Welcome to the Labs!

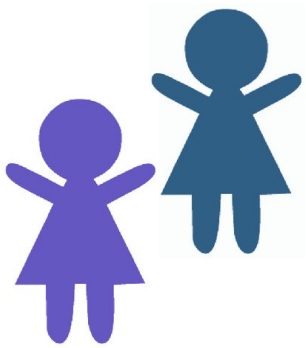
Tic Tac Toe

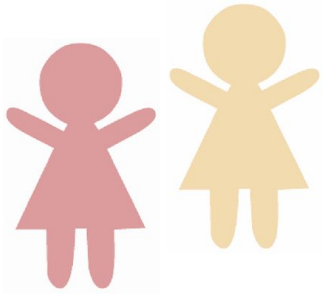
Who are the tutors?

Who are you?

Two Truths and a Lie

1. Get in a group of 3-5 people
2. Tell them three things about yourself:
   a. Two of these things should be true
   b. One of these things should be a lie!
3. The other group members have to guess which is the lie





Log on

Log on and jump on the GPN website

girlsprogramming.network/workshop

You can see:

- These **slides** (to take a look back or go on ahead).
- A digital copy of your **workbook**.
- Help bits of text you can **copy and paste**!

There's also links to places where you can do more programming!

Tell us you're here!

Click on the
Start of Day Survey
and fill it in now!

SplootCode

SplootCode is new

We're trying something new!

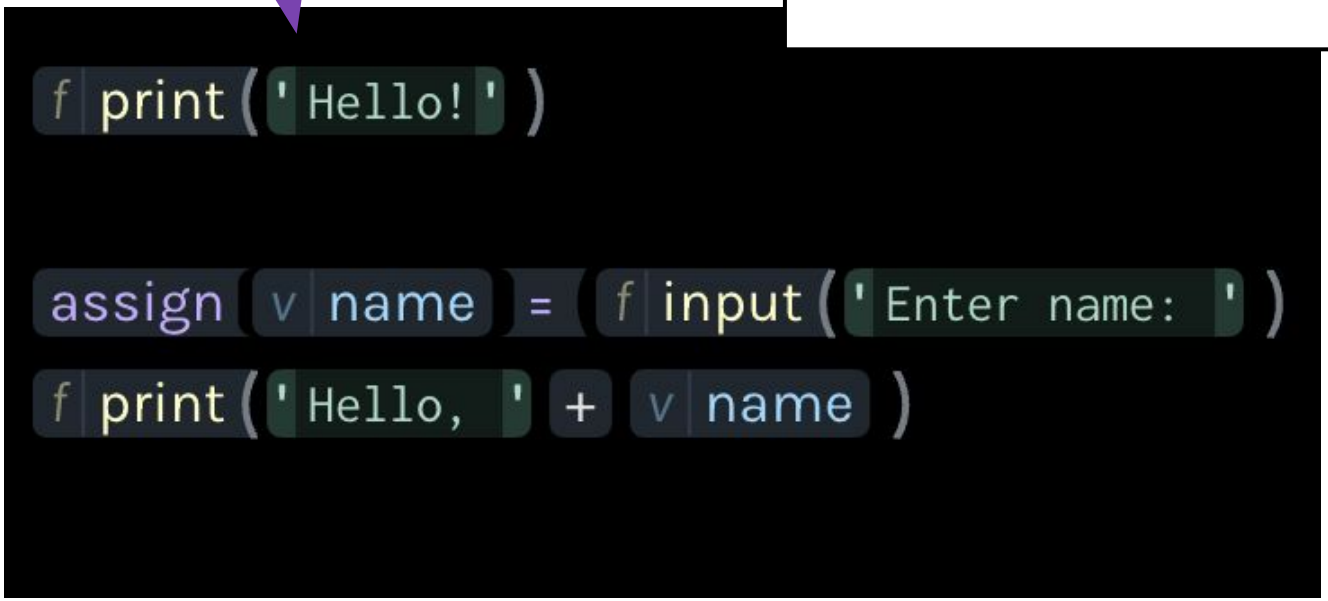
SplootCode is a bit different to Python

Normal Python

```
print("Hello!")

name = input("Enter name: ")
print("Hello, " + name)
```

SplootCode Python



Today’s project!

Tic Tac Toe

Using the workbook!

The workbooks will help you put your project together!

Each **Part** of the workbook is made of tasks!

Tasks - The parts of your project

Follow the tasks **in order** to make the project!

Hints - Helpers for your tasks!

Stuck on a task, we might have given you a hint to help you **figure it out**!

The hints have **unrelated** examples, or tips. **Don't copy and paste** in the code, you'll end up with something **CRAZY**!

Task 6.2: Add a blah to your code!

This has instructions on how to do a part of the project

1. **Start by doing this part**
2. **Then you can do this part**

Task 6.1: Make the thing do blah!

Make your project do blah ….

Hint

A clue, an example or some extra information to help you **figure out** the answer.

```
print('This example is not part of the project' )
```

Using the workbook!

The workbooks will help you put your project together!

Check off before you move on from a **Part**! Do some bonuses while you wait!

Checklist - Am I done yet?

Make sure you can tick off every box in this section before you go to the next Part.

Lecture Markers
This tells you you'll find out how to do things for this section during the names lecture.

Bonus Activities
Stuck waiting at a lecture marker?
Try a purple bonus. They add extra functionality to your project along the way.

☑ **CHECKPOINT** ☑

If you can tick all of these off you're ready to move the next part!
☐ Your program does blah
☐ Your program does blob

★ **BONUS 4.3: Do some extra!**

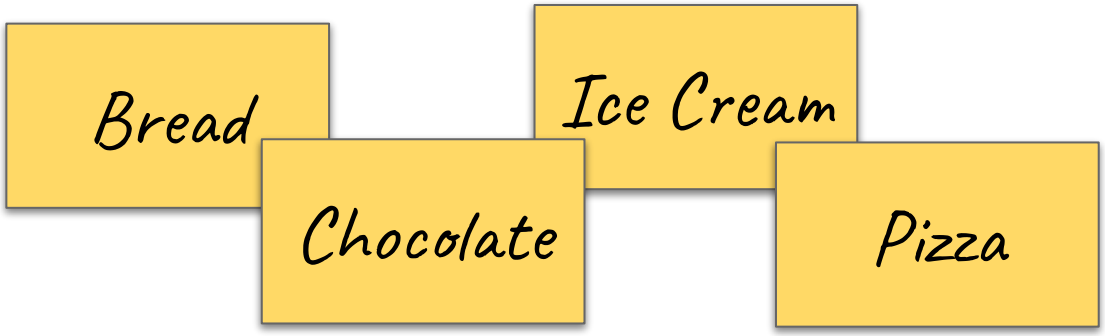
Something to try if you have spare time before the next lecture!

Lists

Lists

When we go shopping, we write down what we want to buy!

But we don't store it on lots of little pieces of paper!



We put it in one big shopping list!

- Bread
- Chocolate
- Ice Cream
- Pizza

Lists

It would be annoying to store it separately when we code too

```
assign v shopping_item_1 = 'Bread'
assign v shopping_item_2 = 'Chocolate'
assign v shopping_item_3 = 'Ice Cream'
```

So much repetition!

