

CS 476 – Programming Language Design

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Imperative Languages

- Arithmetic and boolean expressions
- Variables and assignment
- Control flow (conditionals, loops)
- Variable declarations
- Function declarations and calls
- There's more, but we've covered the essentials!

An Overview of Programming Languages

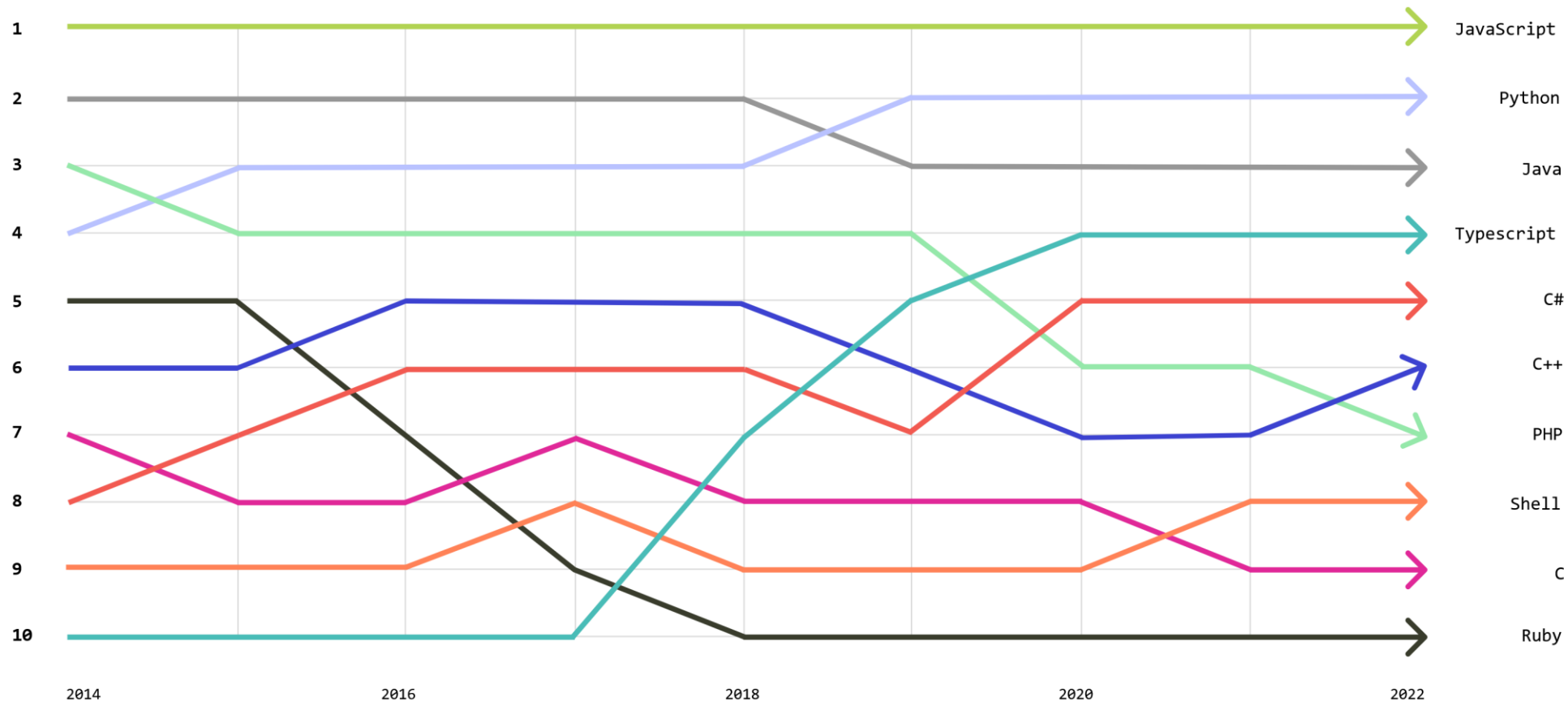
- What counts as a programming language?
- What kinds of programming languages are there?
- Where did they come from? Why are there so many?
- Do the differences between them really matter?

History of Programming Languages

- 1945: ENIAC, the first programmable computer, is built, programmed by setting switches (machine language, 1's and 0's)
- 1947: Kathleen Booth invents assembly language
- 1951-1952: Grace Hopper and her team invent A-0, a very low-level compiler
- 1955-1959: Hopper invents FLOW-MATIC, the first programming language with English-like syntax, which later becomes part of COBOL
- 1957: an IBM team led by John Backus releases the FORTRAN compiler, the first commercially available compiler
- 1960: FORTRAN, COBOL, ALGOL, and LISP become the four main programming languages
- 1970—: They inspire an explosion of new languages



An Overview of Programming Languages



<https://octoverse.github.com/2022/top-programming-languages>

Kinds of Languages

- Imperative: C, Rust, ...
- Object-oriented: Java, C++, C#, ...
- Functional: OCaml, F#, Haskell, Lisp, ...
- Logic: Prolog, Datalog, ...

- Scripting: JavaScript, Python, PHP, Ruby, shell script(?)
- Systems: C, C++, Rust

An Overview of Programming Languages

- Genealogy: <https://erkin.party/blog/190208/spaghetti/>
- Over 900 listed on [https://www.rosettacode.org/wiki/Category:Programming Languages](https://www.rosettacode.org/wiki/Category:Programming_Languages)

Why are there so many languages?

- Example: the ML family
- 1970s: Robin Milner's group at U. Edinburgh develops Meta Language (ML) to implement a proof-checking program
- 1980s: the original ML team develops Standard ML (SML), while a team at INRIA builds their own version, Caml
- 1996: the Caml team rebuilds the compiler from scratch and adds object-oriented features, making OCaml
 - Meanwhile, SML adds its own set of extensions! vectors, etc.
- 2005: Don Syme at Microsoft Research implements a .NET version of (part of) OCaml, which becomes F#
- And it keeps going: Manticore for parallel programming, F* and Coq for theorem proving, ...

An Overview of Programming Languages

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- Exercise: What language, or kind of language, are you most interested in learning more about?