What is Python?

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What is Python?

Syntax

General-purpose

Multi-paradigm

Interpreted

Garbage-collected

Dynamically-typed

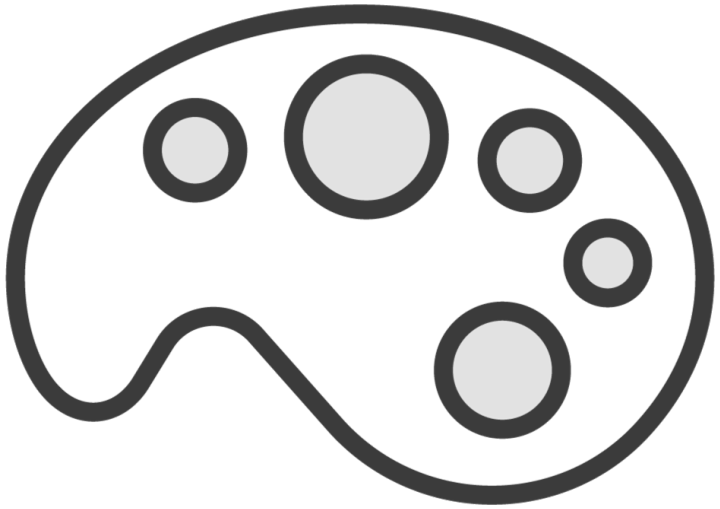
Python Syntax

C-like Syntax

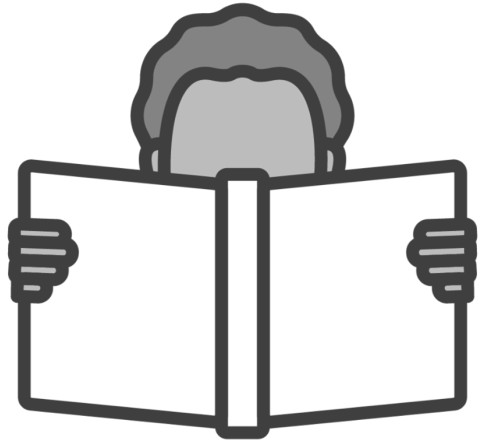
```
long some_function();
/* int */ other_function();

/* int */ calling_function()
{
        long test1;
        register /* int */ test2;

        test1 = some_function();
        if (test1 > 0)
                test2 = 0;
        else
                test2 = other_function();
        return test2;
}
```

C, C++, Java, JavaScript, C#, Go, PHP, etc.

Some Python Principles...



Beautiful is better than ugly



Readability counts

Significant Whitespace

```
n = int(input('Type a number, and its factorial will be printed: '))

if n < 0:
    raise ValueError('You must enter a non-negative integer')

fact = 1

for i in range(2, n + 1):
    fact *= i

print(fact)
```

