"
  }
```

Lower case variables,
Upper case constants

```
scala> import math.{E, Pi}
import math.{E, Pi}

scala> E match {
          case Pi => "strange math? Pi = " + Pi
          case _ => "OK"
        }
res11: java.lang.String = OK
```

Constructor patterns

```
op match {
  case BinOp("+", e, Number(0)) =>
     println("a deep match")
  case _ =>
     println("no match")
}
```

Sequence patterns

```
def seek(x: Any) =
  x match {
    case List(0, _, _) => println("found it")
    case _ =>
  }

def find(x: Any) =
  x match {
    case List(0, _*) => println("found it")
    case _ =>
  }
```

Sequence patterns, :: style

```
def process(x: Any) =
  x match {
    case a :: b :: c :: rest => println("at least 3")
    case a :: Nil => println("just 1")
    case head :: tail => println("at least 1")
    case Nil => println("empty")
  }
```

Tuple patterns

```
 def tupleDemo(expr: Any) =
   expr match {
     case (a, b, c)  =>  println("matched " + a + b + c)
     case _ =>
   }

scala> tupleDemo(("a ", 3, "-tuple"))
matched a 3-tuple
```

Typed patterns

```
def generalSize(x: Any) = x match {
  case s: String => s.length
  case m: Map[_, _] => m.size
  case _ => -1
}
```

```
scala> generalSize("abc")
res16: Int = 3

scala> generalSize(Map(1 -> 'a', 2 -> 'b'))
res17: Int = 2

scala> generalSize(math.Pi)
res18: Int = -1
```

Type check and cast (poor style)

```
expr.isInstanceOf[String]

expr.asInstanceOf[String]

if (x.isInstanceOf[String]) {
  val s = x.asInstanceOf[String]
  s.length
} else ...
```

Type erasure means more matches

```
scala> def isIntIntMap(x: Any) = x match {
         case m: Map[Int, Int] => true
         case _ => false
       }
warning: there were unchecked warnings; re-run with
-unchecked for details
isIntIntMap: (x: Any)Boolean

<console>:5: warning: non variable type-argument Int in
type pattern is unchecked since it is eliminated by erasure
         case m: Map[Int, Int] => true
                 ^
scala> isIntIntMap(Map("abc" -> "abc"))
res20: Boolean = true
```

Variable binding

```
def matchExpr(expr: Expr) =
  expr match {
    case UnOp("abs", e @ UnOp("abs", _)) => e
    case _ => "huh?"
  }


// case UnOp("abs", UnOp("abs", v)) => UnOp("abs", v)
```

Pattern guards

Won't work to change (e + e) to (e * 2):

```
scala> def simplifyAdd(e: Expr) = e match {
         case BinOp("+", x, x) => BinOp("*", x, Number(2))
         case _ => e
       }
<console>:11: error: x is already defined as value x
         case BinOp("+", x, x) => BinOp("*", x, Number(2))

 scala> def simplifyAdd(e: Expr) = e match {
         case BinOp("+", x, y) if x == y =>
          BinOp("*", x, Number(2))
         case _ => e
       }
simplifyAdd: (e: Expr)Expr
```

Pattern guard examples

```
// match only positive integers and zero
case n: Int if n >= 0 => ...

// match only strings starting with the letter 'a'
case s: String if s.headOption == Some('a') => ...
```

Sealed classes

```
sealed abstract class Expr
case class Var(name: String) extends Expr
case class Number(num: Double) extends Expr
case class UnOp(operator: String, arg: Expr) extends Expr
case class BinOp(operator: String,
    left: Expr, right: Expr) extends Expr

def describe(e: Expr): String = e match {
  case Number(_) => "a number"
  case Var(_)    => "a variable"
}
```

```
warning: match is not exhaustive!
missing combination          UnOp
missing combination         BinOp
```

The Option type

```
scala> val capitals =
        Map("France" -> "Paris", "Japan" -> "Tokyo")
capitals: scala.collection.immutable.Map[
        java.lang.String,java.lang.String]
 = Map(France -> Paris, Japan -> Tokyo)

scala> capitals get "France"
res23: Option[java.lang.String] = Some(Paris)

scala> capitals get "North Pole"
res24: Option[java.lang.String] = None
```

Deconstructing Option

```
scala> def show(x: Option[String]) = x match {
         case Some(s) => s
         case None => "?"
       }
 show: (x: Option[String])String

 scala> show(capitals get "Japan")
 res25: String = Tokyo

 scala> show(capitals get "France")
 res26: String = Paris

 scala> show(capitals get "North Pole")
 res27: String = ?
```

Patterns in variable definitions

```
scala> val myTuple = (123, "abc")
myTuple: (Int, java.lang.String) = (123,abc)

scala> val (number, string) = myTuple
number: Int = 123
string: java.lang.String = abc

scala> val exp = BinOp("*", Number(5), Number(1))
exp: BinOp = BinOp(*,Number(5.0),Number(1.0))

scala> val BinOp(op, left, right) = exp
op: String = *
left: Expr = Number(5.0)
right: Expr = Number(1.0)
```

Patterns in for expressions

```
scala> for ((country, city) <- capitals)
     println(s"The capital of $country is $city")
The capital of France is Paris
The capital of Japan is Tokyo
```

Case objects

```
sealed abstract class Op
case object NoOp extends Op
case class Do(it: String) extends Op
case object Stop extends Op

def doIt(x: Op) = x match {
  case NoOp => "Ain’t nothing going on."
  case Do(it) => s"Doing $it"
  case Stop => "That’s it. We’re done."
}
```

Exercises for Flight 12