Languages & Paradigms

What’s a Language?

- It’s a form of expression
- To communicate your intent
- To program a computer
What Makes a Program?

Language Syntax + Semantics + Algorithms
What’s Makes It Special?

- It’s not the syntax of a language that is most interesting
- It is the paradigm and the idioms
- What you can do and how you often realize it
- Conventional wisdom from advanced programmers

Language Purpose/Target

- General Purpose Languages
  - Can be used for general programming
    - Somewhat of a Swiss army knife
- Domain Specific Languages
  - Targeted at a particular narrow domain
  - Small, focused, not generally considered as full programming languages
What Languages you’ve Used?

Language Paradigms

- Imperative
- Object-Oriented
- Concurrent
- Functional
- Logic
- Scripting
Language Paradigms

- Languages do not fall exclusively into a particular type
- By design, generally, they opt in to more than one type

Imperative

- To tell how to do things
- You typically use variables, commands, procedure
- Sequence of instructional commands
- Mutable state
**OO**

- Abstraction
- Encapsulation *
- Inheritance
- Polymorphism *

**Concurrent**

- Concurrent Processes
- Higher level of abstraction to exploit concurrency
Functional

- Functions as Higher order, first class citizens
- Assignment-less programming

Logic

- Infer relationships
- Predicate logic
Scripting

- Commands to execute system level operations, text manipulation, transformations, ...
Control Structures

- Statements
- Expressions
- Assignments
- Unconditional jumps
- Conditionals: if, if-else, switch
- Iterative: for, while, until,…
- Procedures/Subroutines

Most Powerful Language!

Created in 1950s

by John McCarthy

Modern Languages are still trying to catch up to it!

Lisp
What’s Lisp?

It stands of “Lots of Insignificant Silly Parenthesis”

At least that’s what people who dislike it call
It’s actually “List Processing”
Lisp syntax is quite intimidating
Was not written with performance in mind
Ignore that, there is a beautiful language in there

Scheme is a derivative  Clojure is Lisp on the JVM

What Made Lisp Special

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1. Conditionals
2. A function type
3. Recursion
4. Concept of variables
5. Garbage-collection
6. Composed of Expressions
7. A symbol type
8. Notation for tree of symbols
9. Whole Program always available
Exercise

In your favorite language, write a shortest program that prints “Hello World!”