General-purpose and High-level

General-purpose

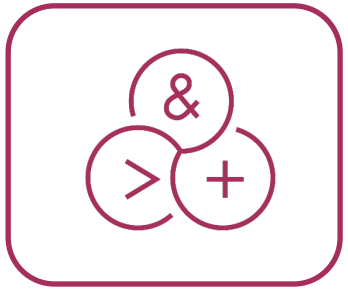
Web Development

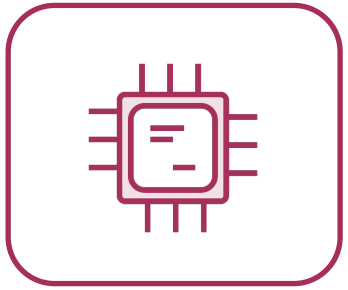
Data Science

STEM

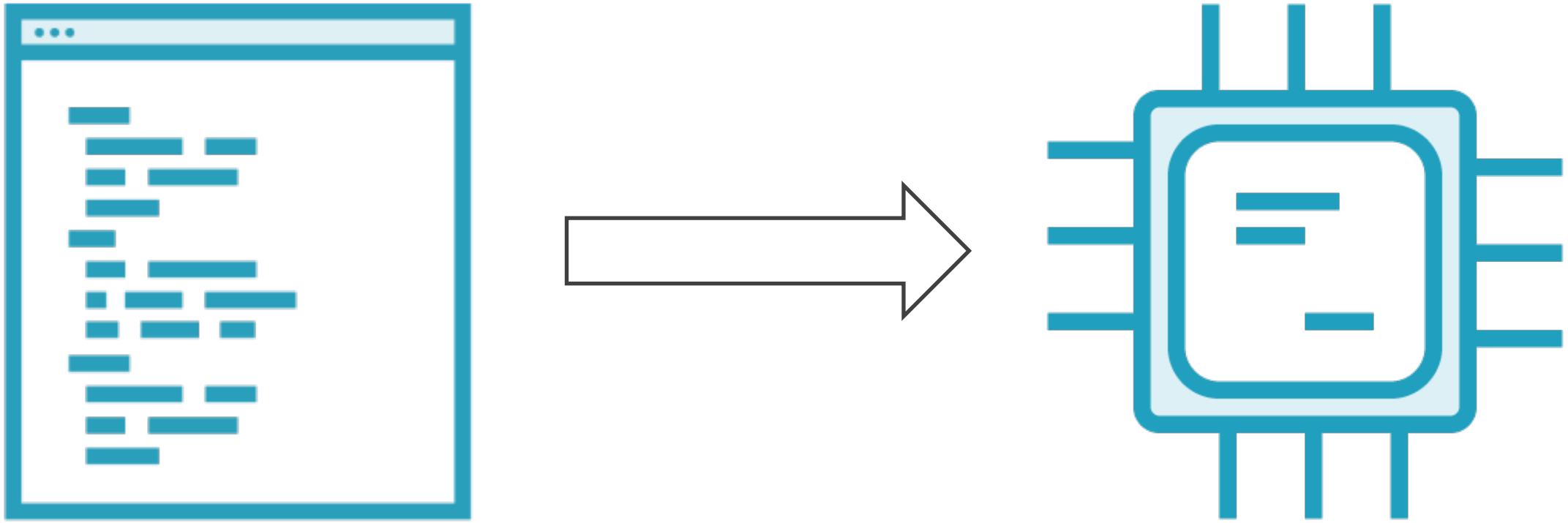
Education

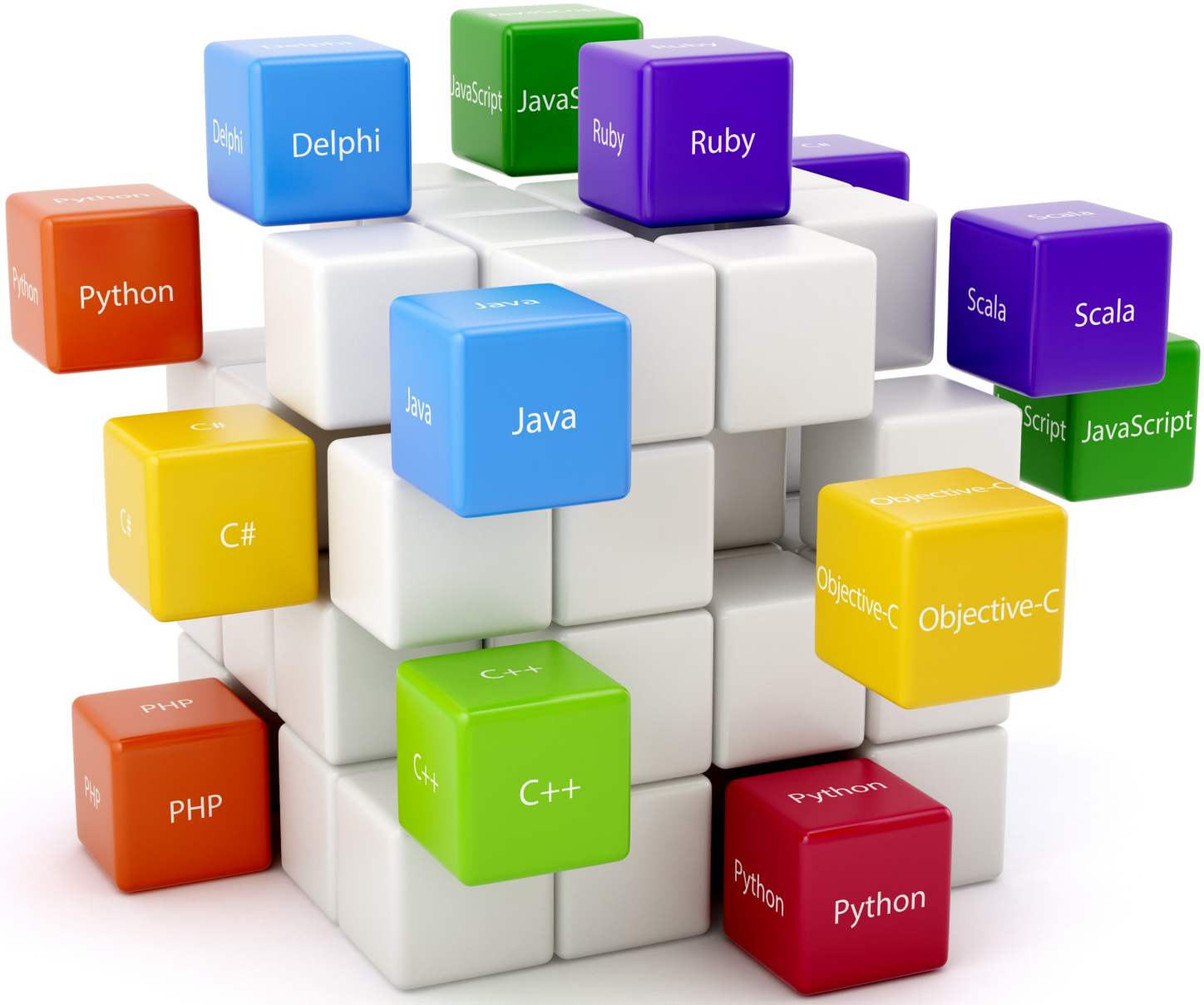
Scripting





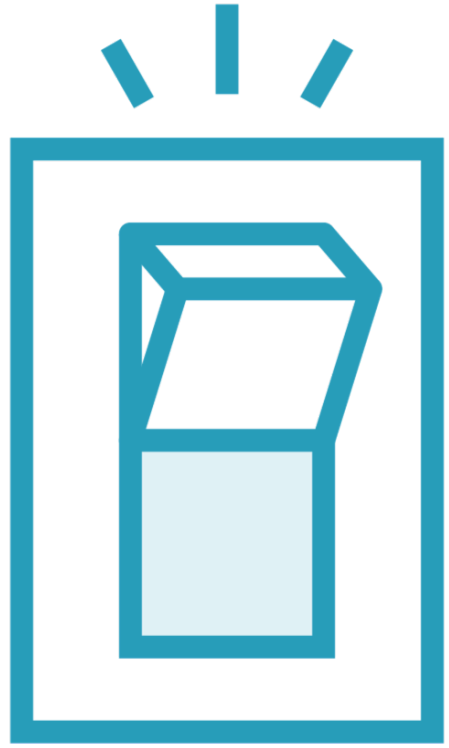
High-level Programming Languages



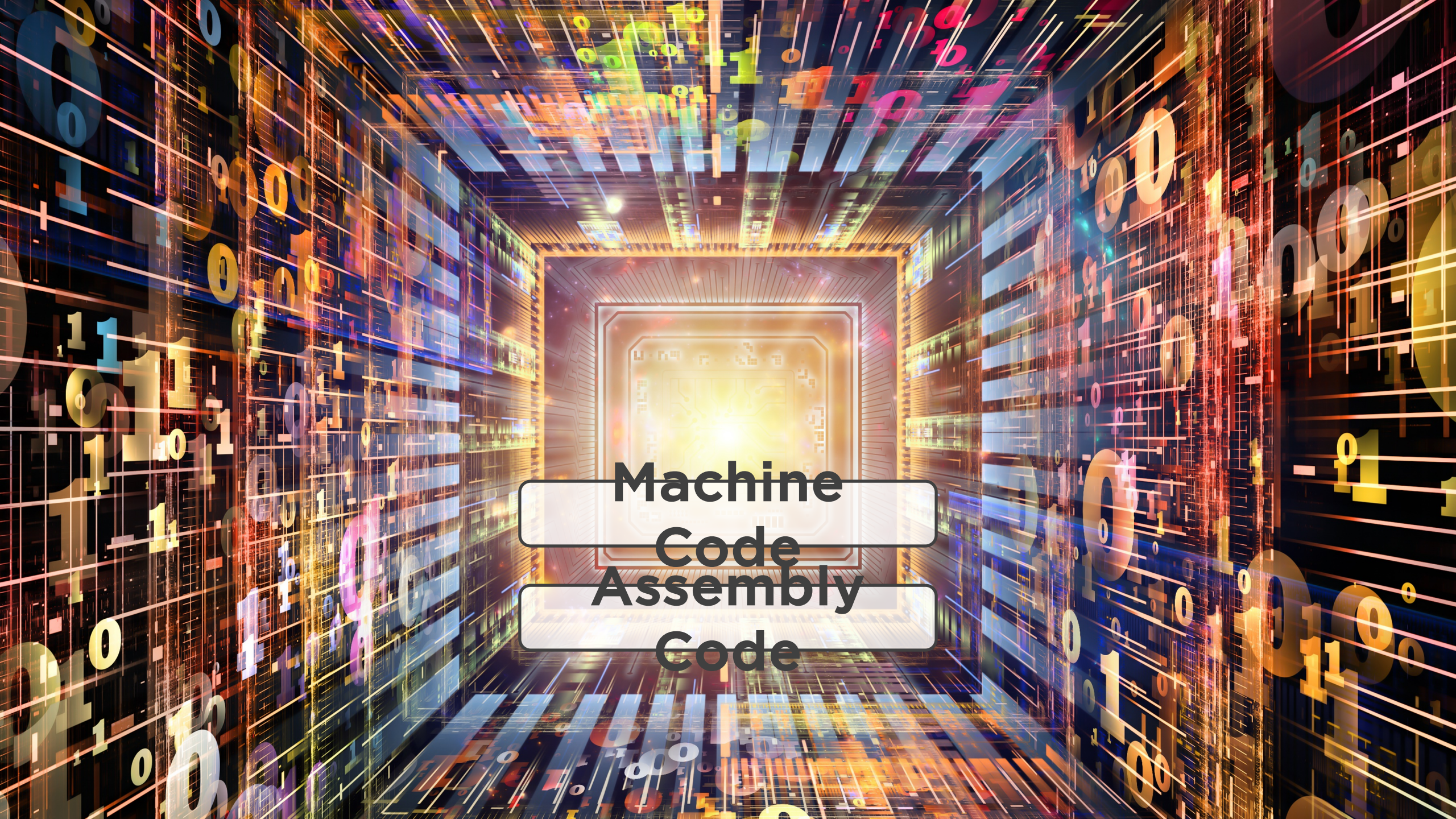

Delphi
Delphi
JavaScript
Ruby
Ruby
Python
Python
Scala
Scala
Java
Java
C#
C#
JavaScript
Objective-C
Objective-C
C++
C++
PHP
PHP
Python
Python