Instead we use a python list!

```
assign v shopping_list = list('Bread'
                              'Chocolate'
                              'Ice Cream')
```

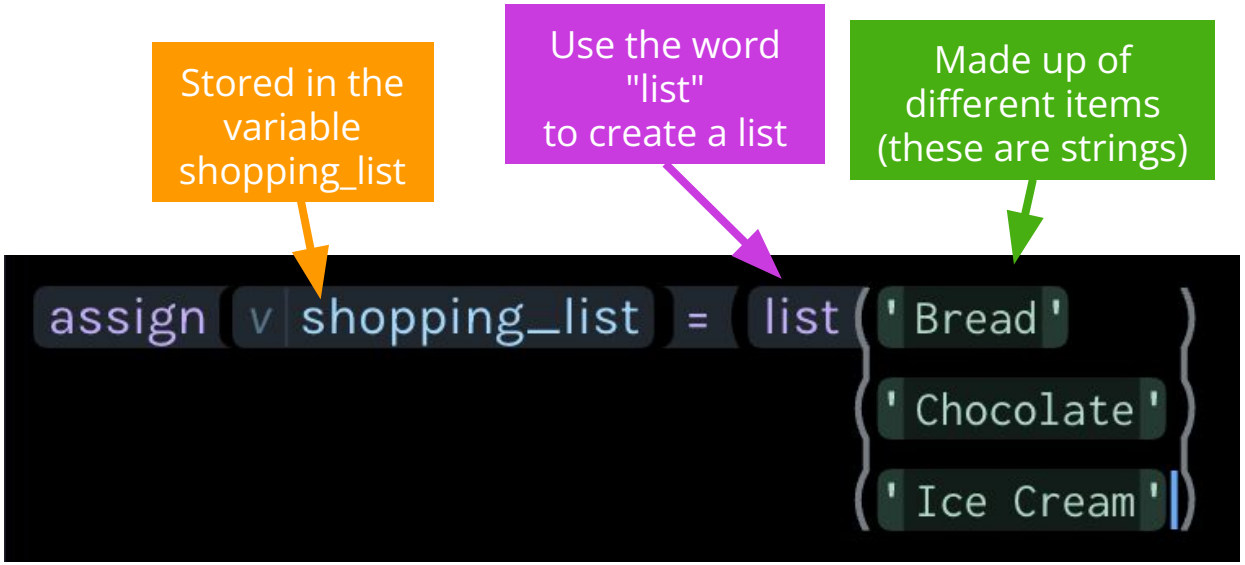
You can put (almost) anything into a list

You can have a list of `integers`

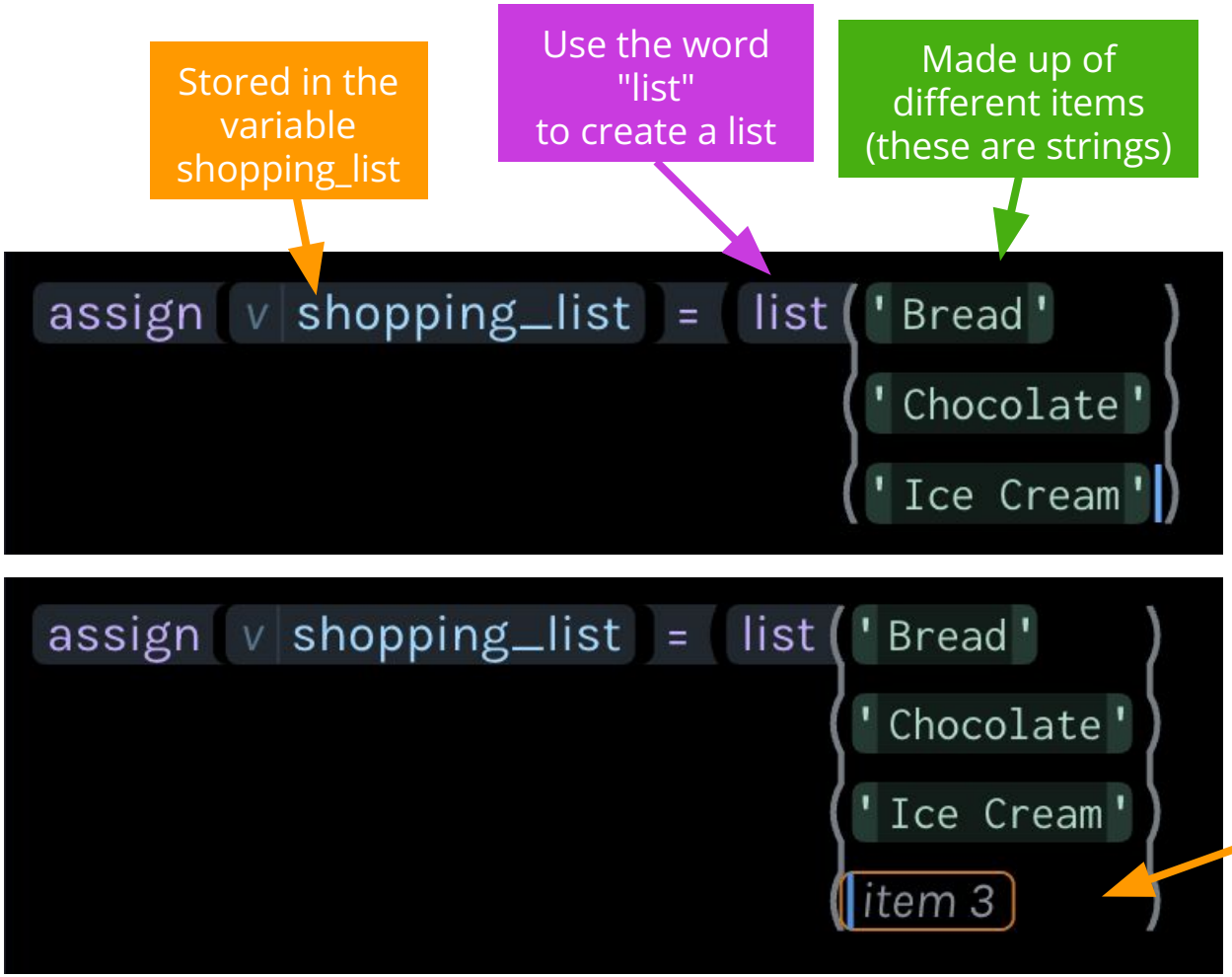
You can have `lists` with mixed `integers` and `strings`

But this is almost never a good idea! You should be able to treat every element of the `list` the same way.

List anatomy



List anatomy



Accessing Lists!

The favourites `list` below holds four strings in order.

```
assign v faves = list ('books'
                       'butterfly'
                       'chocolate'
                       'skateboard')
```

We can count out the items using index numbers!

0 **1** **2** **3**

Remember: Indices start from zero!

Accessing Lists

We access the items in a `list` with an index such as `0`:

```
assign v faves = list ( 'books'
                        'butterfly'
                        'chocolate'
                        'skateboard' )
```

```
v faves item ( 0 )    → "books" (str)
```

What code do you need to access the second item in the list?

Accessing Lists

We access the items in a `list` with an index such as `0`:

```
assign v faves = list ( 'books'
                        'butterfly'
                        'chocolate'
                        'skateboard' )
```

```
v faves item ( 0 )    → "books" (str)
```

What code do you need to access the second item in the list?

0

```
v faves item ( 1 )
```

2

3

Going Negative

Negative indices count backwards from the end of the `list`:

```
v faves item ( - 1 )   → "skateboard" (str)
```

What would `v faves item ( - 2 )` return?

Going Negative

Negative indices count backwards from the end of the `list`:

```
v faves item ( - 1 )   → "skateboard" (str)
```

What would `v faves item ( - 2 )` return?

-4 -3 **-2** -1

Falling off the edge

Python complains if you try to go past the end of a `list`

Updating items!

We can also update things in a list:

```
v faves item ( 2 )    → "chocolate" (str)
assign v faves item ( 2 ) = 'lollipops'    → "lollipops" (str)
```

Updating items!

We can also update things in a list:

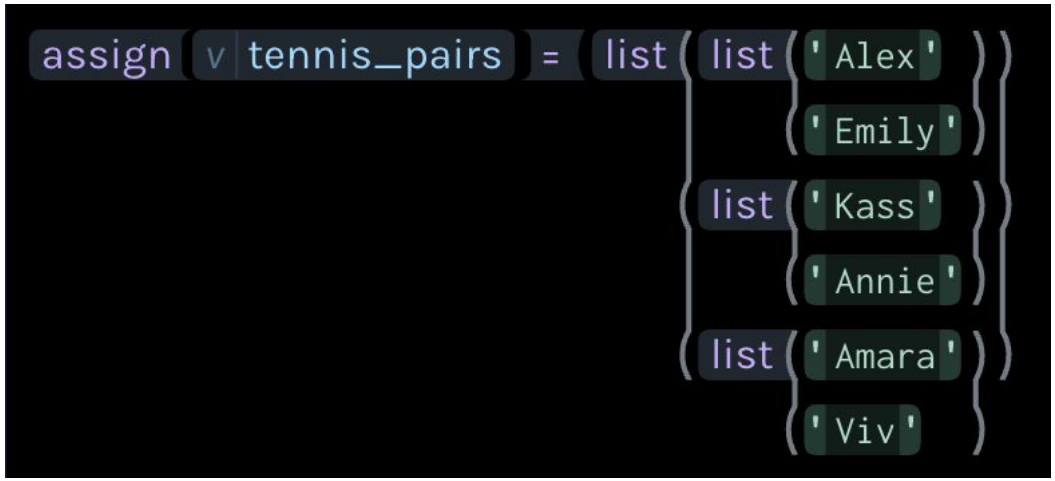
```
v faves item ( 2 )    → "chocolate" (str)
assign v faves item ( 2 ) = 'lollipops'    → "lollipops" (str)

v faves item ( 2 )    → "lollipops" (str)
v faves    → ['books', 'butterfly', 'lollipops', 'skateboard'] (list)
```

List of lists!

You really can put anything in a list, even more lists!

We could use a list of lists to store different sports teams!



Get the first pair in the list

Now we have the first pair handy, we can get the first the first player of the first pair

Project time!

You now know all about lists!

Let’s put what we learnt into our project

Try to do the next Part

The tutors will be around to help!

Functions!

Simpler, less repetition, easier to read code!

How functions fit together!

Functions are like factories!

Metal Worker

Your main factory!

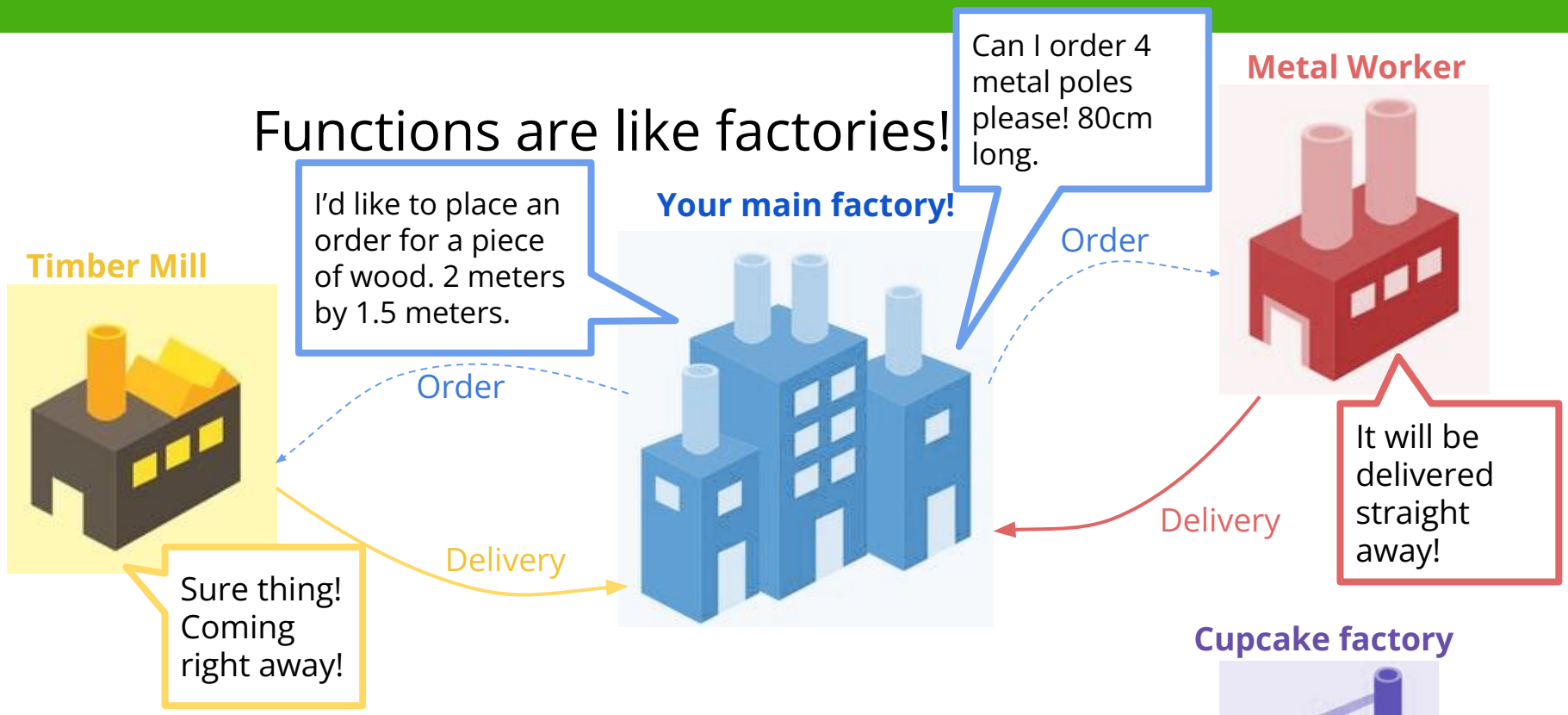
Timber Mill

Cupcake factory

Running a factory doesn't mean doing all the work yourself, you can get other factories to help you out!

How functions fit together!

Functions are like factories!



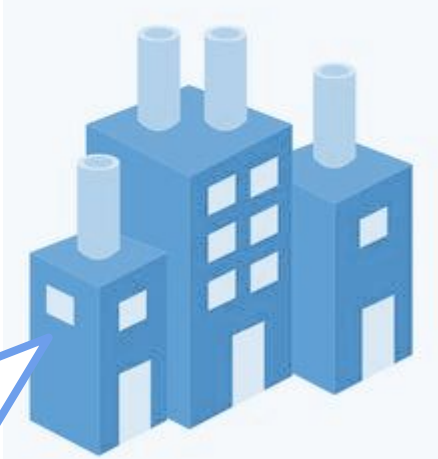
Asking other factories to do some work for you makes your main task simper. You can focus on the assembly!

How functions fit together!

Functions are like factories!

Metal Worker

Your main factory!



Timber Mill

Look at this beautiful table I made!

Outsourcing made it simple!

Cupcake factory

How functions fit together!

