

Introduction to Scala

It's pronounced *skah-lah*, not *scale-uh*.

Scala History

- ▶ First release in 2003
- ▶ Designed by Martin Odersky
 - ▶ Student of ACM Turing Award winner Niklaus Wirth, creator of Pascal, Modula-2 and Oberon
 - ▶ With Philip Wadler, designer of GJ (Generic Java)
 - ▶ Chief implementer of Java 5 compiler still used today

Chief design goal: fuse object-oriented and statically-typed functional programming

Notable Features of Scala

- ▶ Truly object-oriented
 - ▶ Everything is an object. Try
1. `equals`(1)
 - ▶ No primitive/reference dichotomy
 - ▶ No static/instance context dichotomy
- ▶ Functional
 - ▶ First-class function values
 - ▶ Real lambda expressions
 - ▶ Immutable data
- ▶ Concise, pleasant syntax (~1/3 equivalent Java code)
- ▶ Many advanced features
 - ▶ Rich static typing with type inference
 - ▶ By-value parameters
 - ▶ Flexible syntax
 - ▶ Implicits
- ▶ JVM language with excellent Java interoperability
- ▶ “**Scalable Language**”
 - ▶ REPL, small scripts, million-LOC systems
 - ▶ Single machine or clusters
 - ▶ Start with simpler features and work

Running Scala

- ▶ Install Java 8+ and Scala for system-wide use using the instructions linked in hw0
- ▶ Many ways to run Scala:
 - ▶ REPL
 - ▶ Command-line scripts
 - ▶ Command-line sbt projects
 - ▶ IntelliJ (or other IDE) projects
 - ▶ IntelliJ (or other IDE) sbt projects
 - ▶ IntelliJ (or other IDE) worksheets

The Scala REPL

- ▶ Read-Eval-Print-Loop
- ▶ Enter an expression, REPL evaluates expression and prints its value
- ▶ Great way to become familiar with a language and try out parts of a project

```
1 $ scala
2 Welcome to Scala 2.12.8 (OpenJDK 64-Bit Server VM, Java 11.0.1).
3 Type in expressions for evaluation. Or try :help.
4
5 scala> 1 + 1
6 res0: Int = 2
7
8 scala> :quit
9 $
```

Notable REPL Features

When entering blocks of code, class or function definition, more convenient to use `:paste`

```
1  scala> :paste
2  // Entering paste mode (ctrl-D to finish)
3
4  def max(x: Int, y: Int): Int =
5    if (x > y) x
6    else y
7
8  // Exiting paste mode, now interpreting.
9
10 max: (x: Int, y: Int)Int
11
12 scala>
```

Can run a file containing Scala code with `:load`

Scala Scripts

On Unix, put this at the top of a text file:

```
1 #!/bin/sh
2 exec scala -savecompiled "$0" "$@"
3 !#
```

On Windows, put this at the top of a text file ending in `.bat`:

```
1 ::#!
2 @echo off
3 call scala -savecompiled %0 %*
4 goto :eof
5 ::!#
```

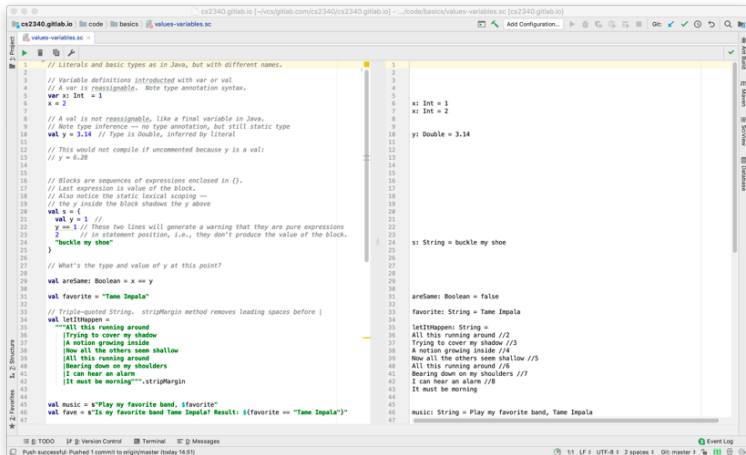
- ▶ `-savecompiled` saves a compiled version of your program with a `.jar` extension so that future execution is faster
- ▶ The other two args tell the shell to run the Scala program and pass it the command line args

Run with:

```
1 $ scala myscript.scala
```

IntelliJ Scala Worksheets

A Scala worksheet is a text file containing Scala code whose name ends in `.sc` (also works in Eclipse). Run with the play button in upper left corner



```
1 // Literals and basic types as in Java, but with different names.
2
3 // Variable definitions introduced with var or val
4 // A var is reassignable. Note type annotation syntax.
5 var x: Int = 1
6 x = 2
7
8 // A val is not reassignable, like a final variable in Java.
9 // Note type inference -- no type annotation, but still static type
10 val y = 3.14 // Type is Double, inferred by literal
11
12 // This would not compile if uncommented because y is a val:
13 // y = 6.28
14
15
16 // Blocks are sequences of expressions enclosed in ().
17 // Last expression is value of the block.
18 // Also notice the static lexical scoping --
19 // the y inside the block shadows the y above
20 val s = {
21   val y = 1 //
22   y == 1 // These two lines will generate a warning that they are pure expressions
23   2 // In statement position, i.e., they don't produce the value of the block.
24   "buckle my shoe"
25 }
26
27 // What's the type and value of y at this point?
28
29 val areSame: Boolean = x == y
30
31 val favorite = "Tame Impala"
32
33 // Triple-quoted String. stripMargin method removes leading spaces before |
34 val letItHappen =
35   """All this running around
36     Trying to cover my shadow
37     A notion growing inside
38     Now all the others seem shallow
39     All this running around
40     Bearing down on my shoulders
41     I can hear an alarm
42     It must be morning""".stripMargin
43
44
45 val music = s"Play my favorite band, $favorite"
46 val fav = s"$Is my favorite band Tame Impala? Result: ${favorite == "Tame Impala"}"
47
```

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6 x: Int = 1
7 x: Int = 2
8
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10 y: Double = 3.14
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Command-Line sbt Projects

- ▶ Create a directory for your project
- ▶ In your project's directory, create a `build.sbt` with minimal contents:

```
1 ThisBuild / scalaVersion := "2.12.8"
2 ThisBuild / organization := "edu.gatech.cs2340"
3
4 lazy val hello = (project in file("."))
5   .settings(
6     name := "YOUR NAME HERE"
7   )
```

Launch sbt at the command line, which will download some things, create a target directory and a `project` directory with `build.properties` (yes, there's a configuration for the build tool)

```
1 $ sbt
2 [info] Loading global plugins from /Users/chris/.sbt/1.0/plugins
3 [info] Loading project definition from
   /Users/chris/scratch/sample/project
4 [info] Updating
   ProjectRef(uri("file:/Users/chris/scratch/sample/project/"),
   "sample-build")...
5 [info] Done updating.
```

sbt Basics

- ▶ sbt is interactive. Use help to list commands
- ▶ Common tasks:
 - ▶ `compile`
 - ▶ `test`
 - ▶ `run` – will find and list all objects with main methods
- ▶ Assumes Maven standard source tree structure and its own configuration files:

```
1  
2 build.sbt  
3 project  
4   build.properties  
5 src  
6   main  
7     java  
8     scala  
9   test  
10     java  
11     scala
```

IntelliJ sbt Projects

Can also use IntelliJ's New Project wizard to create a Scala sbt project.