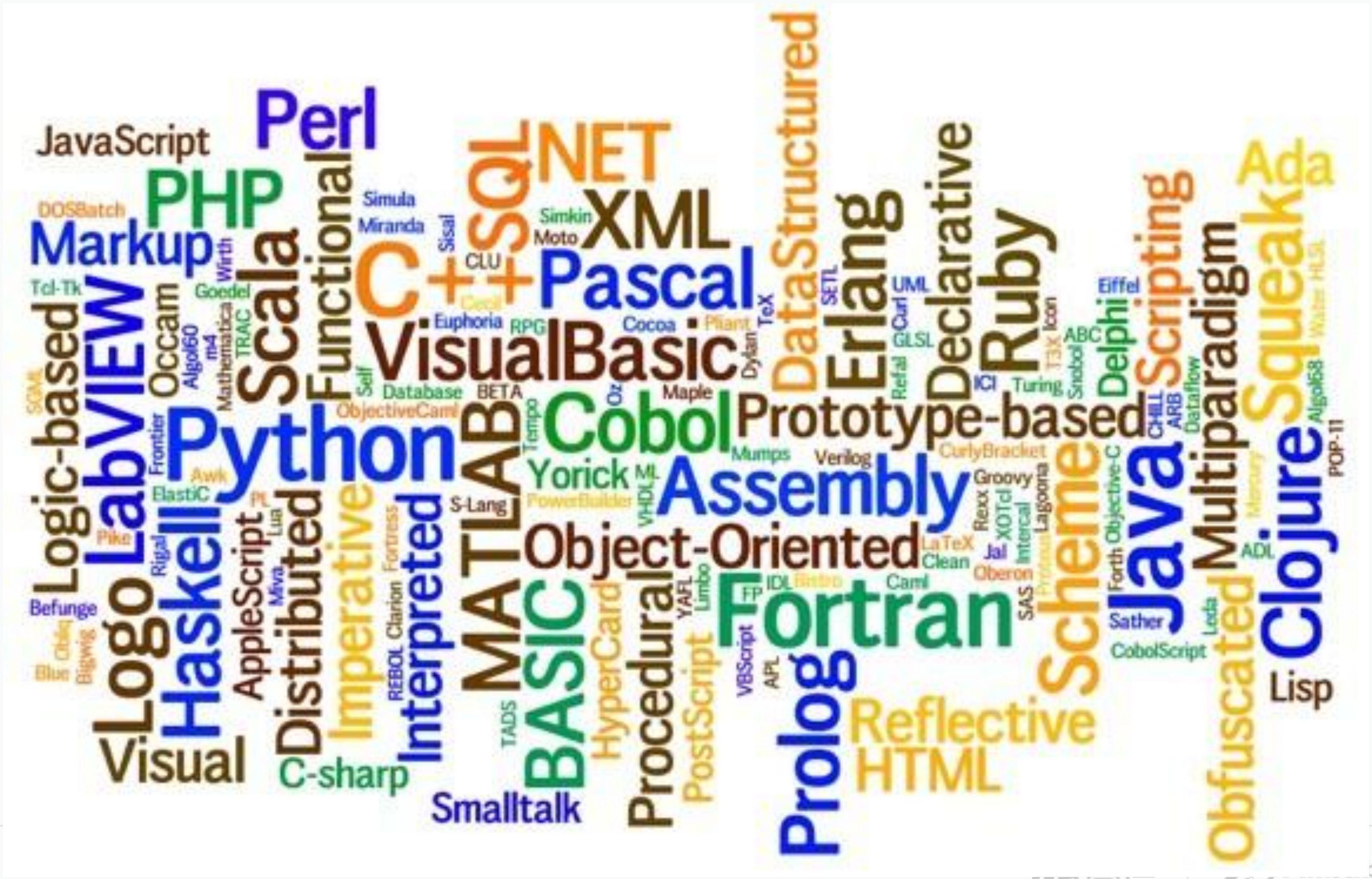
JavaScript
Perl
.NET
SQL
PHP
XML
DOSBatch
Markup
C++
Pascal
Simula
Miranda
Sisal
Simkin
Moto
CLU
DataStructured
Erlang
Declarative
Ruby
Scripting
Multiparadigm
Squeak
Ada
Tcl-Tk
Wirth
Goedel
Occam
Algol60
m4
Mathematica
TRAC
Scala
Functional
Euphoria
RPG
Cocoa
Pliant
TeX
SETL
UML
Curl
GLSL
Refal
Icon
ABC
T3X
Snobol
Delphi
Eiffel
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Dylan
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Maple
ICI
Turing
ObjectiveCaml
Logic-based
LabVIEW
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Prototype-based
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ARB
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Tempo
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Clean
Jal
Oberon
Protocol
Scheme
Sather
Lisp
Obfuscated
Blue
Cilk
Bigwig
IDL
Bistro
Caml
FP
Limbo
YAFL
SAS
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01