Your main code!

You can write a bunch of helpful functions to **simplify** your **main goal**!

You can **write** these **once** and then **use** them **lots** of times! They can be **anything** you like!

Helps with printing nicely

Uses stats to make decisions

Does calculations

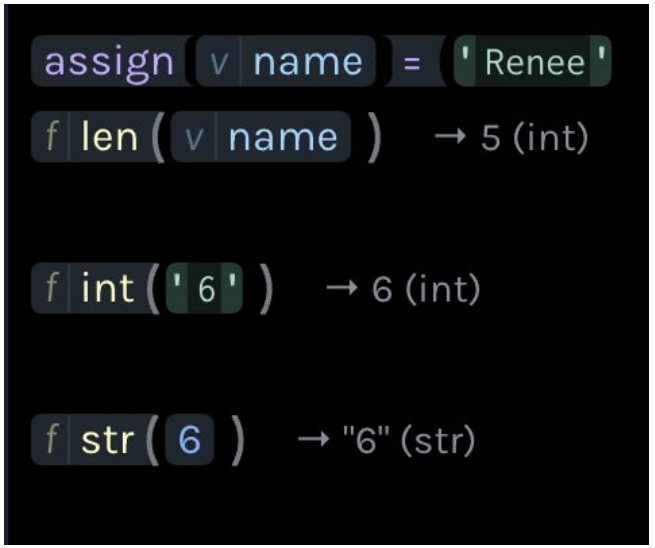
Don’t reinvent the wheel

We’re already familiar with some python in built functions like print and input!

There’s lots of functions python gives us to save us reinventing the wheel!

For instance we can use len to get the length of a string, rather than having to write code to count every letter!

Try these:



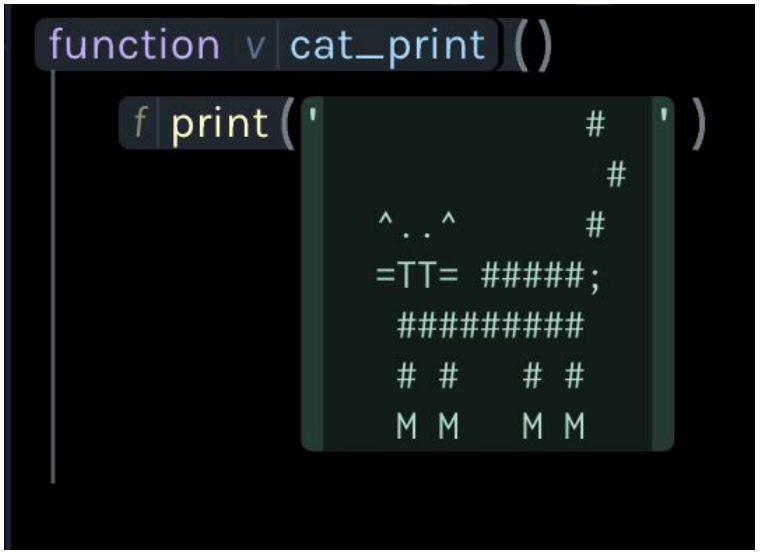
Defining your own functions

Built in functions are great! But sometimes we want custom functions!

Defining our own functions means:

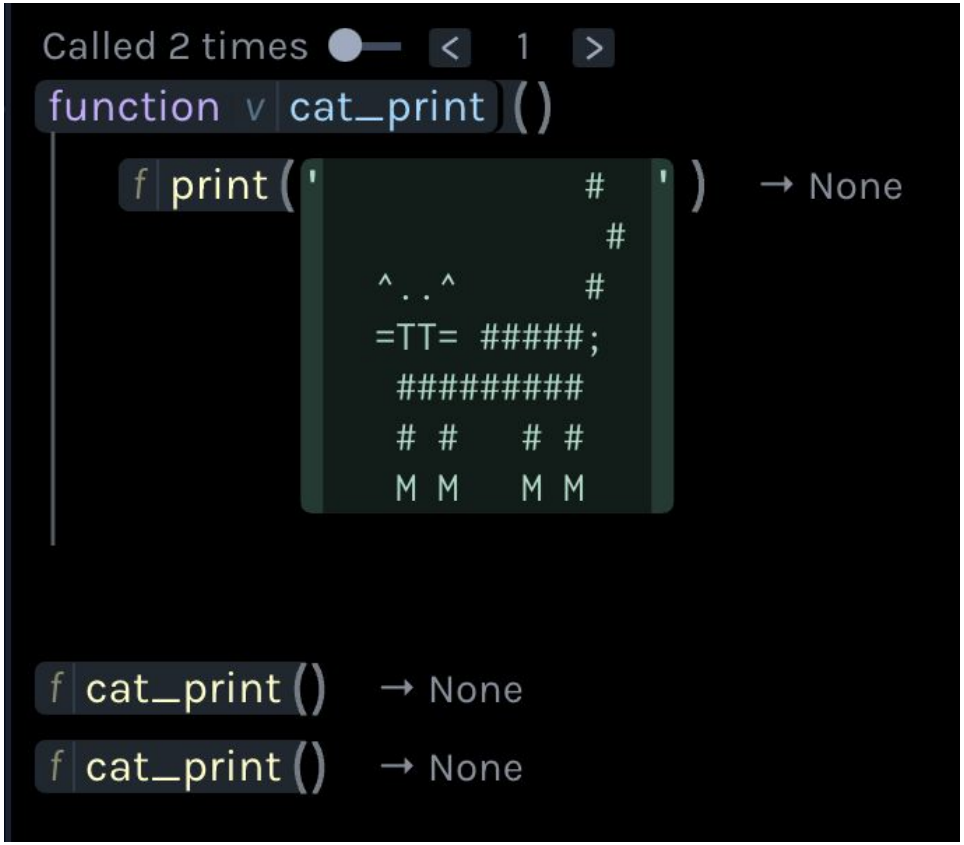
- We cut down on repeated code
- Nice function names makes our code clear and easy to read
- We can move bulky code out of the way

Defining your own functions

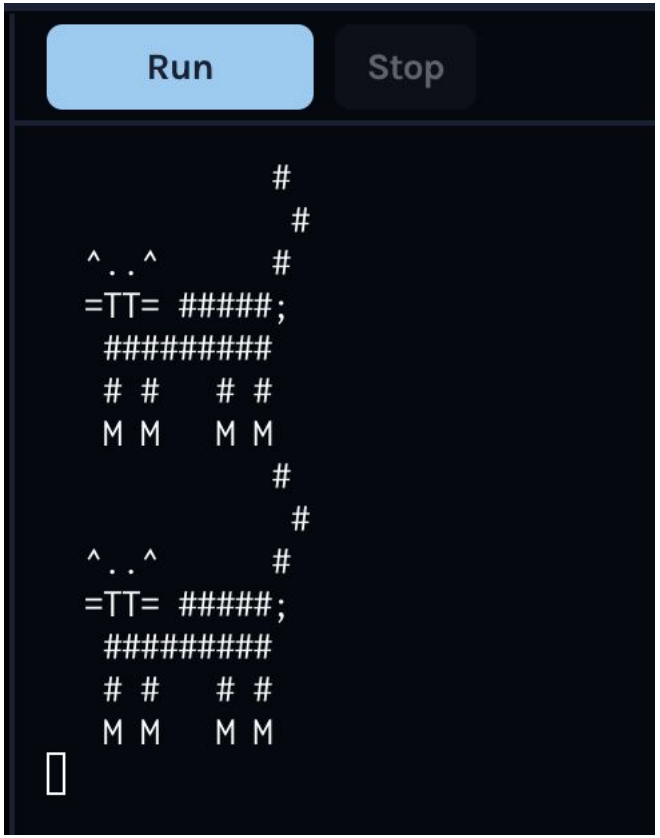


Defining your own functions

Then you can use your function by calling it!

