Parameter Passing

in Function Calls

Introducing Parameters

- Parameters allow functions to require additional pieces of information in order to be called
- Parameters are specified within the parenthesis of function definition
- Parameters look a lot like variable declarations... *because they are!*
- Parameters are local variables to the function. Their names are scoped inside of the function body's block.

General Form

```
# Function Definition
def <name>([parameters]) -> <return_type>:
    [statement_0]
     ...
    [statement_N]
```

Example

```
# Function Definition
def max(x: int, y: int) -> int:
    if x > y:
        return x
    else:
        return y
```

What effect does declaring parameters have?

Function Definition

```
def max(x: int, y: int) -> int:
    if x > y:
        return x
    else:
        return y
```

Function Call Usage

```
max(3, 4)
```

Incorrect Function Call Usage

```
max(3)
```

Incorrect Function Call Usage

```
max(3, 4, 50)
```

- When a function declares **parameters**, it is declaring:
  "you must give me these extra pieces of information in order to call me"

- The function ***definition*** on the left says:
  "in order to call `max`, you must give me two number values"

- In the *usage* to the right, when we ***call*** max, we must give it two `int` values.

Arguments vs Parameters

These are **arguments.**

```
max(3, 4)
```

- Arguments are the *values* we assign to parameters
- The type of the arguments must match the types of the parameters
- We couldn't call max with str values: `max("oh","no")`

These are **parameters.**

Example

```
def max(x: int, y: int) -> int:
    if x > y:
        return x
    else:
        return y
```

Function Calls: Step-by-Step (1 / 3)

```
L1. max(8, 9)
```

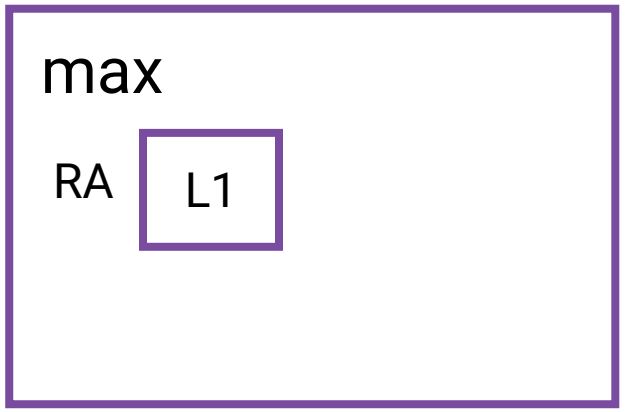
For each function call…

1. Is name defined and bound to a function?
   - NameError if not!
2. Does it have the correct # of arguments for function's parameters?
   - TypeError if not!
3. Its *argument expressions* are evaluated.
   - In this example, 8 and 9 are fully evaluated literals.
4. In memory, a frame is established on the call stack and a Return Address (RA) Line Number is recorded as a "bookmark" of where we'll come back to with a result.

```
def max(x: int, y: int) -> int:
    if x > y:
        return x
    else:
        return y
```

Notice the argument *matches* the parameters in type (number) and count (2)!

Stack Memory:



Function Calls: Parameter Passing (2 / 3)

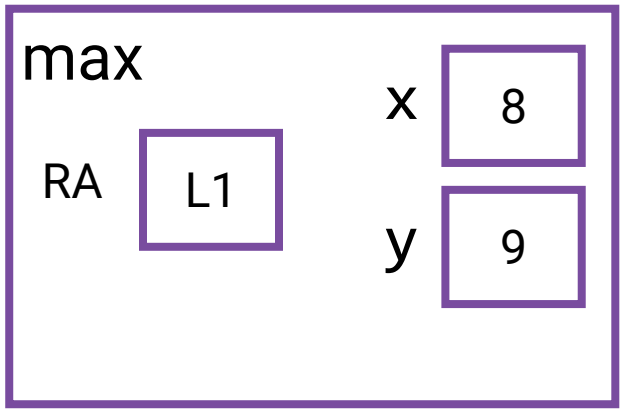
```
L1. max(8, 9)
```

```
def max(x: int, y: int) -> int:
    x = 8
    y = 9
    if x > y:
        return x
    else:
        return y
```

Argument values are assigned to parameters:

1. This happens invisibly when the code is running. *You* will never see the lines to the right.
2. However, each time a call happens, the processor assigns each argument value to its parameter.
3. This is called "parameter passing" because we are copying arguments from one point in code *into* another function's frame in memory.

Stack Memory:



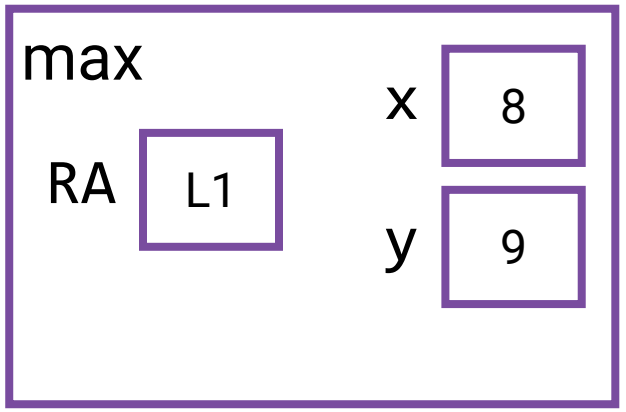
Function Calls: Jumping into Function Body (3 / 3)

```
L1. max(8, 9)
```

3. Finally, the processor then *jumps into* the function and continues onto the first line of the function body block

```
def max(x: int, y: int) -> int:
    x = 8
    y = 9
    if x > y:
        return x
    else:
        return y
```

Stack Memory:



Function Calls: Returning (3 / 3)

```
L1. max(8, 9)
```

The return statement is discussed in full in another lesson, but for completeness, when a return statement is reached its expression is evaluated and added as the RV of the frame.

This value (9) is what the function call expression max(8, 9) would evaluate to. Control would resume at the Return Address at L1.

```
def max(x: int, y: int) -> int:
    x = 8
    y = 9
    if x > y:
        return x
    else:
        return y
```

Stack Memory: