COMP 333 Lecture 1

Kyle Dewey

About Me

- My research:
  - Automated program testing + CS education
  - Programming language design (with JPL)
- Lots of experience with functional and logic programming
- This is my fourth time teaching this class, first time during the summer

About this Class

- See something wrong? Want something improved? Email me about it! (kyle.dewey@csun.edu)
- I generally operate based on feedback

Bad Feedback

- This guy sucks.
- This class is boring.
- This material is useless.

Good Feedback

- This guy sucks, *I can't read his writing.*
- This class is boring, *it's way too slow.*
- This material is useless, *I don't see how it relates to anything in reality.*

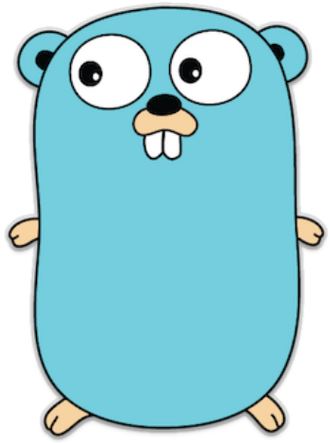
- I can't fix anything if I don't know what's wrong

Why this Course?

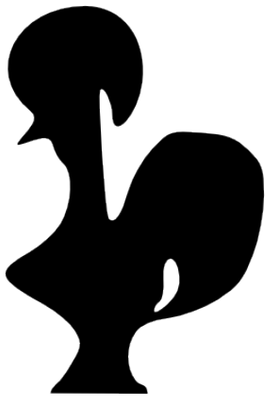
- Navigating programming languages
- Understanding how programming languages work
- Shaping how you think about programming

Navigating Languages

Animals

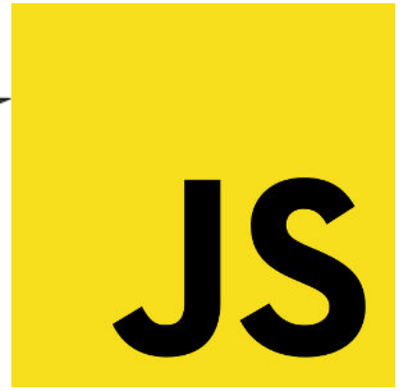


Birds



Camels

Pointy



Coffee

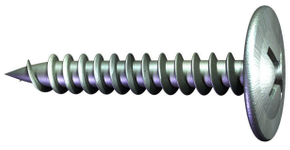
Lambda

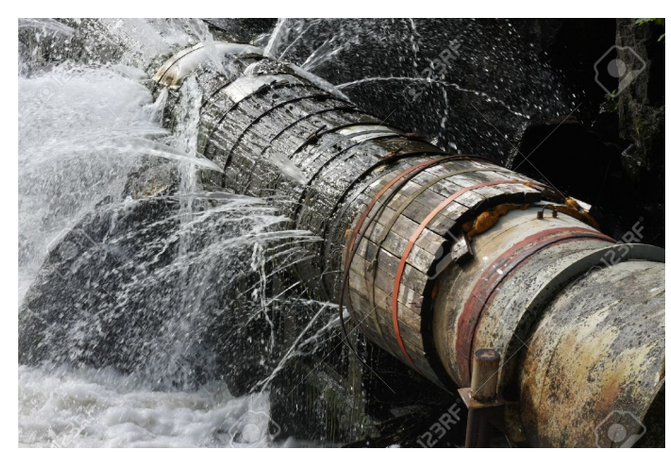
Whatever this is

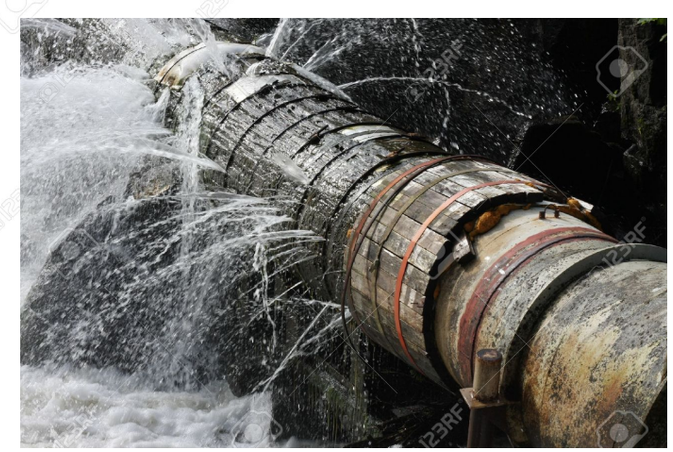
How Languages Work

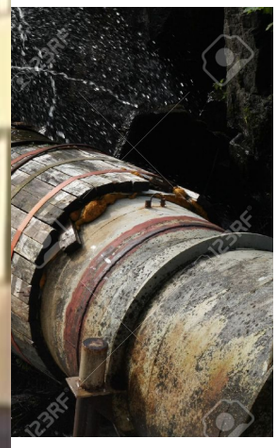
- Proper debugging demands knowledge of underlying language
- Knowledge prevents gotchas (and gotchas usually end with greater knowledge)
- While languages abound, language features are sparse