Scala Intro

xiaofeng.cui@autonavi.com

提纲

- 函数式/命令式
- Scala简介/特点
- Scala 语法
  - 变量/表达式/数据结构
  - **函数**
    - **匿名函数**
    - **闭包**
    - **柯里化**
  - 模式匹配
  - Option
  - 类
- 小结

命令式/函数式

命令式

- 执行命令序列
- How

函数式

- 函数一等公民
- What

命令式/函数式

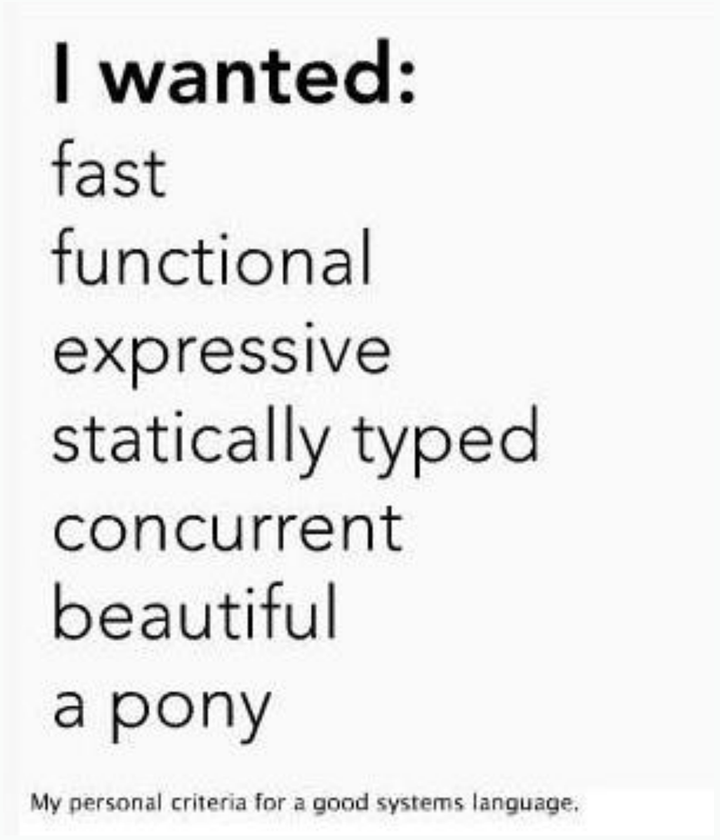
- 函数式编程 WordCount

```
   val file = List("warn 2013 msg 2014", "warn 2013 msg 2013", "error 2013
msg");
   var count = 0;
   for (item <- file) {
     val tmp = item.split(" ");
     for(str <- tmp) {
       if (str == "2013") count = count + 1;
     }
   }
```

```
val file = List("warn 2013 msg", "warn 2012 msg", "error 2013 msg")

val wordNum = file.map(_.split(" ").count("2013" == _)).reduceLeft(_ + _)
```

Scala



I wanted:

