Stairway to Scala - Flight 12

Case classes and pattern matching

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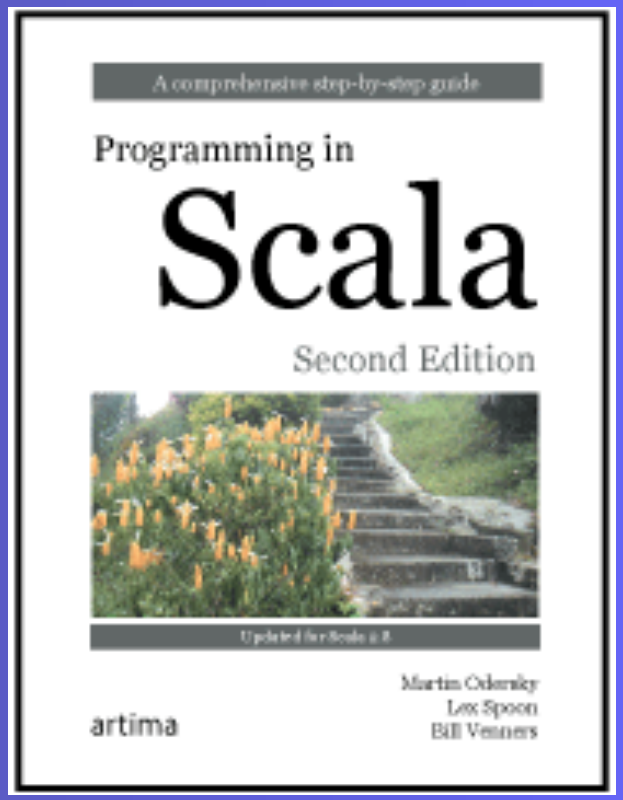

Flight 12 goal

Learn about case classes, match expressions, patterns, and partial functions.

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 (new in 2.8)

```
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 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

```
expr match {
  case 0 => "zero"
  case somethingElse => "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

```
expr match {
  case BinOp("+", e, Number(0)) => println("a deep match")
  case _ =>
}
```

Sequence patterns

```
expr match {
  case List(0, _, _) => println("found it")
  case _ =>
}

expr match {
  case List(0, _*) => println("found it")
  case _ =>
}
```

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

```
expr match {
  case UnOp("abs", e @ UnOp("abs", _)) => e
  case _ =>
}
```

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
case n: Int if 0 < n => ...

// match only strings starting with the letter 'a'
case s: String if s(0) == '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 = new 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("The capital of "+ country +" is "+ city)
The capital of France is Paris
The capital of Japan is Tokyo
```