Introduction to Computer Programming
CSCI-UA 2

From Natural Language to Machine Language
by Way of Python
What is a program?
What is a program?

A sequence of instructions for a computer to follow

May be mathematical or symbolic

Basics include:
• input
• output
• math
• conditional execution
• repetition
Natural Languages and Programming Languages
Similarities

Syntax
Grammar
Parts of speech
Semantics
Syntax

Natural language syntax is the arrangement of words and phrases to create well-formed sentences.

Programming language syntax is the arrangement of words and characters to correctly structure programs.
Grammar

Natural language grammar refers to the whole system and structure of a language, such as sentences and paragraphs.

Programming languages also implement structure, such as tokens, blocks of code and statements within the blocks.
Parts of Speech

Natural languages incorporate different parts of speech, like nouns, verbs, and adjectives.

Programming languages also have parts of speech called “data types” that include different kinds of numbers and characters.
Semantics

In natural languages, semantics refers to the meaning of a word. “Cat” brings something specific to mind.

In programming languages, certain symbols, like + and =, have specific meaning as well as some key words.
Key Words

A primary difference between natural and programming languages

Python keywords:
False, None, True, and, as, assert, break, class, continue, def, del, elif, else, except, finally, for, from, global, if, import, in, is, lambda, nonlocal, not, or, pass, raise, return, try, while, with, yield
Pseudocode

Determining the logic of a program without regard for the language it will be written in

Best written out on paper or in a plain text editor

Pseudocode describes the steps of an algorithmic process
Program Design

Input
Processing
Output
Determine requirements
↓
Write the source code
↓
Convert source code to object code
↓
Run the program
↓
Check the output
Debugging

Syntax errors:
Program doesn’t run because structure isn’t correct or doesn’t follow rules of language

Runtime errors:
Happen when the program is running. Also called “exceptions”

Semantic errors:
Program runs without an error message, but not correctly because it’s not doing what you meant it to
Programming Languages
A contemporary list

Java
C
C++
PHP
C#
Visual Basic
Python
Objective-C
Perl
Javascript
Python

High-level programming language
Developed in the 1990s by Guido van Rossum
Actively maintained and documented by programmers around the world
Clear syntax
General purpose usage
Wide range of libraries available
Python 3
Python Interpreter

Like all high-level programming languages, Python programs must be compiled and/or interpreted to run.

Python scripts have to be processed by another program called the “Python interpreter”.

The interpreter does the following:
- Reads your script
- Compiles it into “bytecode”
- Executes bytecode to run program
IDLE
Interactive Development Environment

This is what we’ll be using to write, run, and debug our code.
Installing Python 3

Python comes preinstalled on Macs but it is version 2

python.org/download

Versions available for Mac, Windows, and Linux