Building Brains 2

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Review

- Functions
  - Used to sequence commands
  - Used to do a well-defined computation
    - Function composition
- Building Brains
  - Use functions to sequence robot movements
  - Use “for VARIABLE in SEQUENCE:”
    - Do something N times
    - Do something to each item in a sequence

Function to Sequence Commands

```
def refrain(timing):
    ''' Function that plays the refrain '''
    beep(timing, c2)
    beep(timing, a)
    beep(timing, fSharp)
    beep(timing, aSharp)

refrain(.5)
```

Function to Sequence Commands

```
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    ''' Function that plays the refrain '''
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    beep(timing, a)
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refrain(.5)
```
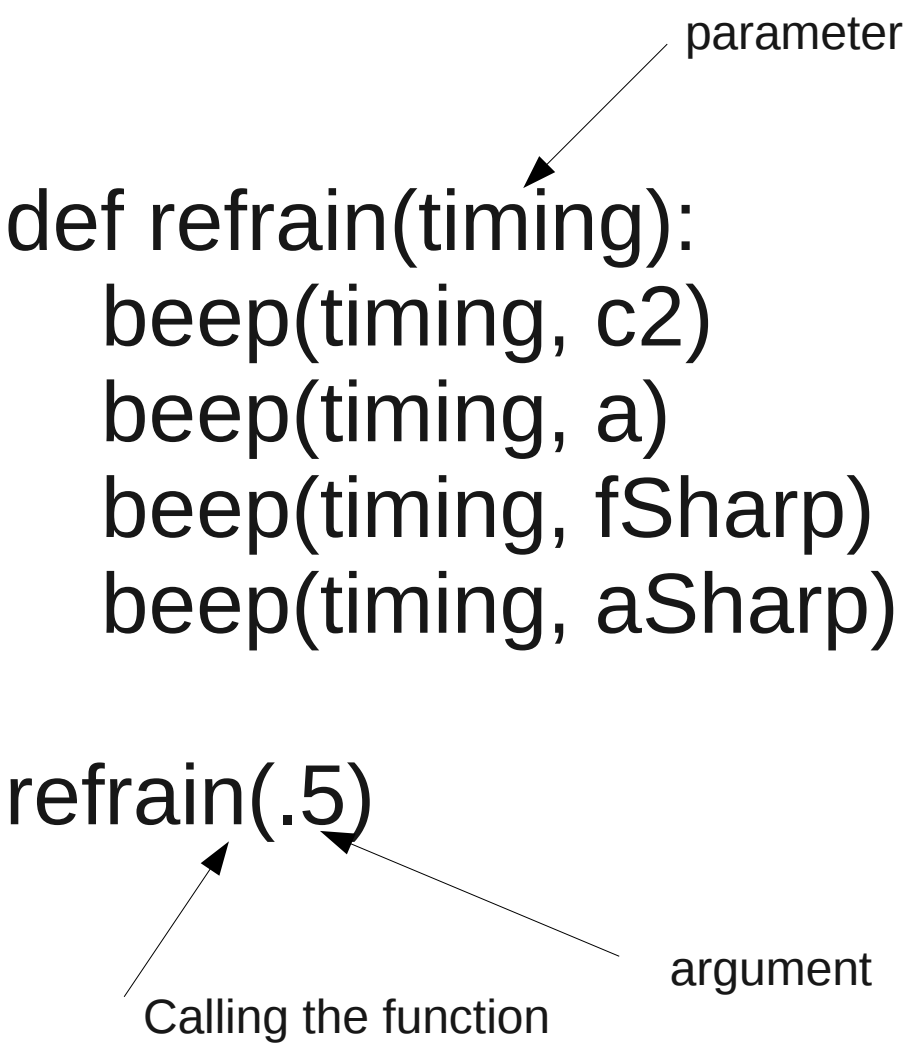

1. Indent commands
2. add a def name():
3. abstract common parts
4. add variables
5. add a return
6. add useful comments
7. “call” the function
8. test and debug!