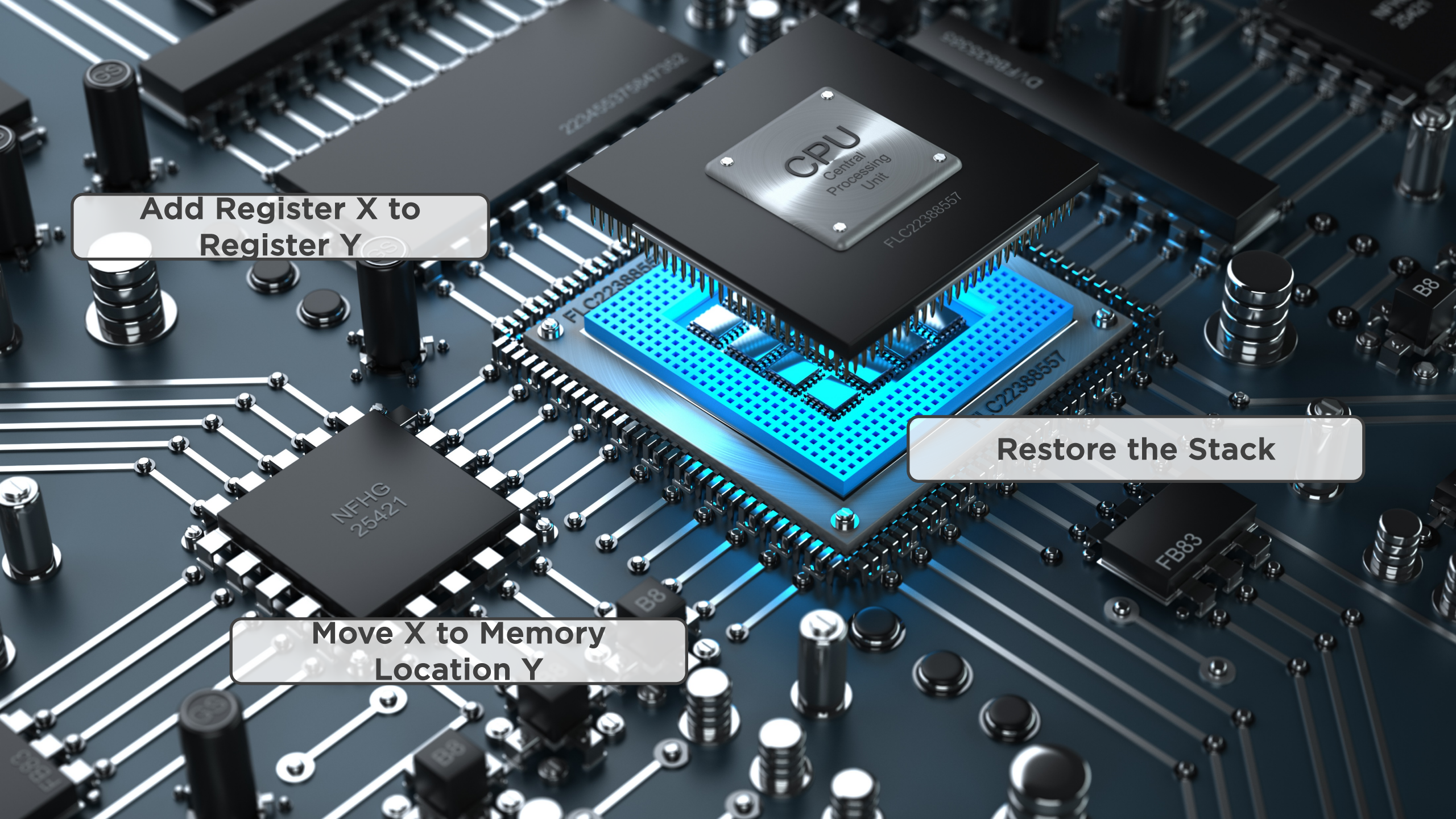
How Computers Work

0100



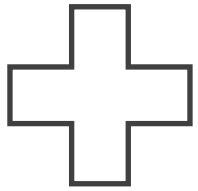

B.120
CS→TC
CS→TD
T→CS
BA
PA
OPERAND


Machine Code
Assembly Code


Add Register X to Register Y
Restore the Stack
Move X to Memory Location Y
CPU
Central Processing Unit
FLC22388557
NFHG 25421
FB83
B8


Display Image
Generate Graph
Play Video

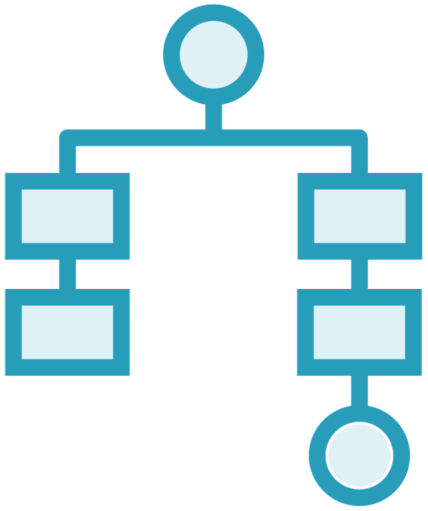
General-purpose



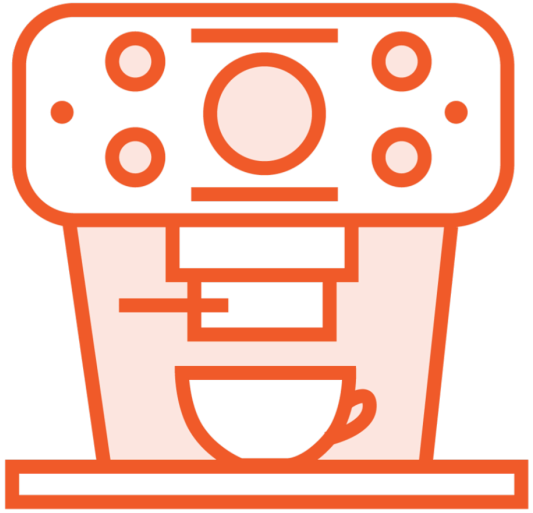
High-level

Multi-paradigm

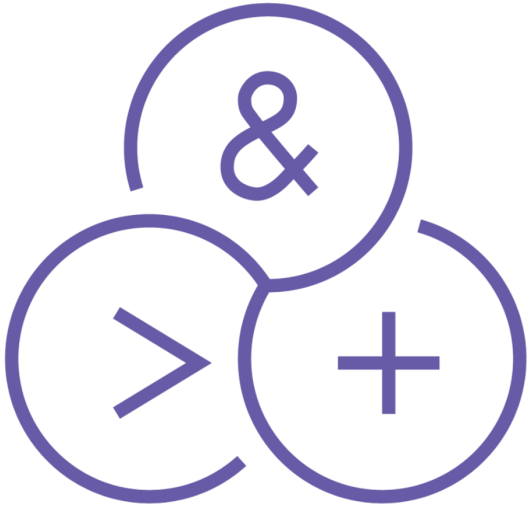
Programming Paradigms



Structured Programming

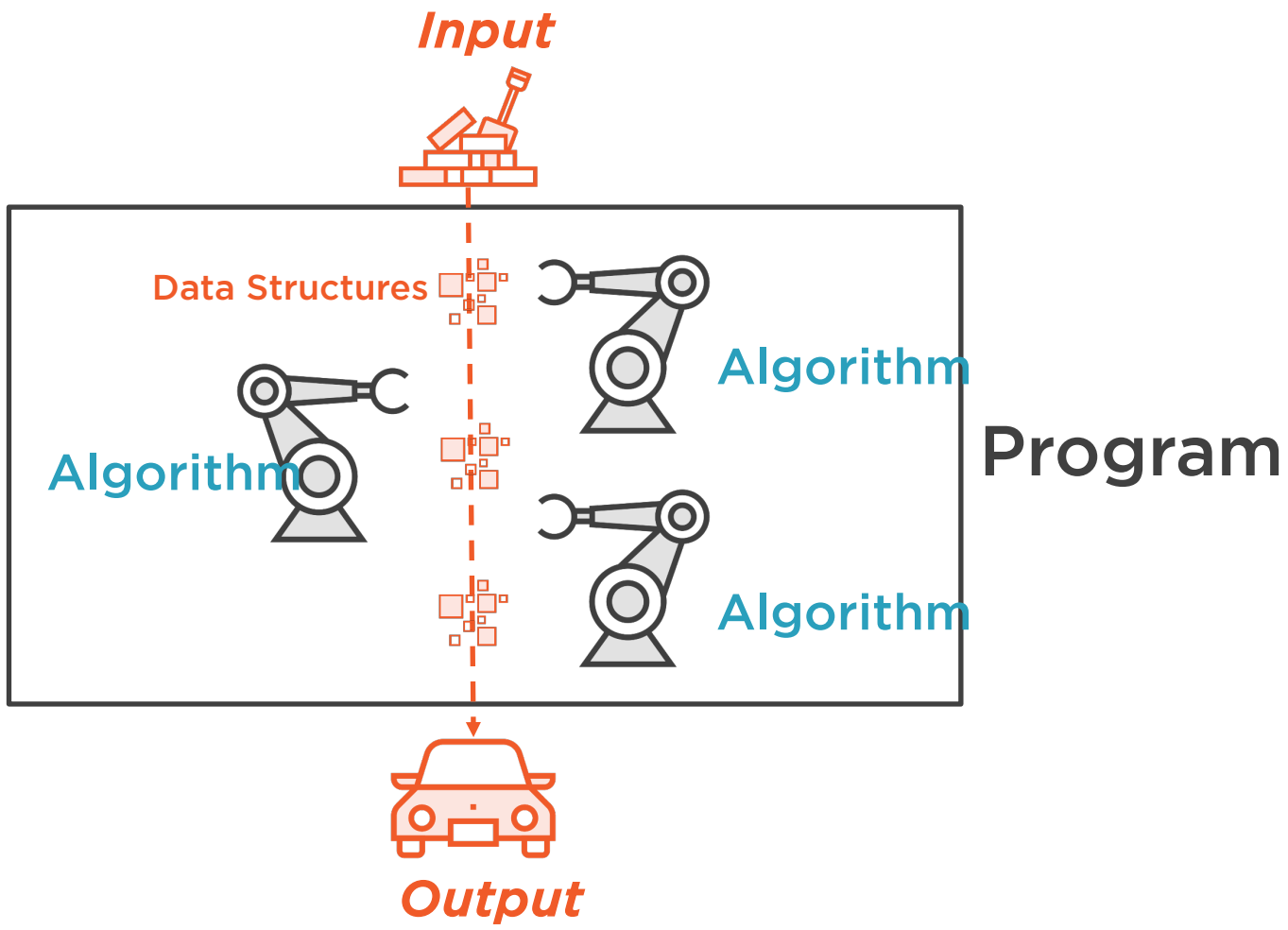


Object-oriented Programming

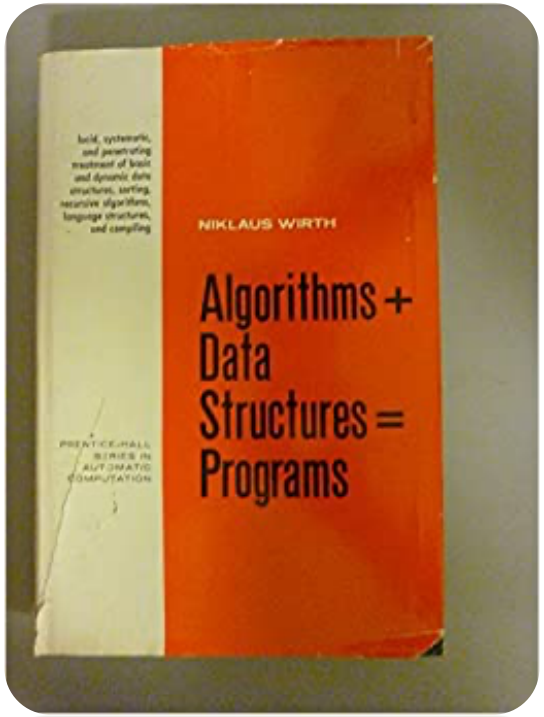


Functional Programming

Programming 101

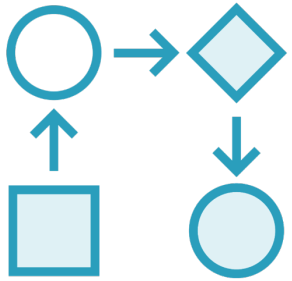


Program



Structured Programming

Control Structures

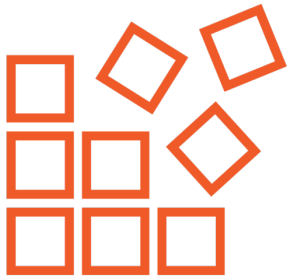


IF this THEN a ELSE b

DO something UNTIL that

WHILE this DO that

Subroutines



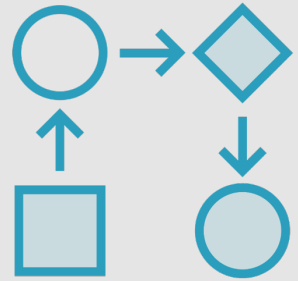
Procedures

Functions

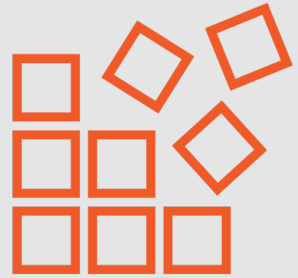
Methods

Structured Programming in Python

```
def fizzBuzz(n):
    for i in range(1, 20):
        if i % 3 == 0 and i % 5 == 0:
            print("FizzBuzz")
        elif i % 3 == 0:
            print("Fizz")
        elif i % 5 == 0:
            print("Buzz")
        else:
            print(str(i))


fizzBuzz(20)
```



