Scala

Les Bases

Lancer l'interpréteur en tapant dans un terminal : `scala`

Taper ensuite : `8*5+2`

```
scala> 8+5*2
res0: Int = 18
```

Comme on peut le voir par défaut le résultat est stocké dans une variable appelée `res0`.

Autres commandes :

```
scala> 8+5*2
res0: Int = 18

scala> 0.5*res0
res1: Double = 9.0

scala> "Hello, "+res0
res2: String = Hello, 18
```

Comme on pouvait s'y attendre on retrouve un comportement similaire à JAVA.

On peut obtenir de l'aide de l'interpréteur en tapant `:help`

```
scala> :help
All commands can be abbreviated, e.g., :he instead of :help.
:completions <string>    output completions for the given string
:edit <id>|<line>        edit history
:help [command]          print this summary or command-specific help
:history [num]           show the history (optional num is commands to show)
:h? <string>             search the history
:imports [name name ...] show import history, identifying sources of names
:implicits [-v]          show the implicits in scope
:javap <path|class>      disassemble a file or class name
:line <id>|<line>        place line(s) at the end of history
:load <path>             interpret lines in a file
:paste [-raw] [path]     enter paste mode or paste a file
```

Une autre commande utile est `:warnings` ou `:w` cette commande permet d'obtenir les avertissements du compilateur

```
scala> :w
Can't find any cached warnings.
```

Déclarer une variable

Contrairement à JAVA, mais tous comme Python en Scala le type d'une variable peut être déduit en fonction de son initialisation, on peut néanmoins toujours si on le souhaite initialiser une variable comme en JAVA :

```
scala> val s = "Hero"
s: String = Hero
```

```
scala> val s:String = "Hello"
s: String = Hello
```

On notera la façon particulière de déclarer le type d'une variable et l'absence de ';'.

```
scala> val greeting:String = null
greeting: String = null

scala> val greeting:Any = "Hello"
greeting: Any = Hello
```

Types de données

Il existe différents types de données en Scala :

Type	Description
Byte	8 bit signed value. Range from -128 to 127
Short	16 bit signed value. Range -32768 to 32767
Int	32 bit signed value. Range -2147483648 to 2147483647
Long	64 bit signed value. -9223372036854775808 to 9223372036854775807
Float	32 bit IEEE 754 single-precision float
Double	64 bit IEEE 754 double-precision float
Char	16 bit unsigned Unicode character. Range from U+0000 to U+FFFF. Use ' ' to declare it.
String	A sequence of Chars. Use " " to declare it
Boolean	Either the literal true or the literal false
Unit	Corresponds to no value
Null	null or empty reference
Nothing	The subtype of every other type; includes no values
Any	The supertype of any type; any object is of type Any (like Object in JAVA)
AnyRef	The supertype of any reference type

Contrairement à JAVA les ***types*** sont aussi des ***classes***, il n'y a pas de différence entre ***types primitives*** et ***classes***, de ce fait on peut directement invoquer les fonctions liées aux classes associées à ces types :

```
scala> 1.toString()
res4: String = 1

scala> 1.to(10)
res5: scala.collection.immutable.Range.Inclusive = Range 1 to 10
```

Déclarer plusieurs variables en même temps :

```
val xmax, ymax = 100 // Sets xmax and ymax to 100
var greeting, message: String = null // greeting and message are both strings, initialized with null
```

SCALA	JAVA
`val s:String = "Hello"`	`const String s = "Hello" ;`
`var s:String = "Hello"`	`String s = "Hello";`

Les opérateurs

`a+b` est un raccourci de `a.+(b)` ici `+` est le nom de la méthode. En Scala, contrairement à Java, on peut définir des méthodes avec des symboles.

En général, on peut écrire :

`a method b` raccourci de `a.method(b)` où `method` est une fonction qui prend 2 paramètres un implicite l'autre explicite. Autre exemple, on peut écrire : `1 to 10` au lieu de `1.to(10)`

SCALA	JAVA
`+=1`	`++`
`-=1`	`--`
BigInt et BigDecimal	

`val x:BigInt = 1234567890`
`x * x * x`
`// Yields 1881676371789154860897069000`
	`BigInteger x = new BigInteger("1234567890");`
	`x.multiply(x).multiply(x);`

Appeler une méthode

En général, on peut écrire :

`a method b` raccourci de `a.method(b)` où `method` est une fonction qui prend 2 paramètres un implicite l'autre explicite. Autre exemple, on peut écrire : `1 to 10` au lieu de `1.to(10)`