fast

functional

expressive

statically typed

concurrent

beautiful

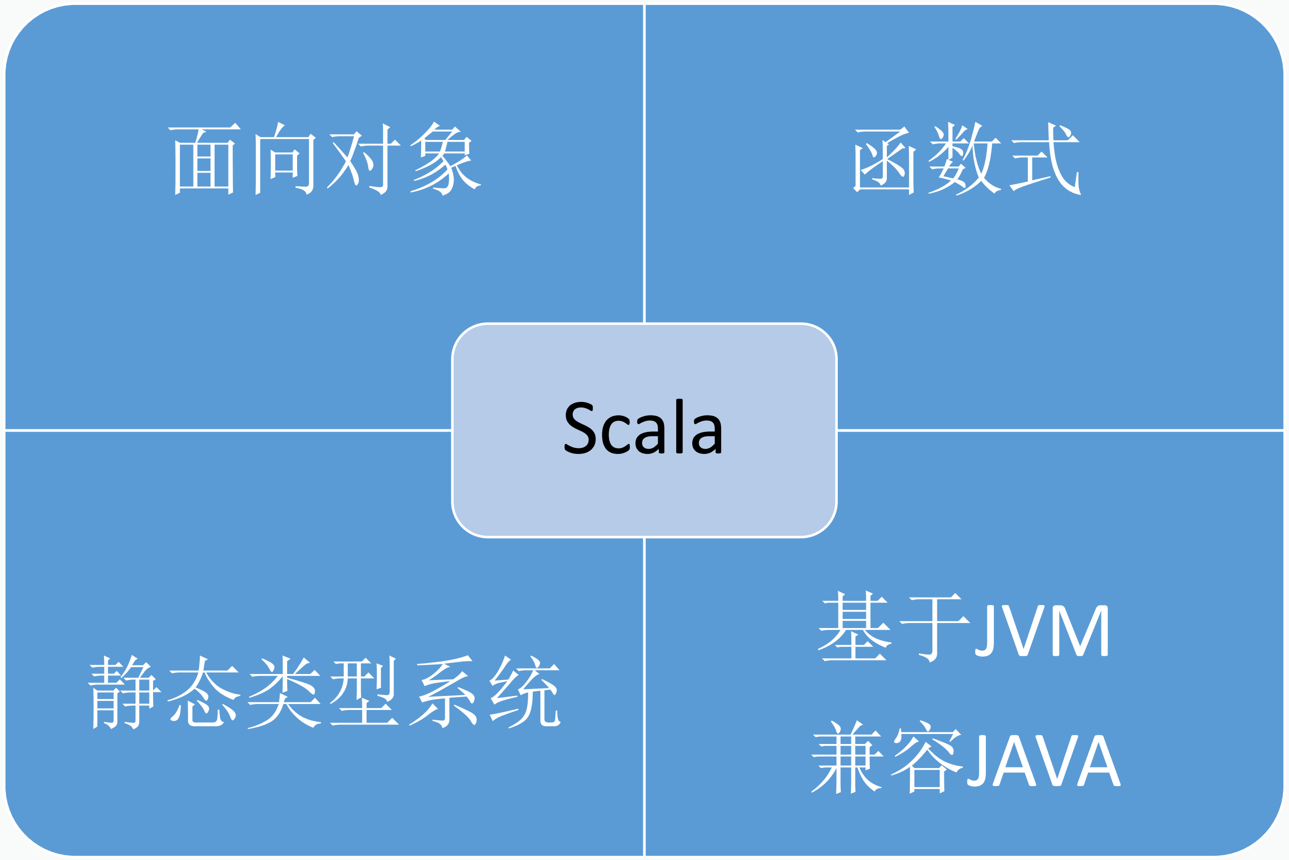
a pony

My personal criteria for a good systems language.

Scala (Unifier)

$$\begin{tikzcd}
\text{Lisp} \arrow[d, "\text{functional programming}"] & \text{C} \arrow[ddr, "\text{syntax}"] & & \text{Simula} \arrow[d, "\text{objects}"] & \text{Prolog} \arrow[dd, "\text{pattern matching}"] \\
\text{ML} \arrow[d] & & & \text{Smalltalk} \arrow[dl] & \\
\text{Haskell} \arrow[ddrr] & & \text{C++} \arrow[d] & & \text{Erlang} \arrow[ddll, "\text{Actors}"'] \\
& & \text{Java} \arrow[d] & & \\
& & \text{Scala} & &
\end{tikzcd}$$

Scala (Unifier)



Scala简介

- 面向对象 + 　函数式
- 兼容Java：
  - 和Java兼容，运行于JVM，可以访问java的类库；
  - import java.util.Date
- 静态类型系统：
  - 可以根据计算的值的类型确定变量和表达式的类型；消除运行时的错误，保证bool不和整数相加等

Scala简介

- **简洁，优雅**
  - Java

```
class Person {
    private String firstName;
    private String lastName;
    private int    age;

    public Person(String firstName, String lastName, int age) {
        this.firstName = firstName;
        this.lastName  = lastName;
        this.age   = age;
    }
}
```

  - Scala

```
class Person(var firstName: String, var lastName: String, var age: Int)
```