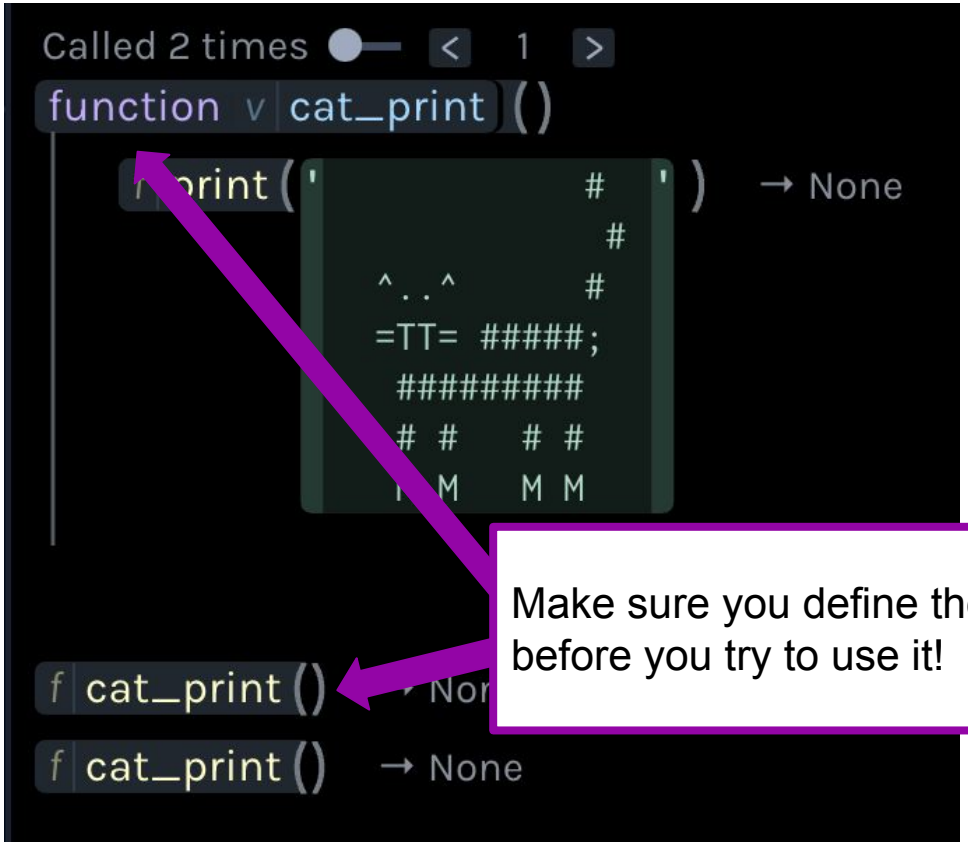


Which will do this!



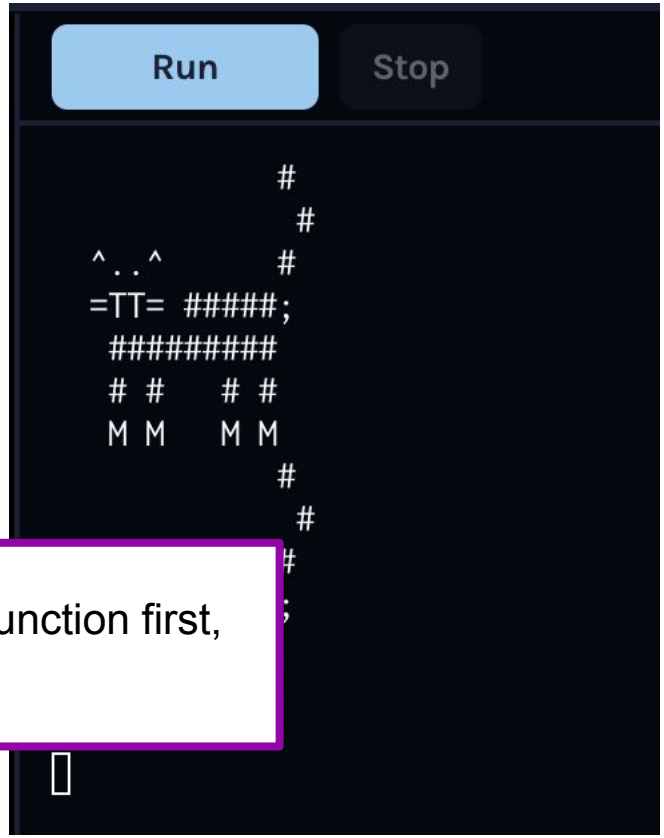
Defining your own functions

Then you can use your function by calling it!



Make sure you define the function first, before you try to use it!

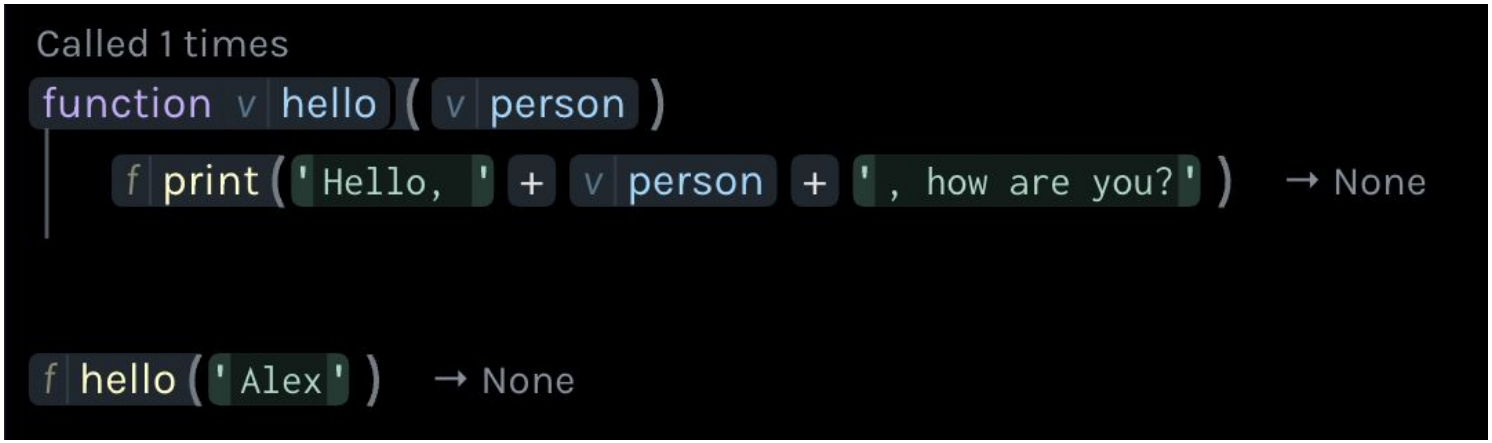
Which will do this!