On a déjà vu comment appeler une méthode sur un objet, exemple : `"Hello".intersect("World")`

Noter que contrairement à Java, **en Scala si la méthode n'a pas de paramètres on peut omettre les parenthèses**, exemple : `"Bonjour".sorted  // Yields the string "Bjnooru"`

Import de package

SCALA	JAVA
`import scala.math._` Si le package est préfixé par scala, on peut écrire : `import math._`	`import scala.math.* ;`

Même si l'on importe pas un package, on peut utiliser ses méthodes en écrivant `pckge.method()`, exemple : `scala.math.sqrt(2) //Yields 1.4142135623730951` et `min(3, Pi) // Yields 3.0`

La méthode apply

SCALA	JAVA

`val s = "Hello"`
`s(4)  // équivaut à s.apply(4)`
`// Yields 'o'`
	`String s = "Hello" ;`
	`s.charAt(4) // Yields 'o' ;`

Comme on peut le voir `s(4)` est un raccourci de `s.apply(4)`.

Pourquoi est-ce que l'on n'utilise pas les [] ?

On peut voir une séquence **s** d'élément de type ***T*** comme une fonction mathématique qui va de {0,1,…,n-1} à ***T*** qui fait correspondre(**map**) i à ***s(i)***, i ième élément de la séquence.

Créer un objet

SCALA	JAVA
`val x = BigInt("1234567890")` `// x: scala.math.BigInt = 1234567890`	`BigInteger x = new BigInteger("1234567890");`

`val y = Array(1,2,3,4)`
`// y: Array[Int] = Array(1, 2, 3, 4)`
	`int[] arr = new int[4];`
	`for (int i = 0; i < arr.length; i++){`
	`  arr[i]=i+1;`
	`}`
	ou
	`int arr[] = {1,2,3,4};`

En effet `val x = BigInt("1234567890")` est un raccourci `BigInt.apply("1234567890")`, on n'a pas besoin de ***new*** pour créer l'objet grâce à **apply**.

Avertissement

Occasionnellement, il arrive que la ***notation*** () soit en conflit avec une autre fonctionnalité de Scala : ***les paramètres implicites***. Exemple :

```
scala> "Bonjour".sorted(3)
                        ^
       error: type mismatch;
        found   : Int(3)
        required: Ordering[?]
```

Ce code produit une erreur car la méthode **sorted** peut être appelée de façon optionnelle avec un ordre de tri, or 3 n'est pas un ordre valide de tri.

Solution : `("Bonjour".sorted)(3)` ou `"Bonjour".sorted.apply(3)`

Keep In Mind

Keep these tips in mind:

• Remember to look into `RichInt`, `RichDouble`, and so on, if you want to know how to work with **numeric types**. Similarly, to work with **strings**, look into `StringOps`.

• The mathematical functions are in the *package* `scala.math`, not in any class.

• Sometimes, you'll see functions with funny names. For example, `BigInt` has a method `unary_-`. This is how you define the prefix negation operator -x.

• Methods can have functions as parameters. For example, the `count` method in `StringOps` requires a function that returns true or false for a `Char`, specifying which characters should be counted:

```
def count(p: (Char) => Boolean) : Int
```

You supply a function, often in a very compact notation, when you call the method. As an example, the call `s.count(_.isUpper)` counts the number of uppercase characters.

• You'll occasionally run into classes such as `Range` or `Seq[Char]`. They mean what your intuition tells you—a range of numbers, a sequence of characters. You will learn all about these classes as you delve more deeply into Scala.

• In Scala, you use square brackets for type parameters. A `Seq[Char]` is a sequence of elements of type `Char`, and `Seq[A]` is a sequence of elements of some type `A`.

• There are many slightly different types for sequences such as `GenSeq`, `GenIterable`, `GenTraversableOnce`, and so on. The differences between them are rarely important. When you see such a construct, just think "sequence." For example, the `StringOps` class defines a method

```
def containsSlice[B](that: GenSeq[B]): Boolean
```

This method tests whether the string contains with a given sequence. If you like, you can pass a `Range`:

```
"Bierstube".containsSlice('r'.to('u'))
// Yields true since the string contains Range('r', 's', 't', 'u')
```

• Don't get discouraged that there are so many methods. It's the Scala way to provide lots of methods for every conceivable use case. When you need to solve a particular problem, just look for a method that is useful. More often than not, there is one that addresses your task, which means you don't have to write so much code yourself.

• Some methods have an **"implicit" parameter**. For example, the `sorted` method of `StringOps` is declared as

```
def sorted[B >: Char](implicit ord: math.Ordering[B]): String
```

That means that an ordering is supplied "implicitly".