HelloWorld

```
object HelloWorld {
  def main(args: Array[String]): Unit = {
    println("Hello World!")
  }
}
```

变量定义

- 常量val，变量var
- 类型推断

```
var num: Int = 123
var num = 123 //类型推断
val num = 123 //常量，类似java的final
var args = new Array[String](3)
```

表达式

- 几乎所有的语言元素都是表达式，都有值
  - If，while，match，= 等

```
val result = if (x > y) x else y
```

  - 块表达式 { }

```
  //val result = (1 + 2) * ( 3 + 4)
  val result = {
    var a = 1 + 2
    var b = 3 + 4
    a * b
  }
```

数据结构

```
Array
     var args1 = Array("1", "2", "3")
     var args = new Array[String](3);
     args(0) = "1"

List
       //List只能包括同类型的元素：
     var list = List(1, 2, 3)
     list = 4 :: list // 将4加到list的头部
     println(list)

Tuple
       //Tuple可以包括不同类型的元素：
     val tuple = (1, "1")

Set
     var set = Set('1', '2')
     set += '3'

Map
     var map1 = Map[String, Int]()
     map1 += ("jj" -> 20 )
     var map = Map("1" -> 1, "2" -> 2)
     map += ("jj" -> 20 )
```

数据结构

- Java初始化集合

```
      ArrayList<String> list = new ArrayList(Arrays.asList("Ryan", "Julie", 
"Bob")) ;

      // 第一层括弧实际是定义了一个内部匿名类 (Anonymous Inner Class)
      // 第二层括弧 实际上是一个实例初始化块 (instance initializer block)，这个块在
内部匿名类构造时被执行。这个块之所以被叫做¡实例初始化块¡是因为它们被定义在了一个类的实例范
围内。
      List list1 = new ArrayList(){
        {
          add("A");
          add("B");
        }
      };

      Map<String, String> hashMap = new HashMap<String, String>(){
        {
          put("A", "a");
          put("B", "b");
        }
      };
```

函数（一等公民）

- 作为参数传递
- 作为返回值
- 可赋值给其他变量

```
def max(x : Int, y : Int) : Int = {
    // x = 6 wrong
    if (x > y) x
    else y
}
```

```
def max(x : Int, y : Int) : Int = if (x > y) x else y //省略大括号
def max(x : Int, y : Int) = if (x > y) x else y //省略返回值,可以推断
```

函数

- 作为参数，返回值
- 函数类型: (输入参数) => 输出参数，（Int, Int） => Int

```
//函数作为参数
def getValue(func: (Int, Int) => Int, x: Int, y: Int) = {
   func(x, y)
}
getValue(max, 1, 2)

// 函数作为返回值
def getFunc(): (Int, Int) => Int = {
  val func = (x: Int, y: Int) => if (x > y) x else y
  func
}
val func = getFunc()
func(1, 2)
```

匿名函数

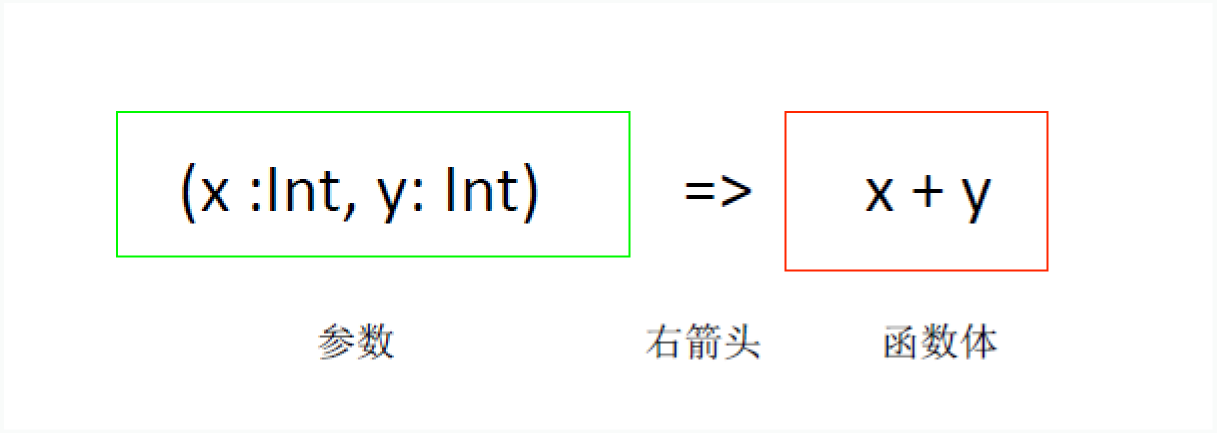
- python lambda

```
list = [1, 2, 3, 4]

print map(lambda x : x + 1, list)
```