Thinking About Programming









The Point

- Languages influence how you think and approach problems
- The same problem can be MUCH simpler to solve in a different language

The Point

- Languages influence how you think and approach problems
- The same problem can be MUCH simpler to solve in a different language

---

Scala

```
for {
  a <- Seq(1, 2, 3)
  b <- Seq("foo", "bar")
} yield (a, b)
```

The Point

- Languages influence how you think and approach problems
- The same problem can be MUCH simpler to solve in a different language

Scala

```
for {
  a <- Seq(1, 2, 3)
  b <- Seq("foo", "bar")
} yield (a, b)
```

Java

- Bulk of Summer
- Bulk of semester

Common Misconceptions: Performance

Always Write the Fastest Code

- "Premature optimization is the root of all evil" - Donald Knuth
- Programmer median salary: $89,190/year
- AWS c6g.2xlarge (reserved): $1,582/year
  - 8 cores, 16 GB RAM

High-Level Languages are Slow

- Java can outperform C
- Choice of algorithm usually WAY more important
  - I have written Prolog that dramatically outperformed Java (thousands - millions of times faster)

Common Misconceptions: Utility

FP is Purely Academic

- Functional programming makes concurrency much simpler
- Good software engineering practices tend to enforce functional styles
- Most modern languages now support functional programming features

15,833 Scala Jobs

Remote Scala Software Developer- Open to C2C

Modis Anaheim, CA

Type Full-Time

Remote! Our Client is seeking a hands-on **Scala** developer for a project with one of their leading Public Cloud providers on a possible 3 Month CTH. Candidates must have strong expertise in the ...

Data Engineer with Java or Scala, Postgres, and Kafka (Up to 175k Salary)

Motion Recruitment Los Angeles, CA

Type Full-Time

Required Skills Experience 6+ years experience Java, **Scala**, or Kotlin Database skills in either Oracle, Postgres, or SQL Redshift, Cassandra, Snowflake, or BigQuery Kafka, Kinesis, or Spark Hadoop ...

Senior Data Engineer/ Python or Scala NEW!

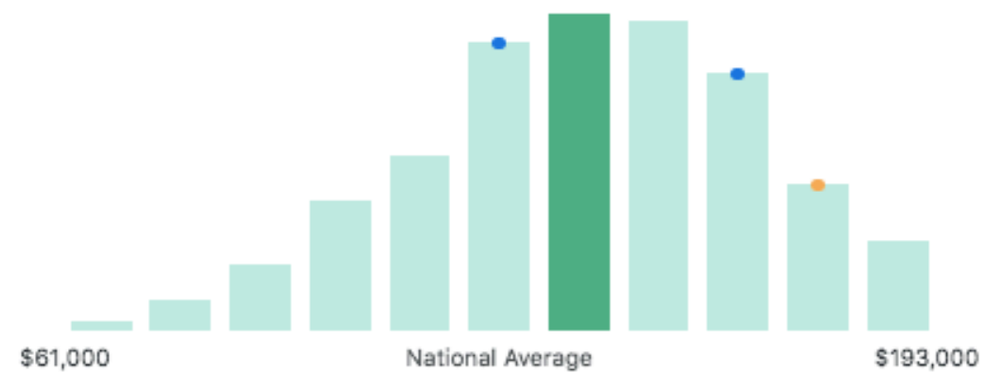
Motion Recruitment Irvine, CA

Type Full-Time

They are open to candidates with Python or **Scala** experience. Required Skills Experience 4+ years of experience in Data Engineering role Desire to advance career into a Data Architect position Python ...

(REMOTE) Data Engineer - Scala/Python

How Much Do Scala Jobs Pay per Year?



$141,810 /year

What Is Scala?

Scala is a programming language that combines object-oriented and functional programming to create one high-level language. Its intention is Java Virtual Machine compatibility, and its different static types work to help avoid bugs in complex applications. Its JavaScript and JVM runtimes make it possible for people to have easy access to large ecosystems of libraries and build high-performance systems. Individuals, such as software engineers, can write Scala code to work on their project. They can also use this programming language with their existing Java code stack.