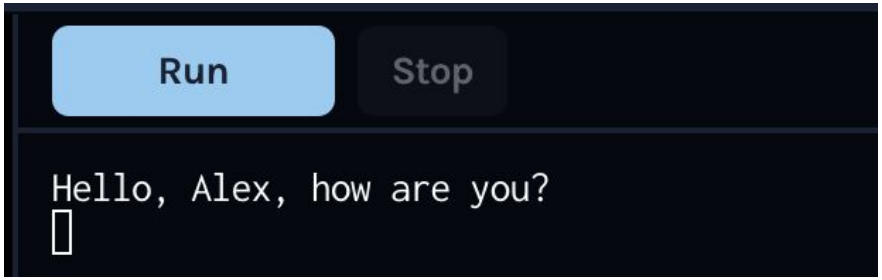
Functions often need extra information

Functions are more useful if we can change what they do

We can do this by giving them arguments (aka parameters)



Here, we give the hello() function a name

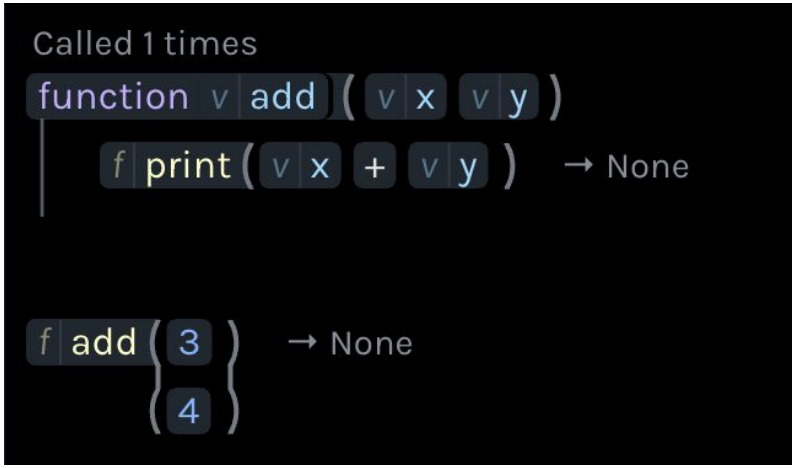


Functions can take multiple arguments

Often we want to work with multiple pieces of information.

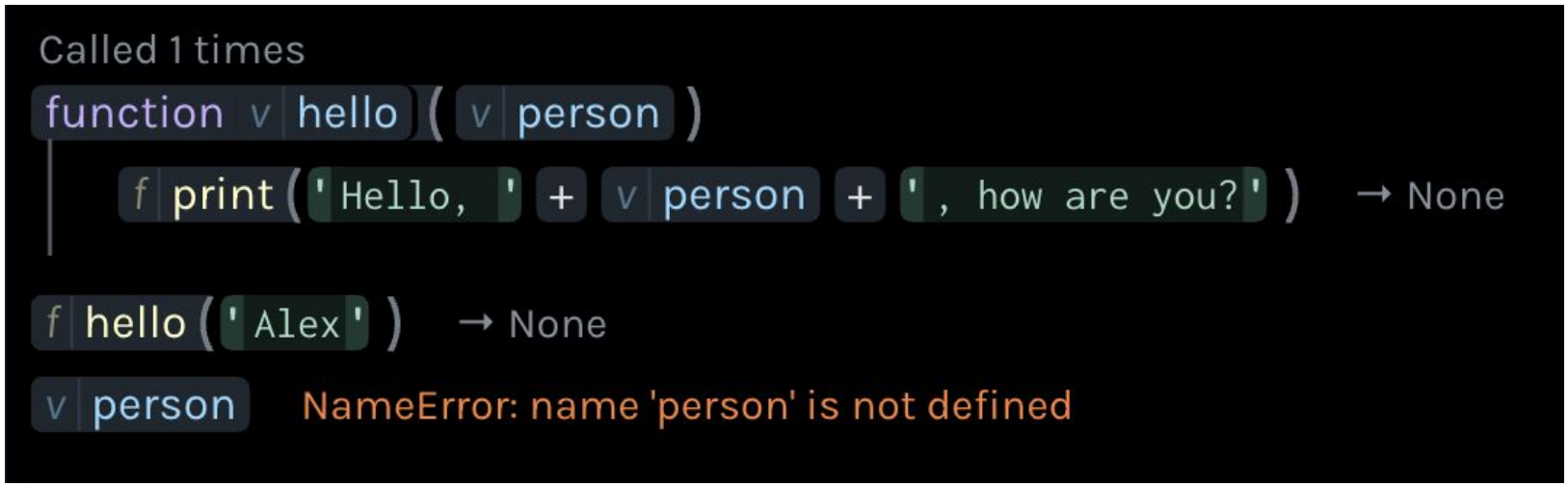
You can actually have as many parameters as you like!

This function takes two numbers, adds them together and prints the result.



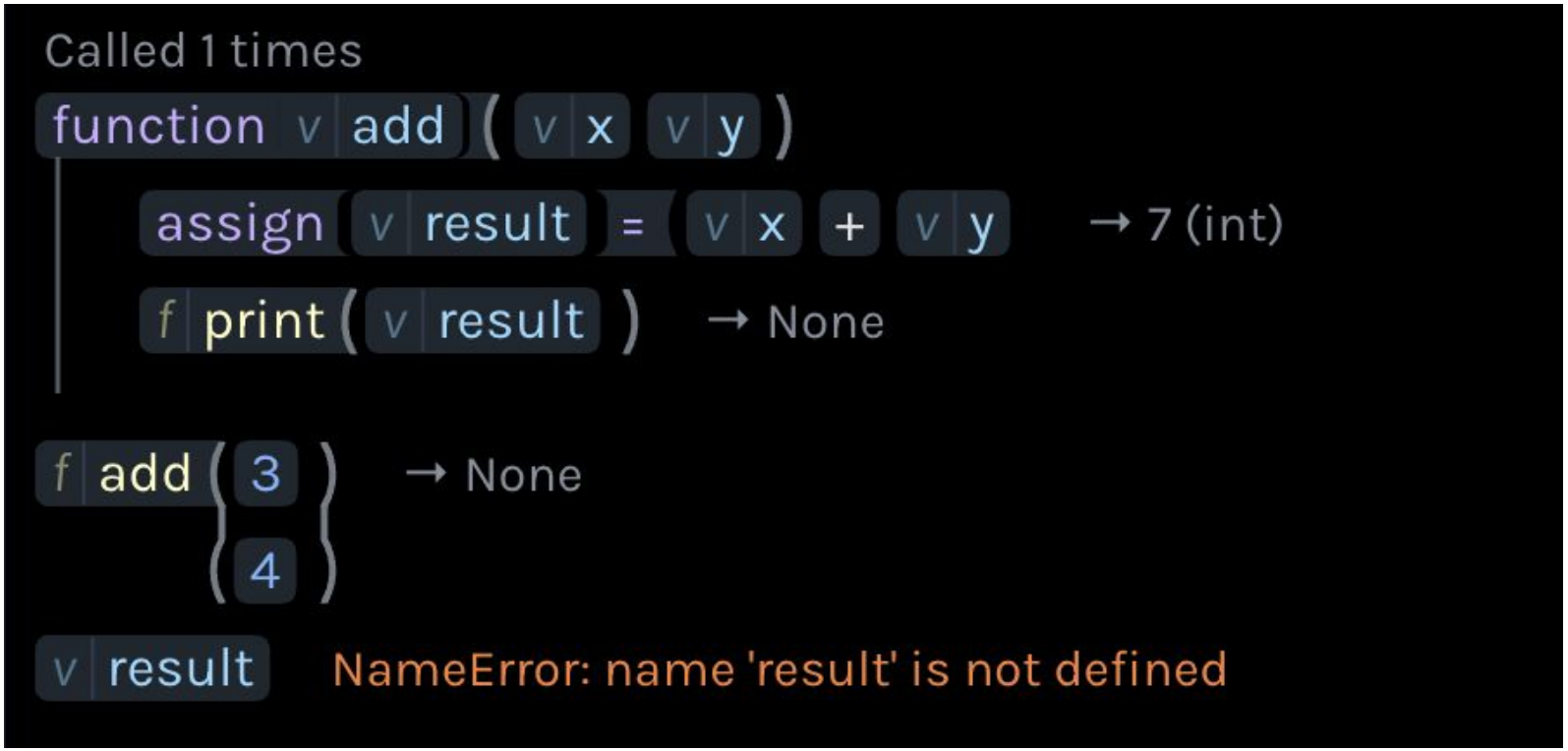
Arguments stay inside the function

The arguments are not able to be accessed outside of the function declaration.