匿名函数

- Lambda： 函数字面量



```
val max1 = (x: Int, y: Int) => if (x > y) x else y
println(max1(1, 5))
```

匿名函数

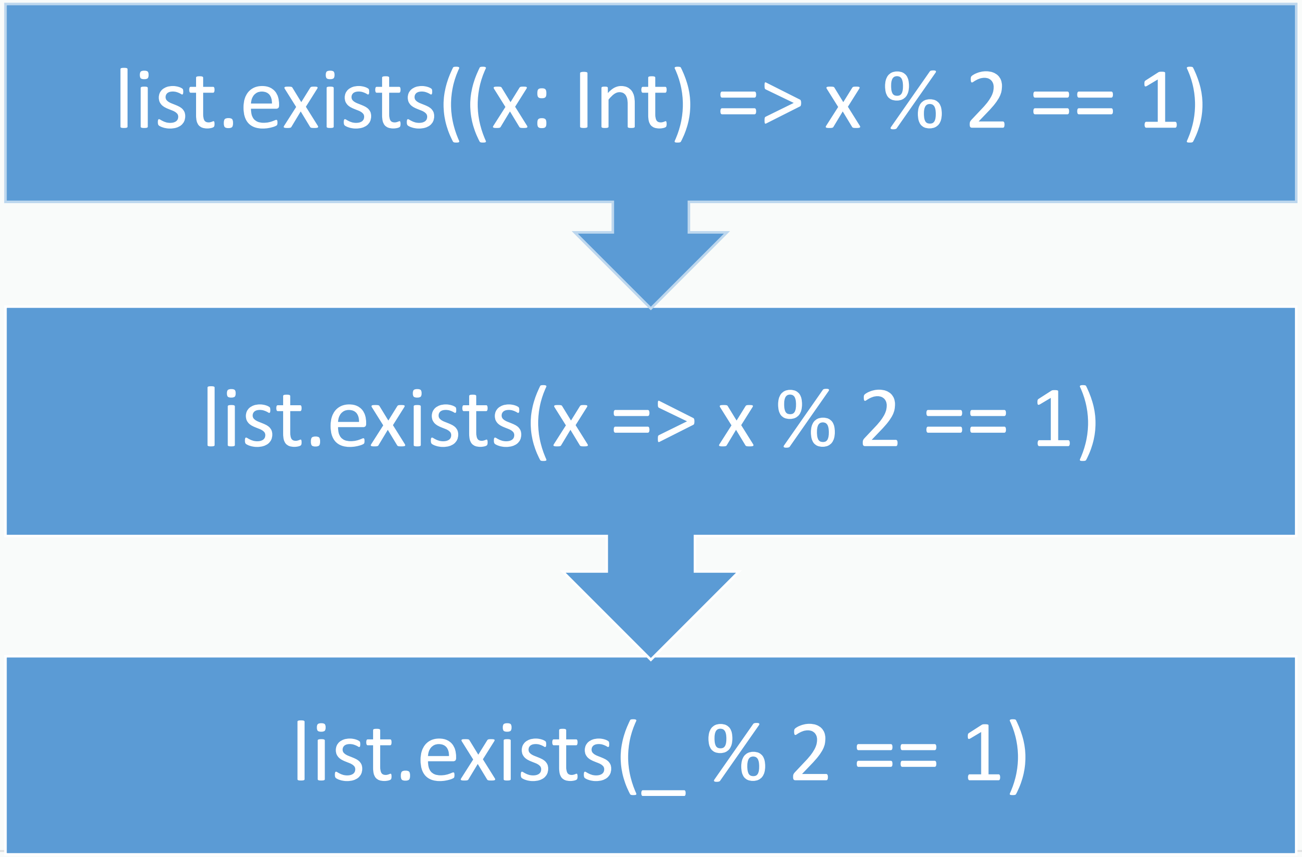
- 简洁，优雅

```
//判断列表中是否包含奇数
val list = List(1, 2, 3, 4)
def containsOdd(list: List[Int]): Boolean = {
  for (i <- list) {
    if (i % 2 == 1)
      return true;
  }
  return false;
}
```

```
list.exists((x: Int) => x % 2 == 1) // 要什么，而不是怎么做
```

