Scala Tutorial

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Basics

משתנים:

```
val x : Int = 5
 // x = 3; // Not Compile because its Value (Values cannot be re-assigned.)
 var y : String = "Hey"
 y = "World" // Compile because its Variable
```

פונקציות Functions:

```
(list of parameters) => expression involving the parameters.
for example:
       val addOne = (x: Int) => x + 1
       val addOne : (Int => Int) = (x: Int) => x + 1
       println(addOne(1)) // 2
```

כאשר (**הצהרה**, **קלט**, **פלט**) והצהרה לא חובה

שיטות Methods: מסומן ע"י `def`

```
def function(x: Int, y:Int) : Int = { println(s"($x,$y)"); x + y}
println(function(1,2))
```

כאשר ■ הינו ערך החזרה

שיטות יכולות לקחת גם כמה ערכים (**multiple parameter lists**) בעוד שפונקציות לא.

```
def MultiMethod(a:Int)(b: Int) = { Math.pow(a,2).toInt * b }
println(MultiMethod(2)(3)) // 2^2 * 3 = 12
```

ערך דיפולטיבי:

```
def Sum(x: Int, y: Int = 99) : Int = x + y
println(Sum(1,1)); println(Sum(1)) // [2,100]
```

בנוסף ניתן לקבל אוסף של קלטים באופן הבא: (מ-ללא קלט עד ..)

```
def getSum(args: Int*) : Int = {
  var sum : Int = 0;
  for(num <- args)
    sum += num
  sum
}
println(getSum(1,2,3)) // 6
```

ההבדל בין Val Function vs. Def

```
def x1 = println( 1 + 1 ) // Will not print
val x2 = println( 1 + 1 ) // Will print
```

נשקול את המקרה הבא:

```
  val even: (Int => Boolean) = { println("val even()"); _ % 2 ==
0 }
  // Prints val even()
  def even2(x:Int) : Boolean = { println("def even()"); x % 2 ==
0}
// NOT Print def even()

  println(even(2))
  // true [do not print val even()]
  println(even2(2))
  // def even()
  // true
```

דוגמא נוספת:

```
val x : Int = { Random.nextInt() }
println(x); // 702823910
println(x); // 702823910

def y = { Random.nextInt() }
println(y); // -777004026
println(y); // -1793062244

lazy val z : Int = { Random.nextInt() }
println(z); // -71605430
println(z); // -71605430
```

לסיכום:

def	val
def(<parm>): <return_type> = <value>	val <name> : <type> = <value>

```
// Lazy Val:
// especially useful to avoid heavy computations
lazy val _lazy : Unit = println("Im Lazy.") // Will NOT print
val not_lazy : Unit = println("Im Not Lazy =).") // Will Print
```

לולאות:

```
for(i <-0 until 10) // [0,10)
for(i <- 0 to 10 ) // [0,10]

val collection = Array(1,2,3)
for(ele <- collection) println(ele)

collection.foreach( ele => print(s"Best element + 1 ${ele+1} \n"))
```

```
for( i<-0 until 2; j<-0 until 2)
  println(s"i = $i , j = $j")

for(i<-0 until 2)
  for(j<-0 until 2)
    println(s"i = $i, j = $j")
/* Output: SAME IN BOTH WAYS
                        i = 0 , j = 0
```

```
                        i = 0 , j = 1
                        i = 1 , j = 1
                        i  = 1 , j = 1 */
```

: Yield

```


var collection = for( i<-0 until 10) yield { i * 2 }
println(collection) // Vector(0, 2, 4, 6, 8, 10, 12, 14, 16, 18)
```

```
val EvenNumbersCollection = for( i<-0 until 10 if i%2 == 0  )
yield { i }
println(EvenNumbersCollection) // Vector(0, 2, 4, 6, 8)
```

רקורסיה:

```
def main(args: Array[String]): Unit = {
  printf("Factorial of 5 is %d",factorial(5))
}
def factorial(num : BigInt) : BigInt = {
  if(num == 1)
    1
  else
    factorial(num - 1) * num
}
```

מערכים: Mutable - (Array, ArrayBuffer)

```
val myNumsFixed = new Array[String](3)
val myNumsDynm = ArrayBuffer[Int]() //
scala.collection.mutable.ArrayBuffer
myNumsFixed(0) = "Hey"
myNumsFixed(1) = "You"
myNumsFixed(2) = "Zvi"
myNumsFixed(3) = "!" //java.lang.ArrayIndexOutOfBoundsException

myNumsDynm.insert(0,555)
myNumsDynm.insert(1,666)
myNumsDynm += 777
myNumsDynm ++= Array(888,999)

for(ele <- myNumsDynm) println(ele)
```

מערכים דו מימדיים:

```
val multDimArray = Array.ofDim[Int](10,5)
for(i<-0 until multDimArray.length; j<-0 until
multDimArray(i).length)
  println(multDimArray(i)(j))
val sortedArray = multDimArray(0).sortWith(_>_)
```