• Finally, don't worry if you run into the occasional indecipherable incantation, such as the `[B >: Char]` in the declaration of sorted. The expression `B >: Char` means **"any supertype of Char"**.

•To get what method can be applied to 3. in the REPL(Scala interpreter), type `3.` followed by **Tab key**

Différence Scala-JAVA

SCALA	JAVA
s(4) <-> s.apply(4) //o	s[4] ;//o
"Bonjour".sorted [pas de parenthèses si la méthode ne nécessite pas d'argument]	"Bonjour".sorted() ;
import scala.math._	import scala.math.* ;
scala.math.sqrt(2)	pas d'équivalent
val s = if (x > 0) 1 else -1	If(x>0){s=1 ;} else{s=-1 ;}
If(x>0) 1 else //si la condition n'est pas vérifier alors l'expression vaut Unit	
if (x > 0) 1 else -1	x > 0 ? 1 : -1 ;
val distance = { val dx = x - x0; val dy = y - y0; sqrt(dx * dx + dy * dy) } distance has value and the type of red expression	
{ r = r * n; n -= 1 } Expression has value Unit()	

for (i <- 1 to n)
r = r * i
	for(int i=1 ; i<=n ;i++){
	r = r * i ;
	}

val s = "Hello"
var sum = 0
for (i <- 0 to s.length - 1)
sum += s(i)
<->
var sum = 0
for (ch <- "Hello") sum += ch	

Pas break	
Multiples generators : for (i <- 1 to 3; j <- 1 to 3) print(f"${10 * i + j}%3d") // Prints 11 12 13 21 22 23 31 32 33	
for (i <- 1 to 3; j <- 1 to 3 if i != j) print(f"${10 * i + j}%3d") // Prints 12	

13 21 23 31 32	
for (i <- 1 to 10) yield i % 3 // Yields Vector(1, 2, 0, 1, 2, 0, 1, 2, 0, 1)	
Lazy values	

You can think of lazy values as halfway between val and def.
Compare :
val words =
scala.io.Source.fromFile("/usr/share/dict/words").mkString
// Evaluated as soon as words is defined
lazy val words =
scala.io.Source.fromFile("/usr/share/dict/words").mkString
// Evaluated the first time words is used
def words =
scala.io.Source.fromFile("/usr/share/dict/words").mkString
// Evaluated every time words is used	

for(i<-10 to (0,-1))	for(int i=10 ; i>-1 ;i--)
for(i <- 0 until 10)	for(int i=0 ; i<10 ; i++)
for(0 until 10 by 2) //0 2 4 6 8	for(int i=0 ;i<5 ; i++) 2*i
for(0 until 10 by -1) //9 8 7 6 5 4 3 2 1 0	for(int i=9 ; i>-1 ;i--)

import scala.util.control._
val loop = new Breaks
loop.breakable{
 	
for(i←1 to 10 by 2){
 	
println("Value of i: "+i)
 	
if(i==5) loop.break
 	
}
 	
}
	for(int i=1 ; i<10 ; i+2){
	System.out.println("Value of i: "+i) ;
	if(i==5) break ;
	}

Tableau de taille variable :	
import scala.collection.mutable.ArrayBuffer val tab = ArrayBuffer[Type]()	import java.util.ArrayList ; ArrayList<Type> tab = new ArrayList<Type>()
Ajouter des éléments : tab += (0,1,2,3,4,5) tab ++= ArrayBuffer(6,7,8,9)	Ajouter des éléments : tab.addAll(new ArrayList<Int>(0,1,2,3))
for(i <- tab.indices) for(i <- tab.indices.reverse	
Transformez en tableau de taille fixe : tab.Array	
Array comprehension : val a = Array(2, 3, 5, 7, 11) val result = for (elem <- a) yield 2 * elem // result is Array(4, 6, 10, 14, 22) <->	

val result = a.map{2*_}	
Array comprehension : val a = Array(2, 3, 5, 7,11) for (elem <- a if elem % 2 == 0) yield 2 * elem <-> a.filter(_ % 2 == 0).map(2 * _) or even a filter { _ % 2 == 0 } map { 2 * _ }	
Array comprehension : val positionsToRemove = for (i <- a.indices if a(i) < 0) yield i for (i <- positionsToRemove.reverse) a.remove(i)	
Array attribut : max, min, sum, sorted, sortWith(func)	
a.mkString(" and ") // « 2 and 3 and 5 and 7 and 11»	Python : " and ".join(a)
a.mkString("<", ",", ">") // "<1,2,7,9>"	
Tableau multi-dimensionnel	

val matrix = Array.ofDim[Double](3, 4) // Three rows, four columns
To access an element, use two pairs of parentheses:
matrix(row)(column) = 42
You can make ragged arrays, with varying row lengths:
val triangle = new Array[Array[Int]](10)
for (i <- triangle.indices)
triangle(i) = new Array[Int](i + 1)	

