BU Summer Challenge
Computer Science

Programming Languages
Programming Languages

- There are many many many programming languages.
- Some languages are easier for certain tasks than others.
- Some languages are old/obsolete.
- Some languages are domain specific.
- Some languages provide high level of reliability, others are better for quick prototyping.
Paradigms

- It is standard to classify general programming languages by their paradigms.

- Imperative programming: every line of code is a command.

- Functional programming: relies heavily on recursion and higher order functions.

- Object oriented programming: Organizes code in blocks (objects) designed after the shape of data.

- Logic programming: specify relationships and perform queries on them.
Paradigms

- New languages usually mix ideas from different paradigms.
- Most popular languages are imperative.
- Newer imperative languages provide some “functional” styled features.
- Many imperative languages also support object oriented programming.
Paradigms

- Functional programming is gaining some momentum recently with new languages like scala.
- Mostly used by researchers.
- Some functional languages allow for advanced type checking and theorem proving to prove and ensure that the code is correct.
Types

- All languages utilize the idea of types in one way or another.
- Some languages enforce strict type safety rules.
- Some languages force programmers to declare the type of the variable explicitly.
- Some functional languages allow the user to leave some types blank and automatically infer them.
- Other languages do not require types to be defined in the code, and allow variables to change types.
Other Classifications

- General purpose VS Domain specific.
- Complete (capable of performing any function) VS Limited.
Examples

- Javascript is imperative, it also has some functional and object oriented features. Javascript is dynamically typed.
- Java is an object oriented imperative language, recently limited functional features were added. Java is statically typed.
- Python is a multi-paradigm language that supports imperative, functional, and object oriented programming. Python is dynamically typed.
- LISP is functional programming language that support symbolic programming (programs can modify themselves!). LISP is dynamically typed.
- Haskell is a function programming language that allows for some type inference. Haskell is statically typed.
- Prolog is a logic programming language.
Examples

- SQL is a popular domain specific language for managing and querying databases.

- HTML and CSS are domain specific languages for designing and styling webpages.

- MATLAB is a very popular domain specific language for manipulating matrices and performing numerical computations.

- Standard SQL is not complete. HTML + CSS recently became complete. MATLAB is complete.
Examples

- Other Popular Imperative languages:
  C/C++ for systems programming.
  Go for web and parallel development.
  PHP for web development...

- Functional languages:
  ML (statically typed).
  Scala (compatible with Java).
  ATS (allows for rigorous type checking).
  Coq (allows for theorem proving) ...