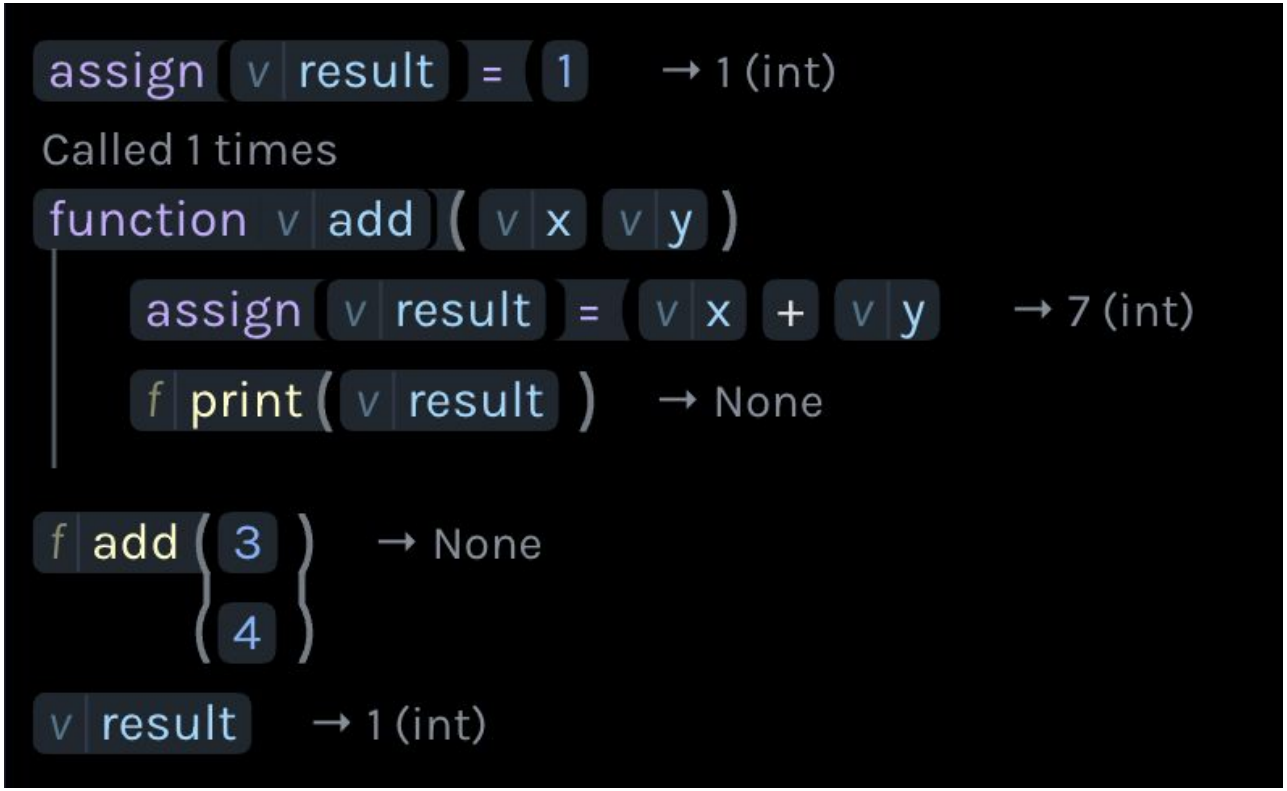
Variables stay inside the function

Neither are variables made inside the function. They are **local variables**.



Global variables are not affected

Changing a variable in a function **only changes it *inside* the function.**



Recap: A function signature

the `function` keyword

function **name**

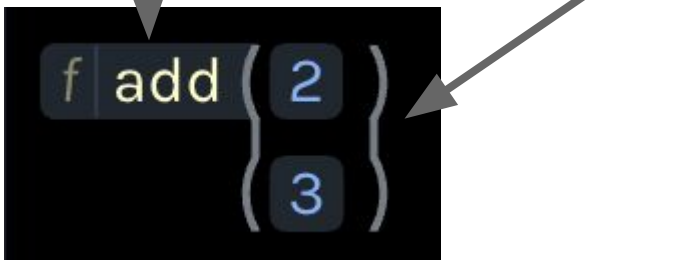
function **arguments**

definition

function **name**

function **arguments**

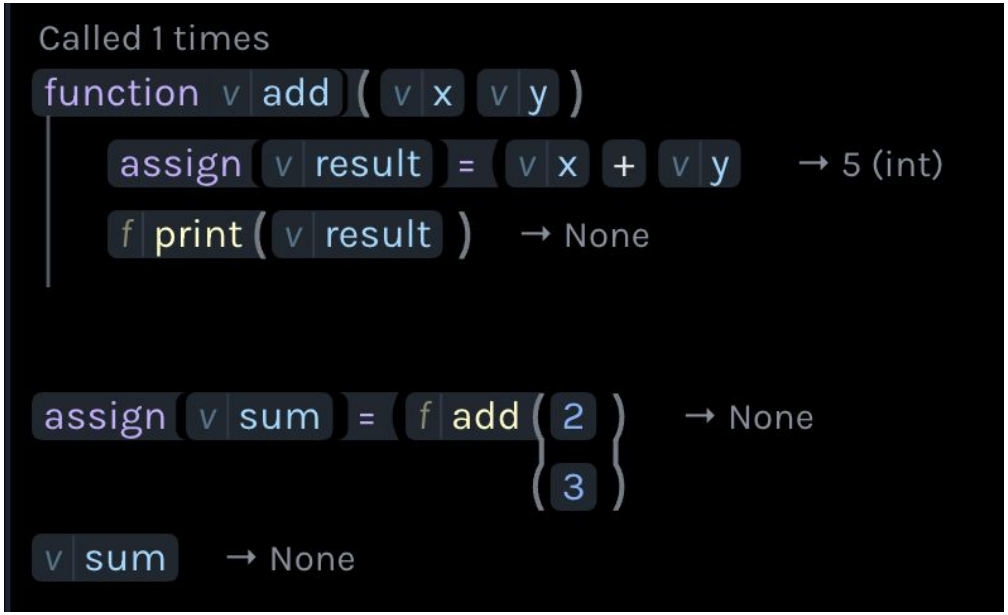
calling a function



Giving something back

At the moment our function just does a thing, but it's not able to give anything back to the main program.