More about Scala Jobs

LP is Useless

- Logic programming is highly specialized, but not useless
- Recall: Prolog 9 million times faster than Java
- I've used it to find bugs in multiple compilers

RESEARCH

A 'high-speed Dr. House' for medical breakthroughs

May 08, 2018 | Print | Email

Written by: Matt Windsor
Media contact: Bob Shepard

Human biology is full of surprises — especially for drug makers. Viagra wasn't designed for erectile dysfunction. Rogaine didn't start out as a hair-loss cream. Both drugs were meant to treat cardiovascular issues (as sildenafil and minoxidil, respectively), until patients reported their sexual and follicular side effects.

When his son was diagnosed with an ultra-rare disease, computer scientist Matt Might, Ph.D., kicked off a search for answers. His quest led to partnerships with researchers across the country, a White House appointment, a faculty position at Harvard, and a profile in the *New Yorker*. It also led to the discovery that off-the-shelf drugs

RESEARCH

A 'high-speed Dr. House' for medical breakthroughs

May 08, 2018 | Print | Email

Written by: Matt Windsor
Media contact: Bob Shepard

Human biology is full of surprises — especially for drug makers. Viagra wasn't designed for erectile dysfunction. Rogaine didn't start out as a hair-loss cream. Both drugs were meant to treat cardiovascular issues (as sildenafil and minoxidil, respectively), until patients reported their sexual and follicular side effects.

When his son was diagnosed with an ultra-rare disease, computer scientist Matt Might, Ph.D., kicked off a search for answers. His quest led to partnerships with researchers across the country, a White House appointment, a faculty position at Harvard, and a profile in the *New Yorker*. It also led to the discovery that off-the-

Common Misconceptions: Stagnation

Industry Moves Slowly

- COBOL was once a vital language
- Perl was once the champion of the Internet
- Java has lost tons of ground to Python
- Companies that cannot adapt, die

Staying in a Comfort Zone

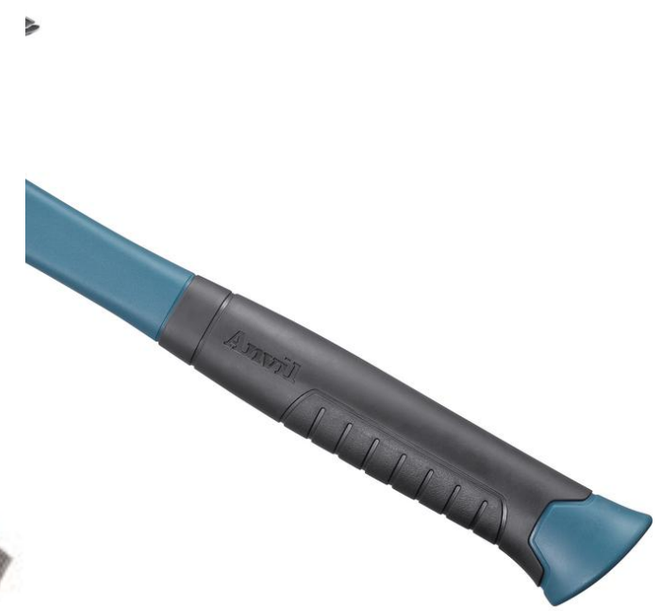
- "I know Python *and* Ruby, so I already am pretty flexible"

Staying in a Comfort Zone

- "I know Python *and* Ruby, so I already am pretty flexible"

Staying in a Comfort Zone

- "I know Python *and* Ruby, so I already am pretty flexible"



What this Course Is

- Heavy on programming
- Exposure to object-oriented, functional, logical, and a little parallel programming
- Exposure to various language features in the context of the languages you'll use

What this Course **Isn't**

- Advanced topics in any one style
- In-depth look at language implementations
- Heavy on theory

Languages We Will Use

- Java (class-based object-oriented programming)
- JavaScript (prototype-based object-oriented programming)
- Swift (functional programming)
- Prolog (logic programming)
- Java 8 (parallelism)

Why Java?

- 5th most popular language on StackOverflow
- OOP with class-based inheritance
- Even if you have used it, you may be rusty
- Statically typed, garbage collected, just-in-time compilation

Why JavaScript?

- Most popular language on StackOverflow
- OOP with prototype-based inheritance
- Dynamically typed, garbage collected, (typically bytecode) interpreted, just-in-time compilers available

Why Swift?

- 17th most popular on StackOverflow, and 9th most loved
- Not *exactly* a functional language, but it has key functional features without getting too weird
- Statically typed, unbounded and bounded generics, compiled, algebraic data types, pattern matching, typeclasses, optional call-by-name, reference counting

Why Prolog?

- Arguably the simplest logic programming language out there
- For better or worse, logic programming is largely synonymous with Prolog's features
- Unification, nondeterminism, both (bytecode) interpreted and compiled

Syllabus