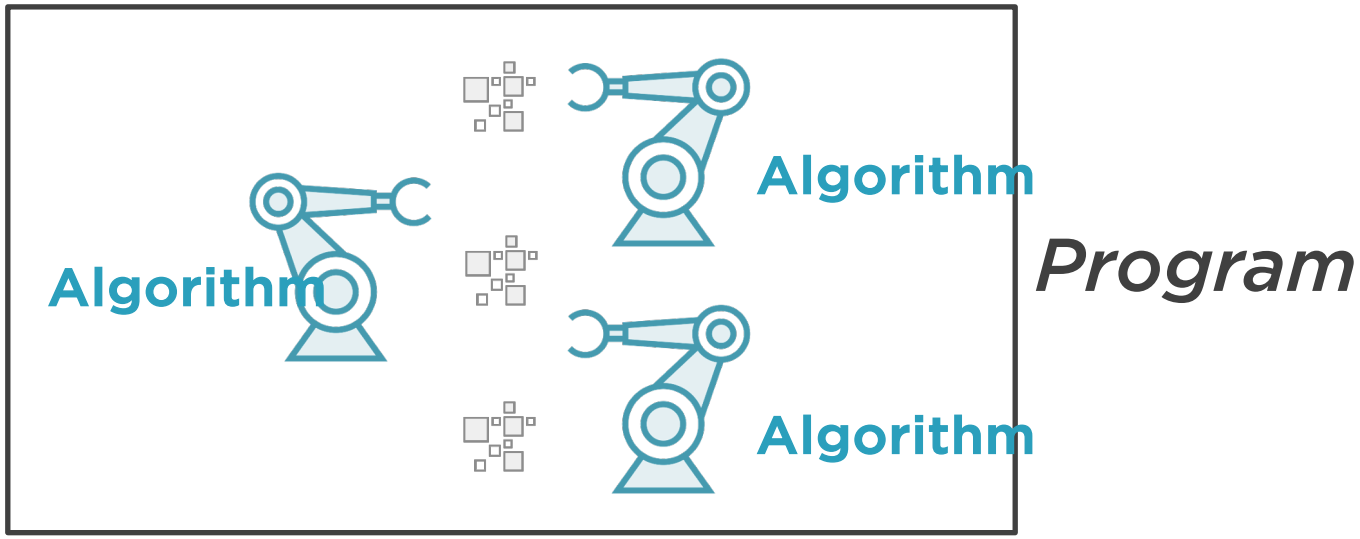
Control Structures



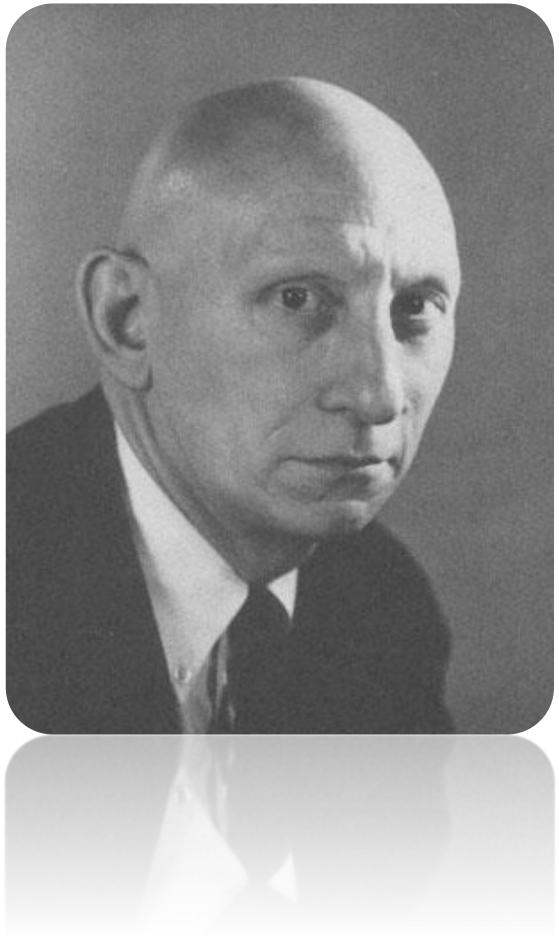
Subroutines

```
 push    ebp
mov     ebp, esp
mov     eax, [ebp+8]
mov     ecx, [ebp+0Ch]
lea     eax, [ecx+eax*2]
 pop     ebp
 retn
push    ebp
mov     ebp, esp
push    ecx
mov     eax, [ebp+0Ch]
mov     ecx, [eax+4]
push    ecx
 call    dword ptr ds:__imp__atoi
add     esp, 4
mov     [ebp-4], eax
mov     edx, [ebp-4]
push    edx
 mov     eax, [ebp+8]
push    eax
call    _sub
add     esp, 8
mov     esp, ebp
pop     ebp
retn
```

Functional Programming



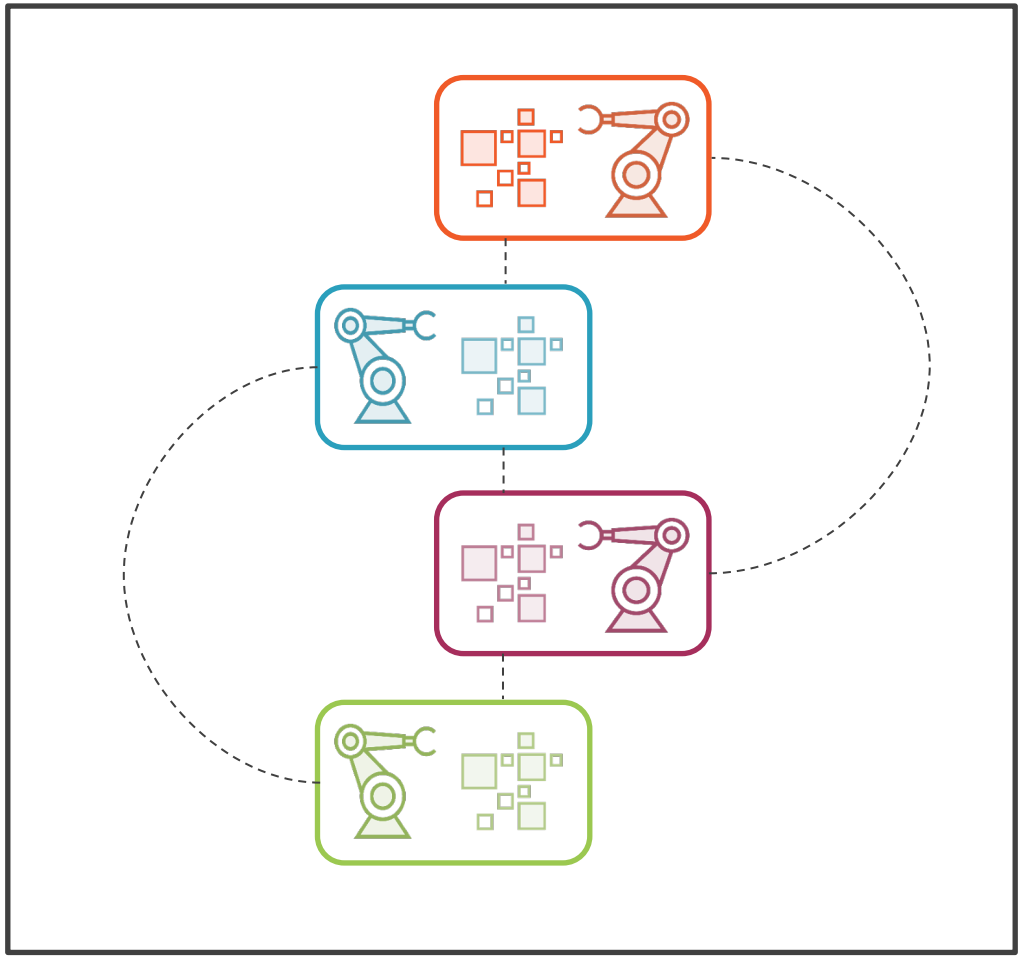
Functional Programming



“It is better to have 100 functions operate on one data structure than to have 10 functions operate on 10 data structures.”