Map	
val scores = scala.collection.mutable.Map[String, Int]()	
val scores = Map("Alice" -> 10, "Bob" -> 3, "Cindy" -> 8) ⍰ val scores = scala.collection.mutable.Map("Alice" -> 10, "Bob" -> 3, "Cindy" -> 8) ⍰ val scores = Map(("Alice", 10), ("Bob", 3), ("Cindy", 8))	
val bobsScore = scores("Bob") If the map doesn't contain a value for the requested key, an exception is thrown	scores.get("Bob")
val bobsScore = if (scores.contains("Bob")) scores("Bob") else 0 ⍰ val bobsScore = scores.getOrElse("Bob", 0) If the map contains the key "Bob", return the value; otherwise, return 0.	

1. scores("Bob") = 10
// Updates the existing value for the key "Bob" (assuming scores is mutable)
et
2. scores("Fred") = 7
// Adds a new key/value pair to scores (assuming it is mutable)
 	
(1., 2.) scores += ("Bob" -> 10, "Fred" -> 7)
	scores.put("Bob",10)

scores -= "Alice" Remove the key Alice	
val newScores = scores + ("Bob" -> 10, "Fred" -> 7) // New map with update	
var scores=… scores = scores + ("Bob" -> 10, "Fred" -> 7) ⍰ scores += ("Bob" -> 10, "Fred" -> 7)	
scores = scores – Alice ⍰ scores -= Alice	
for ((k, v) <- *map*)	

scores.keySet
// A set such as Set("Bob", "Cindy", "Fred", "Alice")
for (v <- scores.values) println(v) // Prints 10 8 7 10	

To reverse a map—that is, switch keys and values—use for ((k, v) <- *map*) yield (v, k)	
visit the keys in sorted order val scores = scala.collection.mutable.SortedMap("Alice" -> 10, "Fred" -> 7, "Bob" -> 3, "Cindy" -> 8)	
If you want to visit the keys in insertion order, use a LinkedHashMap. For example, val months = scala.collection.mutable.LinkedHashMap("January" -> 1, "February" -> 2, "March" -> 3, "April" -> 4, "May" -> 5, ...)	
import scala.collection.JavaConversions.mapAsScalaMap val scores: scala.collection.mutable.Map[String, Int] = new java.util.TreeMap[String, Int]	
get a conversion from java.util.Properties to a Map[String, String]: import scala.collection.JavaConversions.propertiesAsScalaMap val props: scala.collection.Map[String, String] = System.getProperties()	

Scala map to a method that expects a Java map, provide the opposite implicit conversion :
import scala.collection.JavaConversions.mapAsJavaMap
import java.awt.font.TextAttribute._ // Import keys for map below
val attrs = Map(FAMILY -> "Serif", SIZE -> 12) // A Scala map
val font = new java.awt.Font(attrs) // Expects a Java map	

val t = (1, 3.14, "Fred") access its components with the methods _1, _2, _3 val second = t._2 // Sets second to 3.14 Unlike array or string positions, the component positions of a tuple start with 1, not 0.	
val (first, second, third) = t // Sets first to 1, second to 3.14, third to "Fred" You can use a _ if you don't need all components:	

val (first, second, _) = t	
Classes	

Class Person{
var age=0
//Le setter et getter sont automatiquement crées si déclarer var
Sinon si déclarer val, seul le getter est uniquement créer
}
val p = new Person //<=> new Person()
p.age //<=> p.getAge() en JAVA
p.age_ //<=> p.setAge() en JAVA	

class Person(val name: String, val age: Int) {
// Parameters of primary constructor in (...)
...
}
	public class Person { // This is Java
	private String name; private int age;
	public Person(String name, int age) {
	this.name = name; this.age = age;
	}
	public String name() { return
	this.name; } public int age() { return
	this.age; }
	...
	}

Avertissement :

Occasionally, the () notation conflicts with another Scala feature: implicit parameters. For example, the expression "Bonjour".sorted(3) yields an error because the sorted method can optionally be called with an ordering, but 3 is not a valid ordering.You can use parentheses: ("Bonjour".sorted)(3) or call apply explicitly: "Bonjour".sorted.apply(3)

AIDE SCALA :

Scala possède un interpréteur.

Pour obtenir de l'aide on peut faire ex: Taper 3. et Press Tab Key

Vous obtiendez une liste de métles opérations disponible pour l'objet 3

FoldLeft

foldLeft

foldLeft est une méthode de la classe scala.collection.immutable.List et voici ce que le scaladoc nous en dit:
"*Applies a binary operator to a start value and all elements of this list, going left to right.*"
Scaladoc nous dit que foldLeft applique une fonction prenant deux paramètres (opérateur binaire) à une valeur initiale (appelée **accumulateur** dans le jargon fonctionnel) et à tous les éléments de la liste en partant de la gauche. Voyons attentivement la signature de la méthode pour rendre les choses un peu plus claires!

```
1  def foldLeft [B] (z : B)(f : (B, A) ⇒ B) : B
```

Ah tiens une chose transparaît dans cette signature: *foldLeft* est une méthode currifiée. Si vous n'avez jamais fait de programmation fonctionnelle auparavant cette notion ne doit pas vous parler. En fait malgré les apparences la méthode foldLeft ne prend pas deux arguments! Voici comment elle fonctionne: elle prend un paramètre z de type B et renvoie une fonction qui prend à son tour un paramètre qui est une fonction de type (B, A) => B. z représente la valeur initiale de l'accumulateur et est du même type que la valeur de retour de foldLeft. A chaque étape la fonction f est appliquée à l'accumulateur et à l'élément courant de la liste. La valeur de l'accumulateur peut changer tout au long du déroulement de l'opération. Prenez une minute pour bien visualiser la chose ce n'est pas si compliqué que cela une fois qu'on a compris la notion. La méthode fold est d'une puissance incroyable! Elle vous permet de faire quasiment de faire toutes les opérations imaginables avec les listes.

Voici un usage simple de *foldLeft*: Calculer la somme des éléments d'une liste d'entiers.

L'accumulateur (la valeur initiale) est égal à zéro et l'opérateur binaire est une fonction qui prend deux entiers et fait leur somme:

```
1  val nums = List(1, 2, 3, 4)
2  val sum = nums.foldLeft(0){
3    (acc, num) => acc + num
4  }
```

Class

In Scala (as well as in Java or C++), a method can access the private fields of all objects of its class. For example,

```
class Counter {
        private var value = 0
        def increment() { value += 1 }
        def isLess(other : Counter) = value < other.value
        // Can access private field of other object
}
```

Accessing other.value is legal because other is also a Counter object.

Scala allows an even more severe access restriction with the private[this] qualifier:

```
private[this] var value = 0 // Accessing someObject.value is not allowed
```

Now, the methods of the Counter class can only access the value field of the current object, not of other objects of type Counter . This access is sometimes called object-private, and it is common in some OO languages such as SmallTalk.

Table 5–1 Generated Methods for Fields

Scala Field	Generated Methods	When to Use
`val/var name`	public `name` `name_=` (`var` only)	To implement a property that is publicly accessible and backed by a field.
`@BeanProperty val/var name`	public `name` `getName()` `name_=` (`var` only) `setName(...)` (`var` only)	To interoperate with JavaBeans.
`private val/var name`	private `name` `name_=` (`var` only)	To confine the field to the methods of this class, just like in Java. Use `private` unless you really want a public property.
`private[this] val/var name`	none	To confine the field to methods invoked on the same object. Not commonly used.
`private[`*ClassName*`] val/var name`	implementation-dependent	To grant access to an enclosing class. Not commonly used.

Table 5–2 Fields and Methods Generated for Primary Constructor Parameters

Primary Constructor Parameter	Generated Field/Methods
`name: String`	object-private field, or no field if no method uses `name`
`private val/var name: String`	private field, private getter/setter
`val/var name: String`	private field, public getter/setter
`@BeanProperty val/var name: String`	private field, public Scala and JavaBeans getters/setters

Nested Class

In Scala, you can nest just about anything inside anything. You can define functions inside other functions, and classes inside other classes. Here is a simple example of the latter:

```
import scala.collection.mutable.ArrayBuffer
class Network {
        class Member(val name: String) {
                val contacts = new ArrayBuffer[Member]
        }

        private val members = new ArrayBuffer[Member]

        def join(name: String) = {
                val m = new Member(name)
                members += m
                m
        }
}
```

Consider two networks:

```
val chatter = new Network
val myFace = new Network
```

In Scala, each instance has its own class Member , just like each instance has its own field members . That is, chatter.Member and myFace.Member are different classes.