:Maps

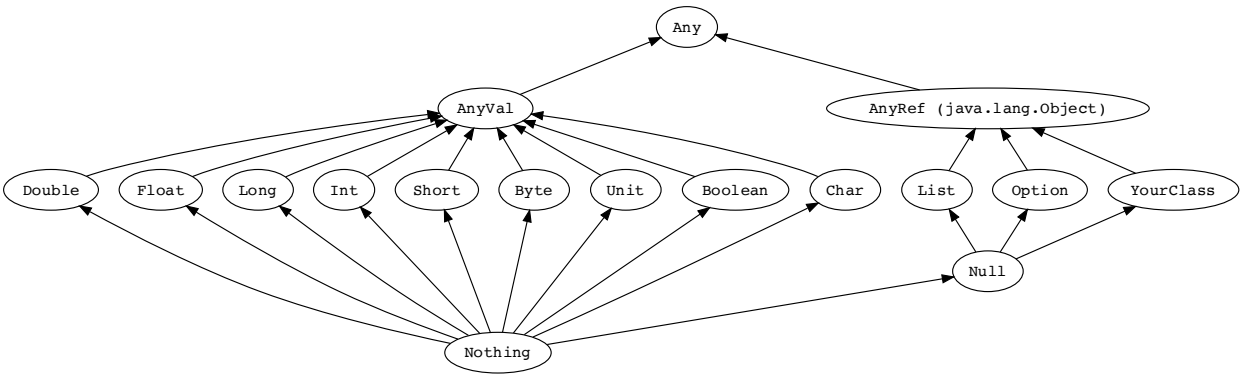
```
// Immutable
val employees = Map("VP RND" -> "Yoni", "Software Developer" -> "Zvi")
println( if(employees.contains("Software Developer")) "Y" else "N" )
```

```
// Mutable
val employees = scala.collection.mutable.Map("VP RND" -> "Yoni",
"Software Developer" -> "Zvi")
for( (k,v) <- employees ) println(s"k = $k, v = $v")
```

Map,Filter,Foreach

```
var _list : List[Int] = List(1,2,3,4,5,6,7)
val filterFunction : (Int => Boolean) = _ % 2 == 0
val mapFunction : (Int => Int) = (x:Int) => { x*2 }
_list.filter(filterFunction).map(mapFunction).foreach(println)
// 4,8,12
```

Unified Types



ניתן ליצור רשימה באופן הבא:

```
object HelloWorld {
  class Element
  def main(args: Array[String]): Unit = {
    var Any_list : List[Any] = List("String", new Element);
    var AnyVal_list : List[AnyVal] = List(1,1.5,true);
    var AnyRef_List : List[AnyRef] = List("String",() => "Function",
                                          new Element, null);
  }
}
```

העברת פונקציות:

A **higher-order function** takes other **functions** as a parameter or returns a **function** as a result. This is possible because **functions** are a first-class value in **Scala**. ... It means that **functions** can be passed as arguments to other **functions**, and **functions** can return other **functions**.

```
// Higher Order Functions
def times3(x:Int) = x*3
def MultNum(f:(Int=>Int), x: Int) = f(x)

println(MultNum(times3,10))
```

Try-Catch Blocks:

```
  def divide(a: Int, b:Int) = {
    try { a/b
    } catch {
      case ex : java.lang.ArithmeticException => "Cant Divide by
0"
    } finally  {
      println("Finished.")
    }
  }
println(divide(2,0)) // Finished. Cant Divide by 0
```

Classes

```
case class CasePoint(x: Int, y: Int) {   }
class Point(x: Int, y: Int) {  }
```

```
var p1 = new Point(0,0)
var p2 = new CasePoint(0,0)
var p3 = CasePoint(0,0) // You can instantiate case classes without new keyword.
                        //  case classes have an apply method by default
                        //  which takes care of object construction.
println( p2 == p3 ) // true => they are compared by value.
println ( p1 == p2 ) // false => They are compared by reference( p1 == p1 )
```

1.Case Class **doesn't** need explicit new, while class need to be called with new
2.By Default constructors parameters are **private** in class , and **public** in case class
3.case class **compare** themselves by **value**
4.By Default constructors parameters are **val** in case class and **var** in class
5. case class are **immutable** by default

```
case class Ele1(x : Int)
class Ele2(x : Int)

var immutable = Ele1(1)
immutable.x = 3
var mutable = Ele2(1)
mutable.x = 3
```