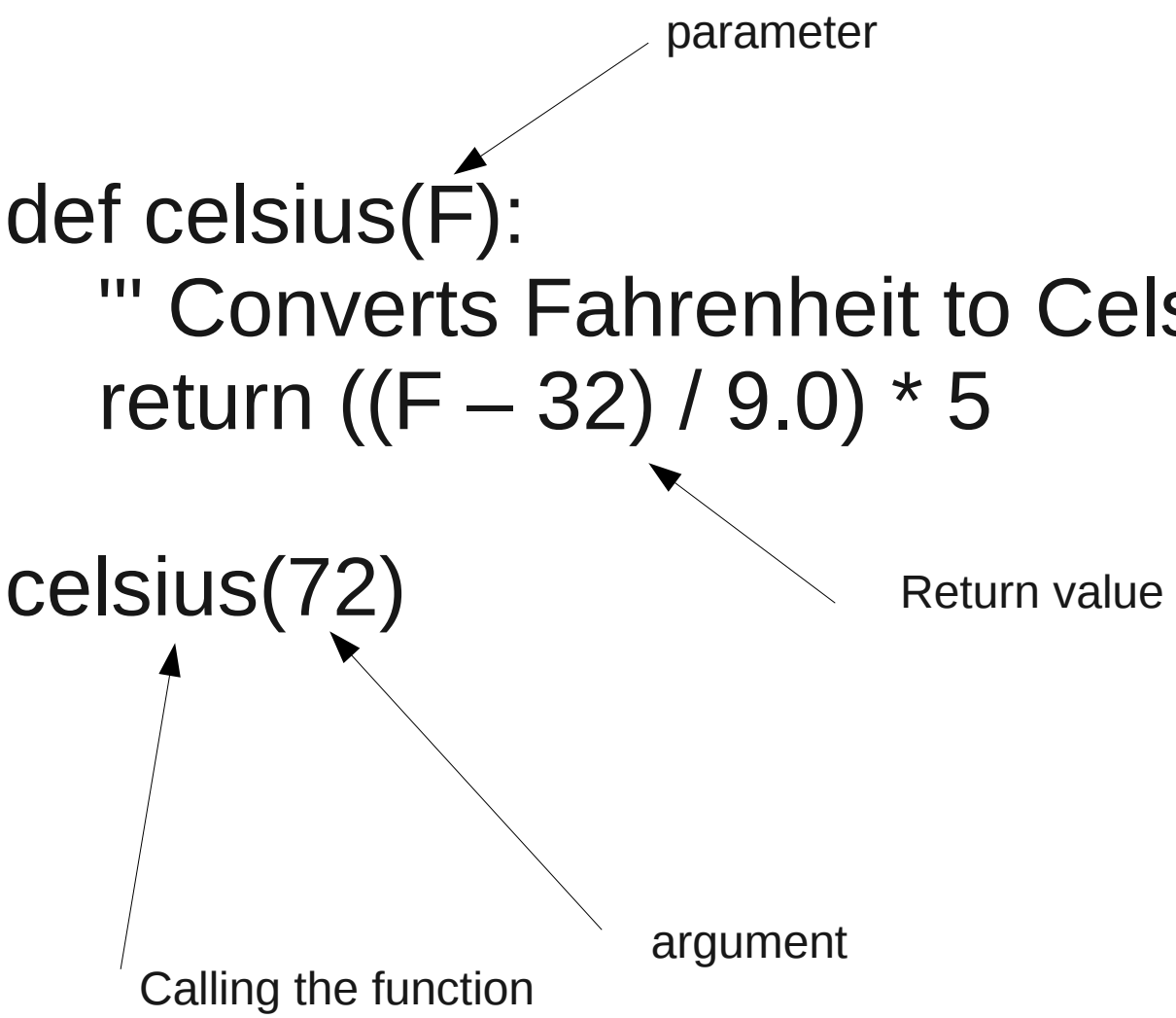
Function to Sequence Commands



Function to Compute

```
def celsius(F):
    ''' Converts Fahrenheit to Celsius '''
    return ((F – 32) / 9.0) * 5

celsius(72)
```

Function to Compute



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Building Brains

```
def yoyo():
    forward(1, 2)
    turnLeft(1, .7)
```

Building Brains

```
def yoyo():
    forward(1, 2)
    turnLeft(1, .7)

yoyo()
yoyo()
yoyo()
yoyo()
```

Building Brains

```
def yoyo():
    forward(1, 2)
    turnLeft(1, .7)

for i in range(4):
    yoyo()
```

Python's **for** command

```
for VARIABLE in SEQUENCE:
    COMMAND
    COMMAND
    ...
```

Python's **for** command

```
for letter in “Hello”:
    print(letter)
```

```
h
e
l
l
o
```

Python's **for** command

```
for letter in “Hello”:
    print(letter)

for i in range(4):
    print(i)
```

Python's **for** command

```
for i in range(4):
    print(i)
```

```
0
1
2
3
```

What is range(4)?

What is range(4)?

```
>>> range(4)
```

What is range(4)?

```
>>> range(4)
[0, 1, 2, 3]
```

What is range(4)?

```
>>> range(4)
[0, 1, 2, 3]
```

New type: List

For Command

- Used for doing things N times (where N is the argument to range)
- Used for doing something to each item in the sequence

```
for i in range(23):
    dance()

for i in [2, 3, 6, 8]:
    beep(.5, 440 * i)

for i in range(8):
    beep(.5, 440 * i)
```

Review

- New type: “list”
- Lists and strings are both “sequences”
- New command: “for”
  - Used for doing things N times (where N is the argument to range)
  - Used for doing something to each item in the sequence

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Building Brains 2

- What's missing from our robot control programs so far?

Building Brains 2

- What's missing from our robot control programs so far?

  Senses!

Know your Robot: Senses

Reading Sensors

- Light sensors
  - getLight(POSITION)
  - getBright(POSITION)
  - POSITION is either “left”, “center”, “right”, 0, 1, 2
- Infrared (IR) sensors
  - getIR(POSITION) - “left”, “right”, 0, 1
  - getObstacle(POSITION) - “left”, “center”, “right”, 0, 1, 2
- POSITION can also be “all”

Building Brains 2

- Follow a maze
- Avoid obstacles
- Go to the light
- Run away from the light

Structure of a Robot Brain

- Read sensors
- Decide what to do
- Make Movement
- Repeat

Structure of a Robot Brain

```
while True:
    left = getLight(“left”)
    right = getLight(“right”)
    if left < right:
        turnLeft(1, .4)
    else:
        turnRight(1, .4)
```