Alan J. Perlis
Computer Scientist

Object-oriented Programming



Program

Python is Multi-paradigm

Functional Programming

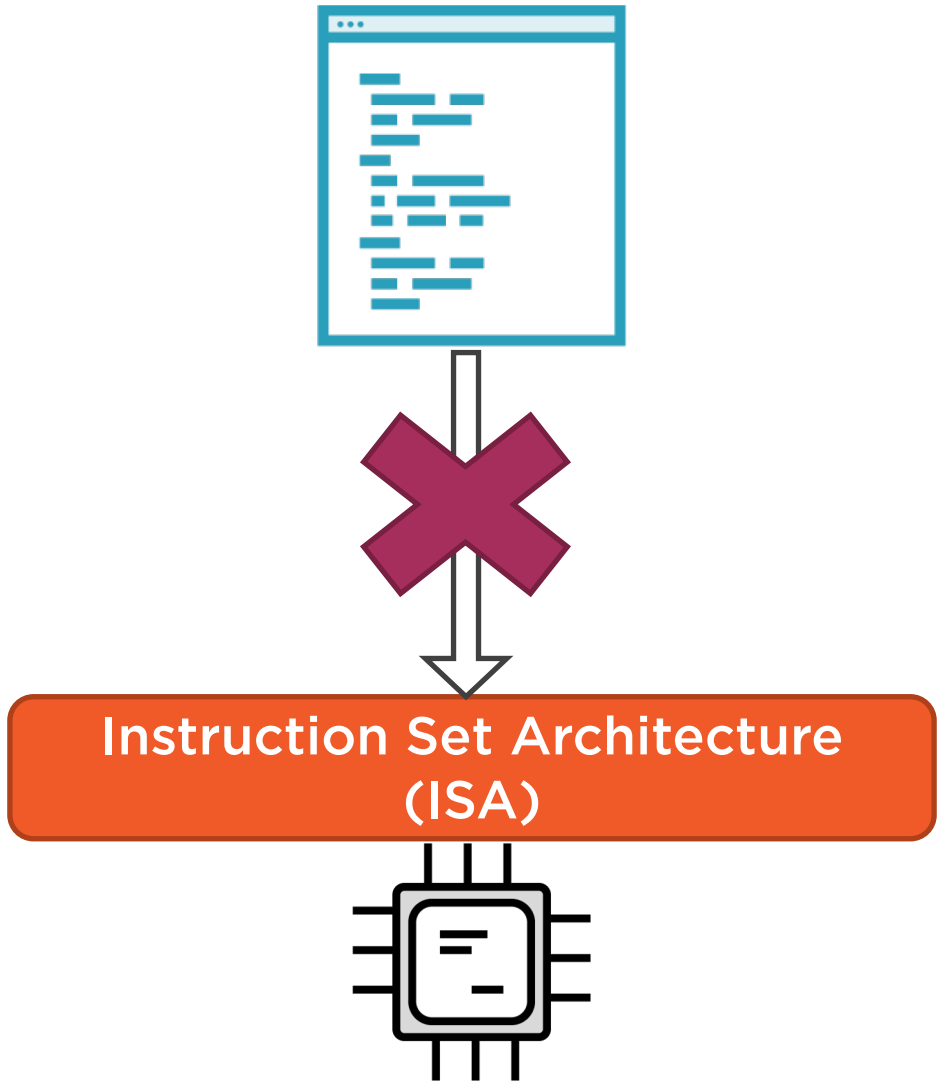
```
def reverse(s):
     return s[::-1]

animals = ["wolf", "horse", "cat",
"dog"]

iterator = map(reverse,
sorted(animals))

for i in iterator:
     print(i);

...

tac
god
esroh
flow
```

Object-oriented Programming

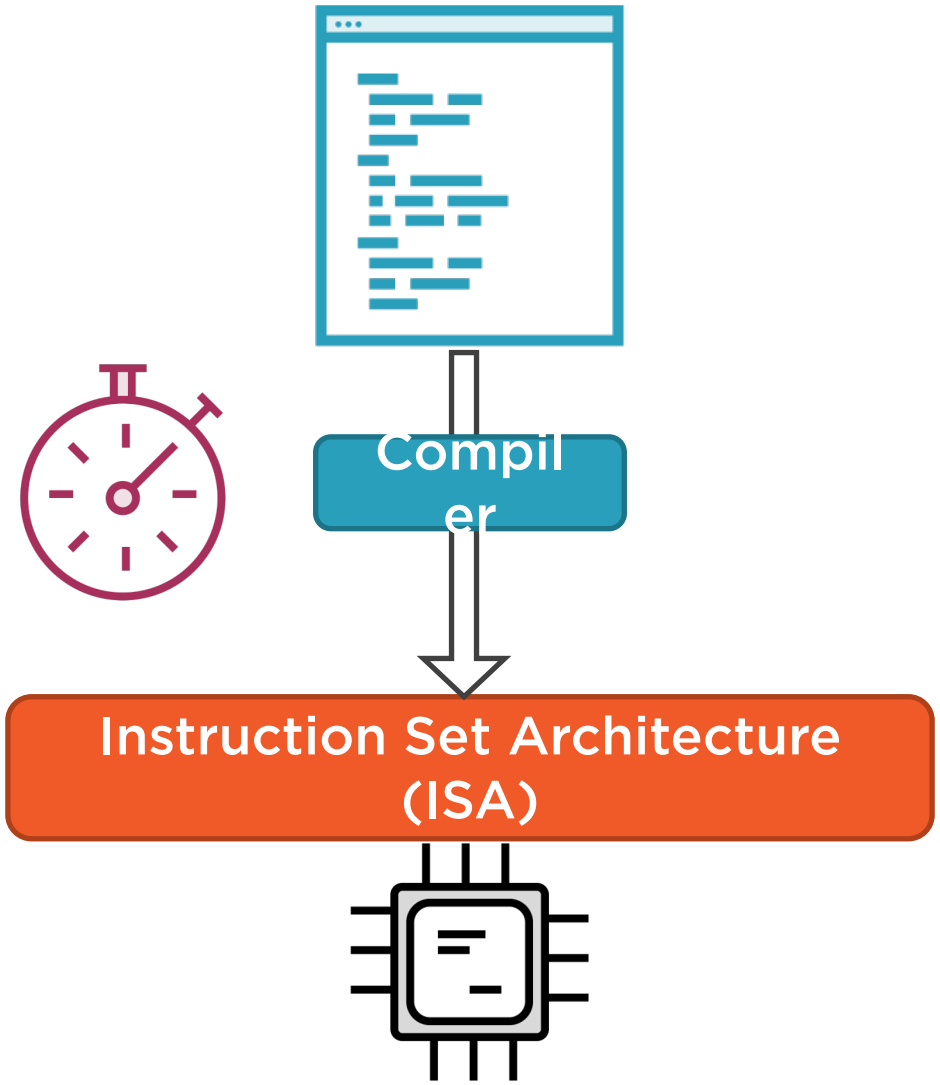
```
class Animal:
     def pet(self):
          print("...")

class Dog(Animal):
     def pet(self):
          print("bark!")

class Cat(Animal):
     def pet(self):
          print("meow!")

def pet_animal(animal):
     animal.pet()

pet_animal(Dog())
pet_animal(Cat())
```