מחלקת נקודה:

```
object HelloWorld {
  def main(args: Array[String]): Unit = {
    var p1: Point = new Point(1,2)
    var p2 : Point = new Point(-1)
    println(p2.getX) // 0
    var p3 : Point = new Point()
    println(p3) // (3,0,0)
    p3.x_(4)
    println(p3.x)
  }
  class Point(private var _x: Int,
              private var _y: Int) {
    private val _id = Point.getUniqueID // "Static" Method
    this.setX(_x)
    this.setY(_y)
```

```
    // Constructors
    def this(x: Int) = this(x,0)
    def this() = this(0,0)

    // Getters and Setters
    def x_(x: Int) = { this._x = if(x>=0) x else 0 }
    def x = _x

    def setX(x: Int) =  { this._x = if(x >= 0) x else 0 }
    def setY(y: Int) =  { this._y = if(y >= 0) x else 0 }
    def getX = this._x;
    def getY: Int = this._y

    // Override
  override def toString = s"(${this._id},${this._x},${this._y})"
  }

  object Point {
    private var count : Int = 0
    def getUniqueID() : Int = {
      count += 1
      count
    }
  }
}
```

Closures

```
// Scala - Closures
/* A Closure is a function which uses one or more
variable declared outside this function
 */
object HelloWorld {
  var more : Int = 10
  var add : (Int => Int) = (x: Int) => x + more // more is Free
variable
  def main(args: Array[String]): Unit = {
    println(add(3)) // 13
    more = 20 // The Result will change!
    println(add(3)) // 23
  }
}
```

הערה: כאשר המשתנה אשר הפונקצייה משתמש בו הוא Val אז זה נקרא Pure Closure

ירושה: (Inheritance)

```
class OtherCoolPoint(x1 : <type>, x2: <type> ... ) extends Point
{}
```

מחלקה אבסטרקטית:

```
abstract class A(private var _x: Int) {
  var _y : Int
  def getX() : Int
  override def toString() = "Implemented Function."
}
class B(_x: Int) extends A(_x) {
  // Must to Implement:
  override var _y: Int = ???
  override def getX(): Int = ???

  // New Methods:
  def Move() = ???
}
```

Traits

כמו ממשק בג'אווה, ההבדל הוא שניתן לממש פונקציות

```
trait Flyable {
  def fly : String
}
trait BulletProof {
  def HitByBullet : Boolean
  def getState : String =  "Easy."
}
class Superhero(name: String) extends Flyable with BulletProof {
  // Must to implement
  override def fly: String = ???
  override def HitByBullet: Boolean = ???
}
```

Tuples [1,22 elements]

```
val ingredient = ("Sugar" , 25)
println(ingredient._1) // Sugar
println(ingredient._2) // 25
```

ניתן לאתחל בעזרתם משתנים באופן הבא:

```
val (name, quantity) = ingredient
println(name) // Sugar
println(quantity) // 25
```

ניתן לעבור על Tuples באופן הבא:

```
ingredient.productIterator.foreach( x => println(x))
```

או לחלופין:

```
println(ingredient.toString()) // (Sugar,25)
```

List vs Array

The Scala `List` is an immutable recursive data structure which is such a fundamental structure in Scala, that you should (probably) be using it much more than an `Array` (which is actually **mutable** - the *immutable analog* of `Array` is `IndexedSeq`).

Performance differences

```
                          Array  List
Access the ith element    θ(1)   θ(i)
Delete the ith element    θ(n)   θ(i)
Insert an element at i    θ(n)   θ(i)
Reverse                   θ(n)   θ(n)
Concatenate (length m,n)  θ(n+m) θ(n)
Count the elements        θ(1)   θ(n)
```

Memory differences

```
                          Array  List
Get the first i elements  θ(i)   θ(i)
Drop the first i elements θ(n-i) θ(1)
Insert an element at i    θ(n)   θ(i)
Reverse                   θ(n)   θ(n)
Concatenate (length m,n)  θ(n+m) θ(n)
```

So unless you need rapid random access, need to count elements, or for some reason you need destructive updates, a `List` is better than an `Array`.

An Array is **mutable**, meaning you can change the values of each index, while a List (by default) is **immutable**, meaning that a new list is created every time you do a modification. In most cases it is a more **"functional" style to work with immutable datatypes and you should probably try and use a List with constructs like `yield`, `foreach`, `match` and so forth.**

```
object HelloWorld extends  App {
  val immutable_list : List[Int] = List(1,2,3)
  val mutable_list : ListBuffer[Int] =
scala.collection.mutable.ListBuffer(1,2,3)
  mutable_list(0) = 100 // valid
  mutable_list += 4
  mutable_list -= 4
  mutable_list.foreach(println)
  println(mutable_list.contains(2))
  // immutable_list(0) = 100 // invalid

  val mutable_arr : Array[Int] = Array(1,2,3)
  val dynamic_arr : ArrayBuffer[Int] =
scala.collection.mutable.ArrayBuffer(1,2,3)
  // mutable_arr += 3 // Error
  dynamic_arr += 3
}
```

Class Composition with Mixins

Higher-order Functions

Default Parameter Values

Named Arguments

Packages and Imports

Package Objects