匿名函数中神秘的_

- 进一步简化代码



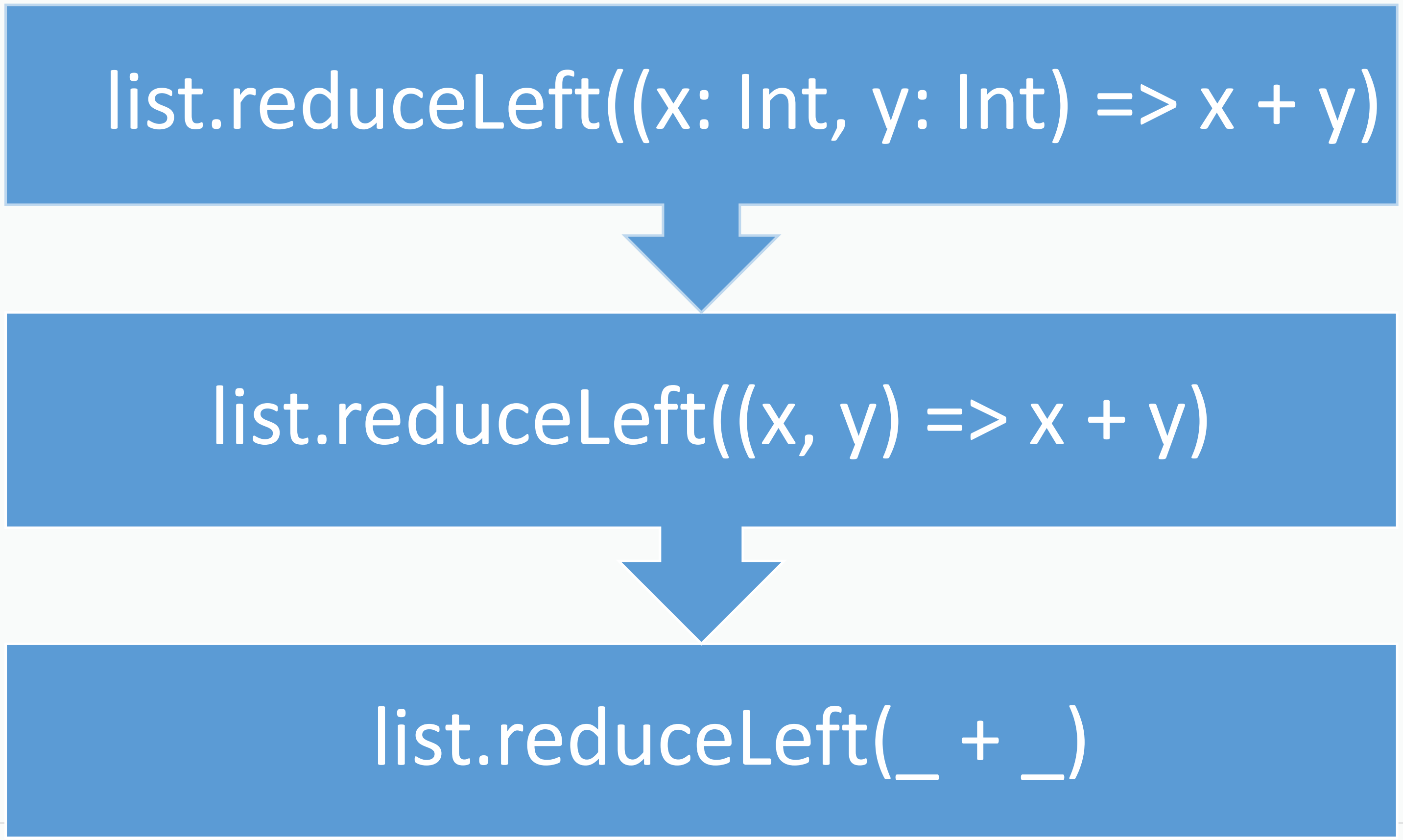
```
list.exists((x: Int) => x % 2 == 1)
```

```
list.exists(x => x % 2 == 1)
```

```
list.exists(_ % 2 == 1)
```