Python Is Interpreted

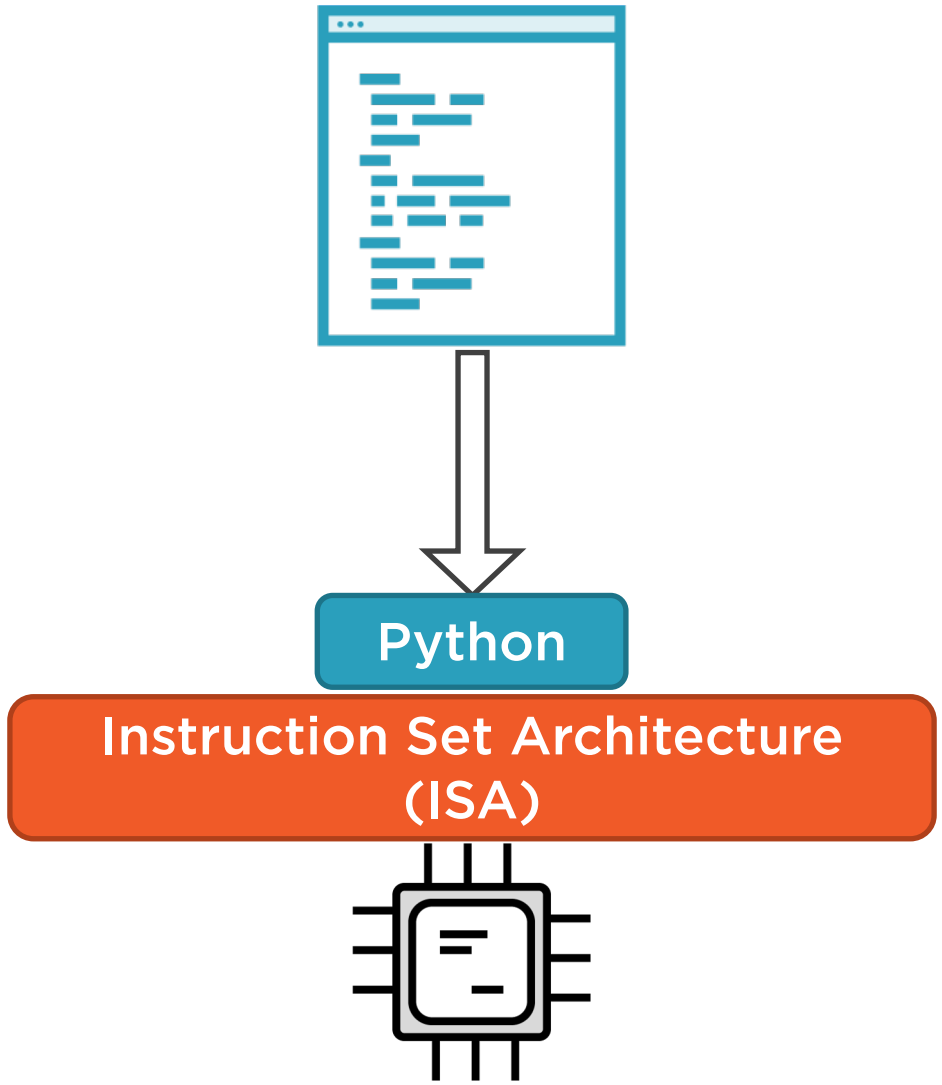
The CPU's Language



Compiling

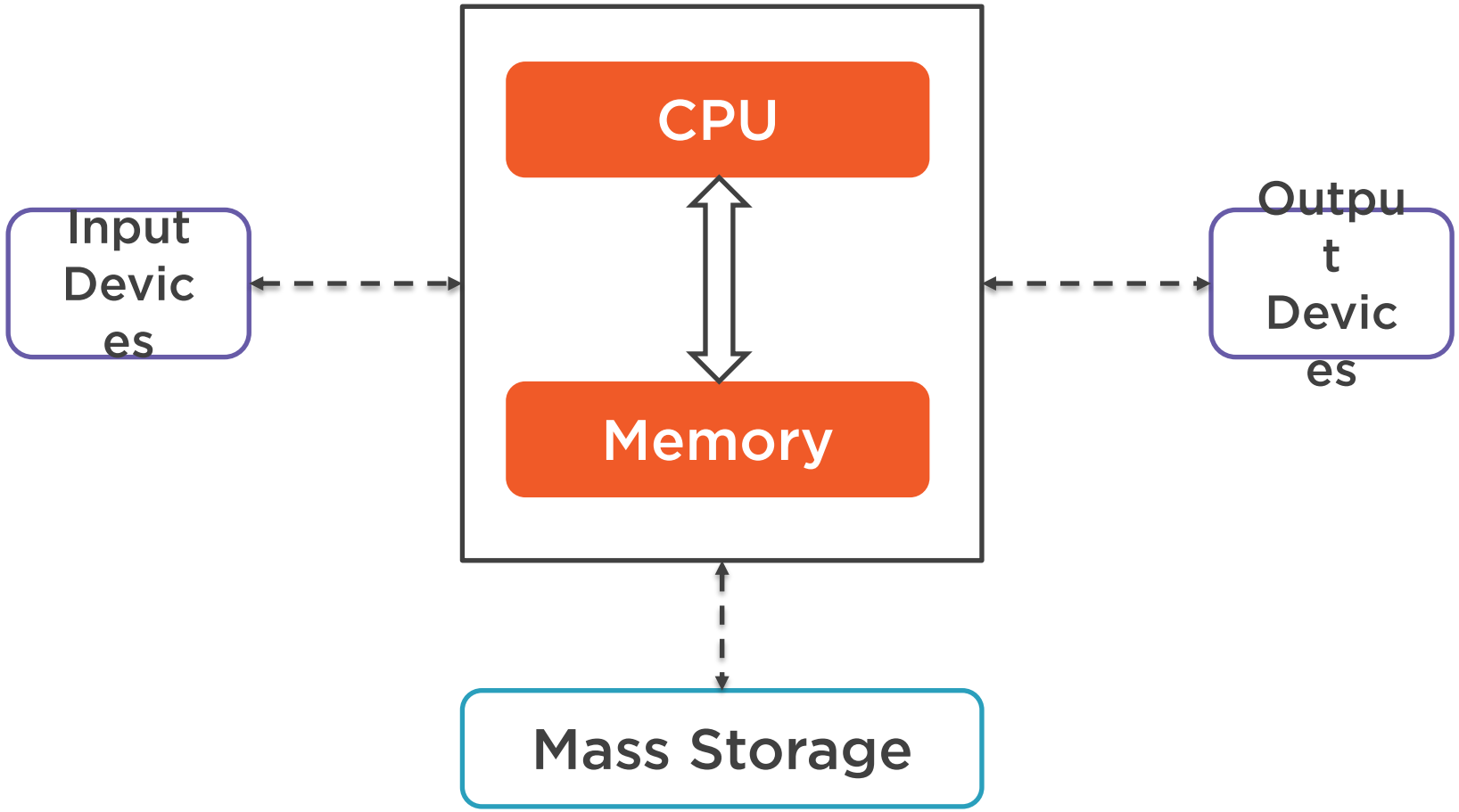


Python Is Interpreted

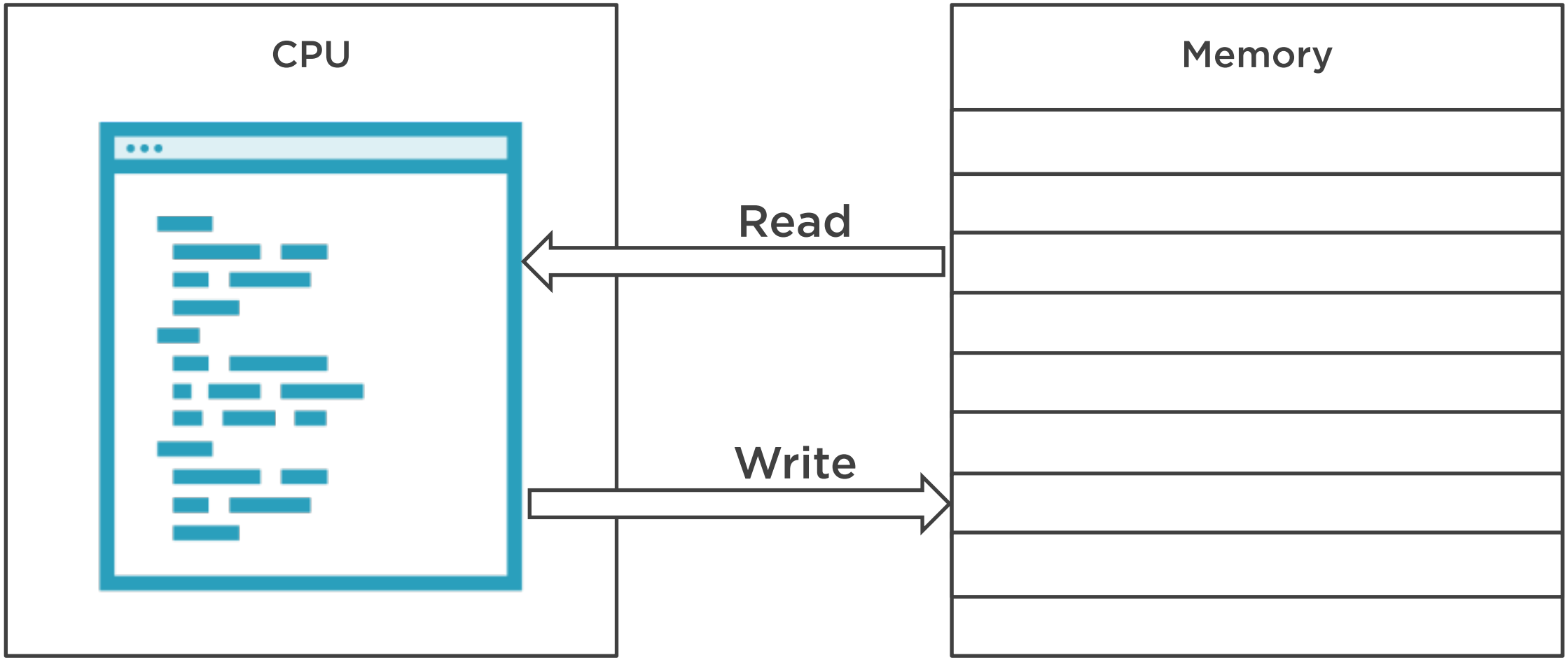


Python Is Garbage-collected

von Neumann Architecture



A Running Program



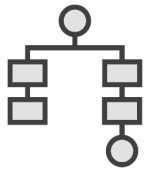

Clean it up yourself!
C/C++
Don’t worry, I got this!
Python

Why Care About Garbage Collection?

No tedious memory bookkeeping

Avoid common memory leaks

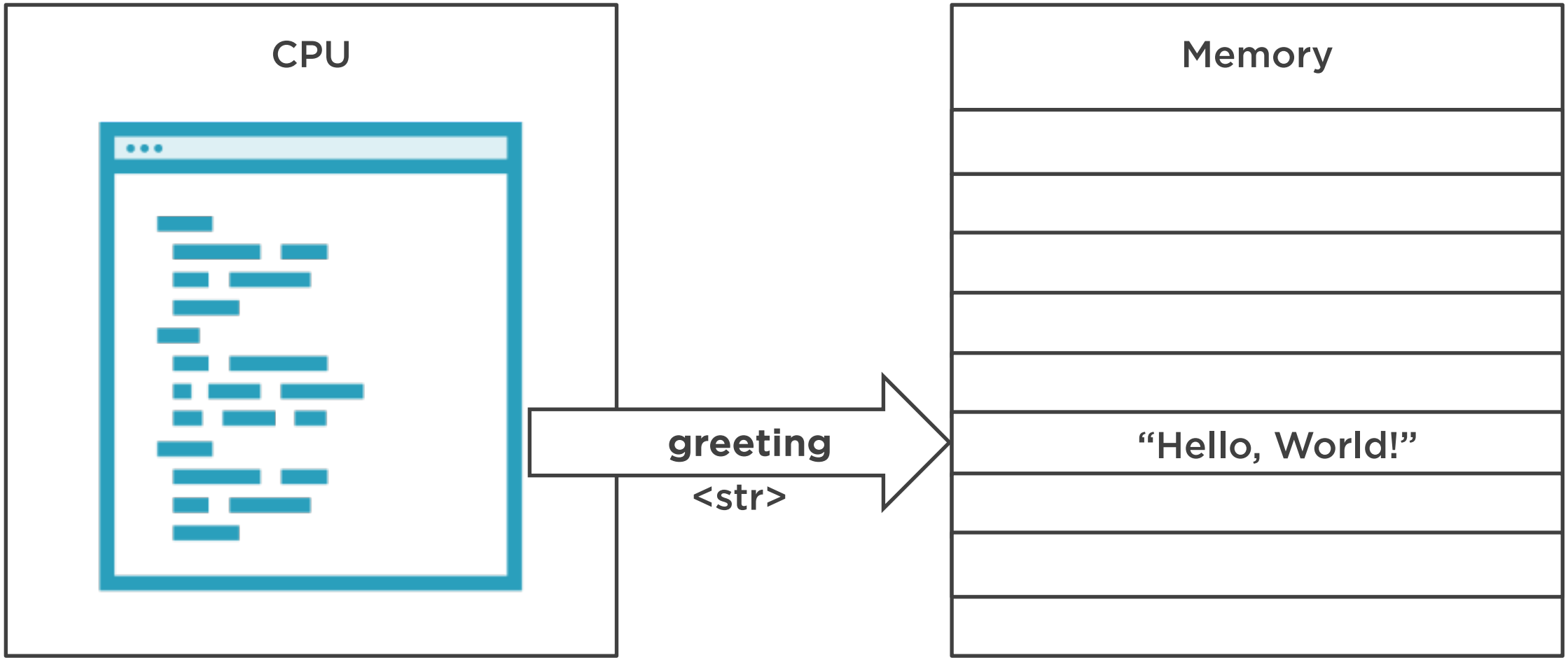
Prevent whole classes of security issues



Efficiently implement certain persistent data structures

Python Is Dynamically-typed

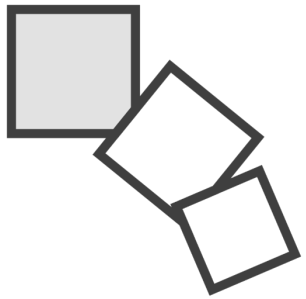
A Running Program



Static Typing

```
String    greeting = “Hello, World!”;
Integer  answer = 42;
…
…

answer = “What is 42?”;
```

Dynamic Typing



Type changing over lifetime of variable

```
answer = “What is 42?”
…
…
answer = 42
```

Type checking happens at runtime

```
>>> 42 + “Forty Two”

TypeError: unsupported operand
type(s) for +: 'int' and 'str'
```

If it walks like a duck
And it quacks like a duck
It must be a duck!

```
class Duck:
      def quack(self):
            print “Quack,
quack!”

class Person:
      def quack(self):
            print “I’m a duck!
Quack!”

def feed_the_duck(thing):
      thing.quack()

feed_the_duck(Duck())
feed_the_duck(Person())
```

So, What Is Python?

Dynamically-typed

Syntax

Garbage-collected

General-purpose

Interpreted

Multi-paradigm