匿名函数中神秘的_

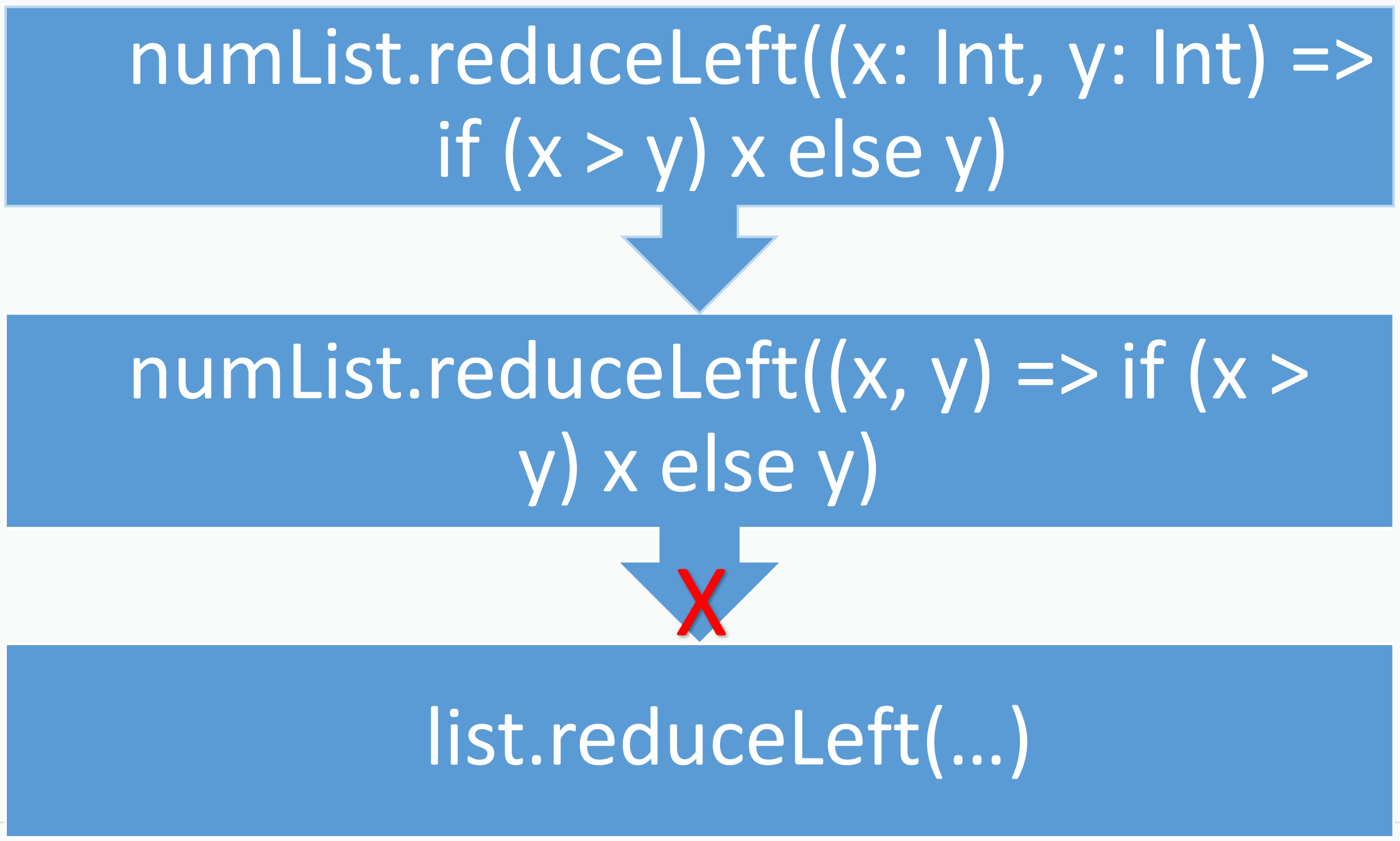
- 复杂一点，求列表中所有元素的和



```
list.reduceLeft((x: Int, y: Int) => x + y)
list.reduceLeft((x, y) => x + y)
list.reduceLeft(_ + _)
```

匿名函数中神秘的_

- Max例子
  -



```
numList.reduceLeft((x: Int, y: Int) => if (x > y) x else y)
```

```
numList.reduceLeft((x, y) => if (x > y) x else y)
```

```
list.reduceLeft(...)
```

闭包(closure)

- 代码块 +上下文，关于引用环境的绑定

```
def increase(more: Int) = {
  (x : Int) => x + more
}
```

```
var inc = increase(100);
println(inc(1))  //101

inc = increase(200);
println(inc(1))  //201
```

柯里化(currying)

柯里化

- 把一个带有多个参数的函数，转换为多个只有一个参数的函数来执行

```
def sum(x:Int, y:Int) = x + y
```

```
def sum(x:Int)(y:Int) = x + y
```

```
sum(1)(2)
```

柯里化

```
def first(x:Int) = (y:Int) => x+y
```

```
var second = first(1)
```

```
var ret = second(2)
```

柯里化

- 控制抽象，改变代码风格

```
var a = 1 + 2
var b = 3 + 4
var c = a * b
sum(1, c);
```

```
var a = 1 + 2
var b = 3 + 4
var c = a * b
sum(1)(c)
```

```
sum1(1) {
  var a = 1 + 2
  var b = 3 + 4
  a * b
}
```

柯里化

- 控制抽象

```
def until(condition: => Boolean)(block: => Unit) {
  if (!condition) {
    block
    until(condition)(block)
  }
}

// 使用
var x = 10
until (x == 0) {
  x -= 1
  println(x)
}
```

柯里化

- 偏函数（部分应用函数）

```
val sum = (a: Int, b: Int, c: Int) => a + b + c
val sum2 = sum(1, _: Int, _: Int)
sum2(2, 3)
```

- C++: bind1st，bind2nd

模式匹配

```
//模式匹配
def activity(day:Any){
  day match {
    case "monday" => println(day)
    case "saturday" => println(day)

    //元组既可以是明确值的  也可是元组是变量形式的
    case ("sunday","friday")=> println(day)
    case (a, b) => println(day)

    case List("sunday","friday") =>  println(day)
    //只要开头是sunday，friday的list都可以匹配
    case List("sunday","friday", _*) =>  println(day)

    //类型匹配
    case a: Int => println(a)
    //类型和guard匹配
    case a: Long if a > 10 => println(a)
    case msg: String => println(msg)
    //元组中的一个元素也可以
    case (a: Int, b: Int) if a > 10 => println(a)

    case _ => //匹配通配符
  }
}
```

Option

- 如何判断Java函数是否返回NULL
  - 依靠 JavaDoc 上的说明
  - 查看那个函式的源码来看
  - 黑盒测试
  - 爆NullpointException才知道

```
HashMap<String, String> myMap = new HashMap<String, String>();
myMap.put("key1", "value1");
String value1 = myMap.get("key1");  // 返回 "value1"
String value2 = myMap.get("key2");  // 返回 null
if (value1 != null) {
  System.out.println(value1.length());
}
if (value2 != null) {
  System.out.println(value2.length());
}
```

Option

- Option：没办法法回传一个有意义的东西
  - Some/None

```
val myMap = Map("key1" -> "value")
val value1: Option[String] = myMap.get("key1")
var length = value1 match {
  case Some(content) => content.length
  case None => 0
}
val value2: Option[String] = myMap.get("key2")
length = value2 match {
  case Some(content) => content.length
  case None => 0
}
```

```
value1.getOrElse("").length
value2.getOrElse("").length
```

尾递归

- 尾递归是指递归调用是函数的最后一个语句，而且其结果被直接返回

```
def factorial(n: Int): Int = {
  if( n <= 1 ) 1
  else n * factorial(n-1)
}
```

↓

```
def factorialTailrec(n: BigInt, acc: BigInt): BigInt = {
    if(n <= 1) acc
    else factorialTailrec(n-1, acc * n)
}
```

factorialTailrec(5, 1)
factorialTailrec(4, 5) // 1 * 5 = 5
factorialTailrec(3, 20) // 5 * 4 = 20

类

```
class Person(name: String, age: Int) {
  //从构造器
  def this(name: String) = this(name, 20)

  def getName() = name
  def getAge() = age
}

//伴生对象
object Person {
  var num = 0
  // 静态函数
  def test =  println("Person test")
  // 执行入口
  def main(args : Array[String]): Unit = {
    println(new Person("name").getAge())
    println(Person.num)
    Person.test
  }
}
```

其他

- Trait
- 泛型
- Actor

小结

- 优点
  -
- 缺点
  - 社区小
  - 偏复杂
  - 可读性稍差

01

Thanks！

命令式/函数式

- 内容

标题-左右结构