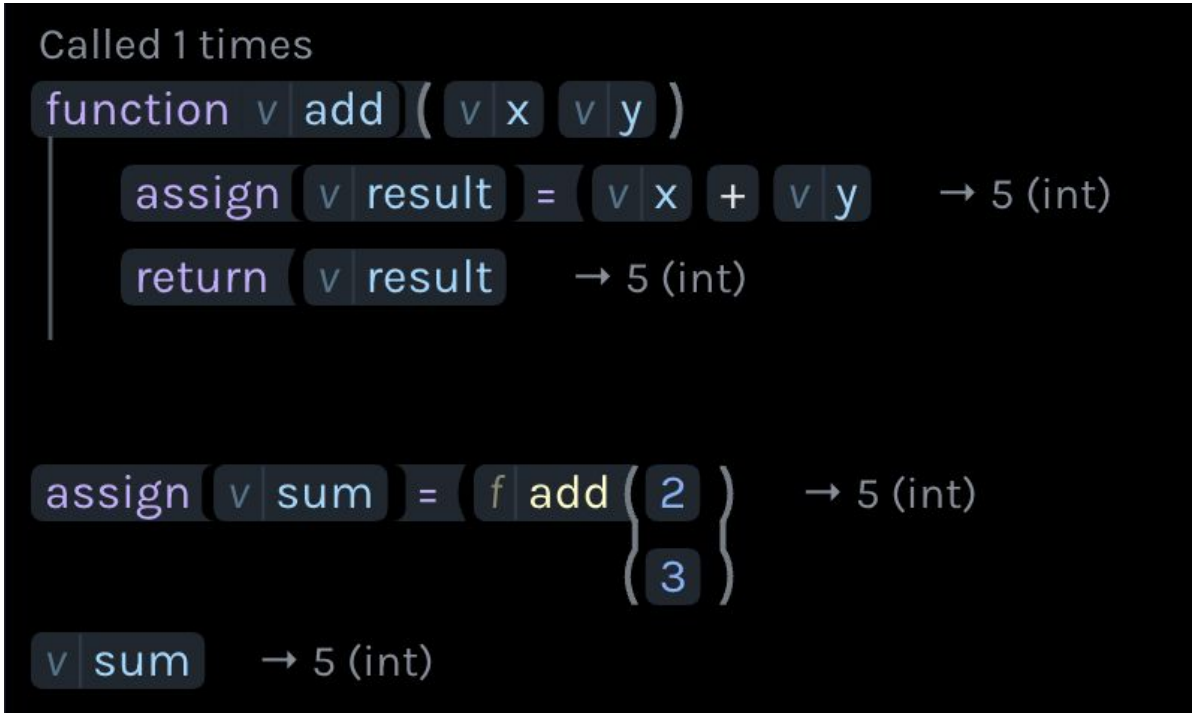
Currently, we can't use the result of add()



sum has no value!

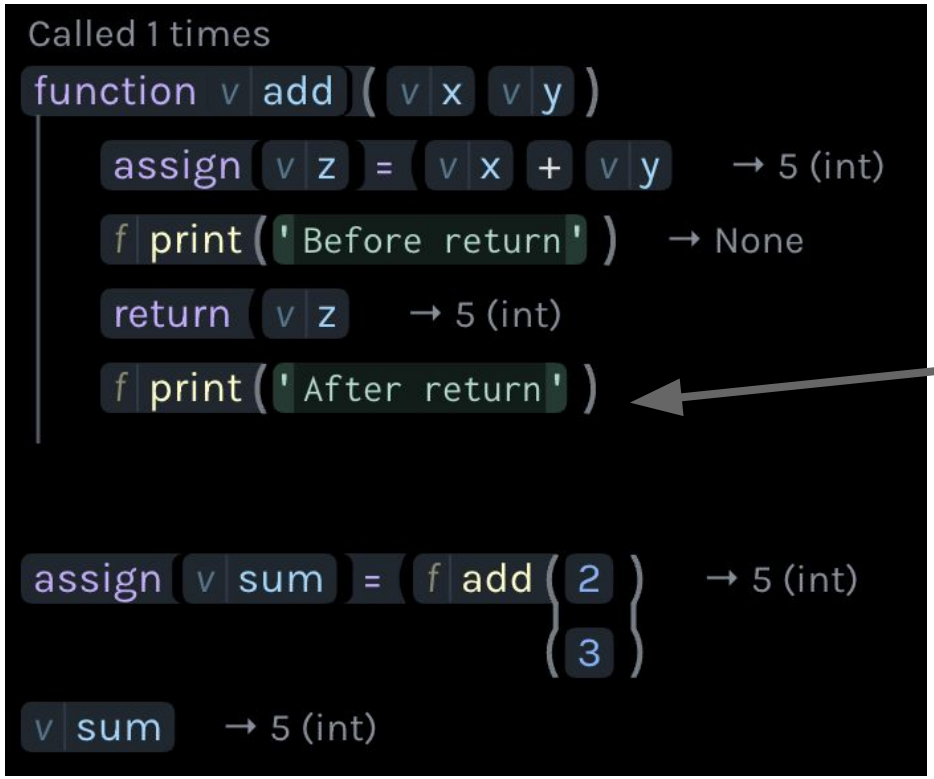
Giving something back

Using `return` in a function returns a result.



Giving something back

When a function returns something, the *control* is passed back to the main program immediate, so no code after the `return` statement is run.



Here, the `print` statement after the `return` never gets run.

Project time!

Now go be functional.

Do the next part of the project!

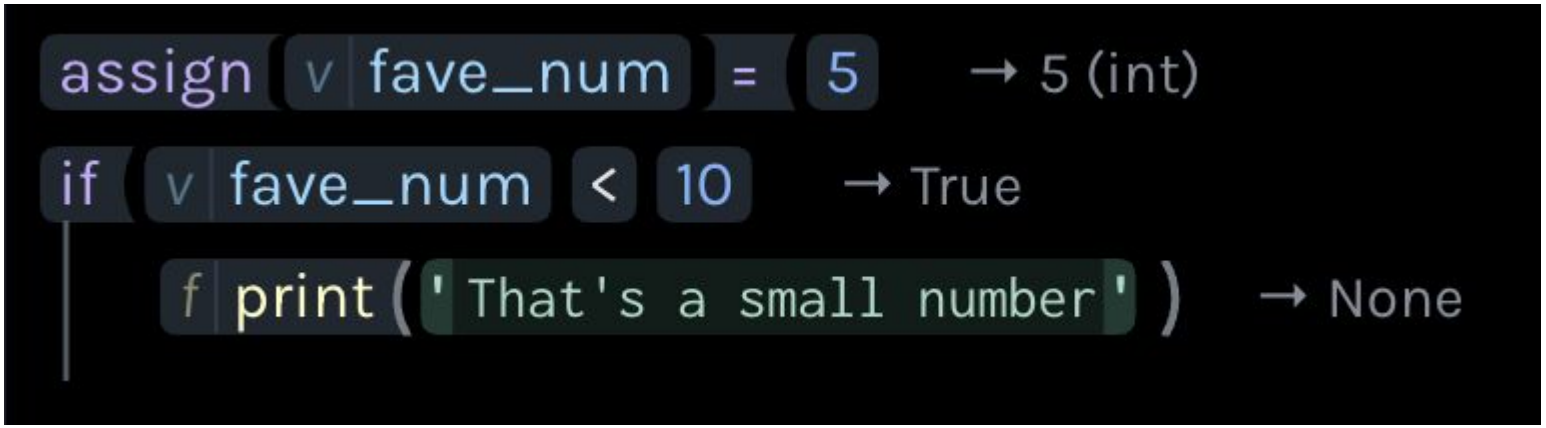
Try to do Part 3

The tutors will be around to help!

If Statements

Conditions

So to know whether to do something, they find out if it's `True`!



Else statements

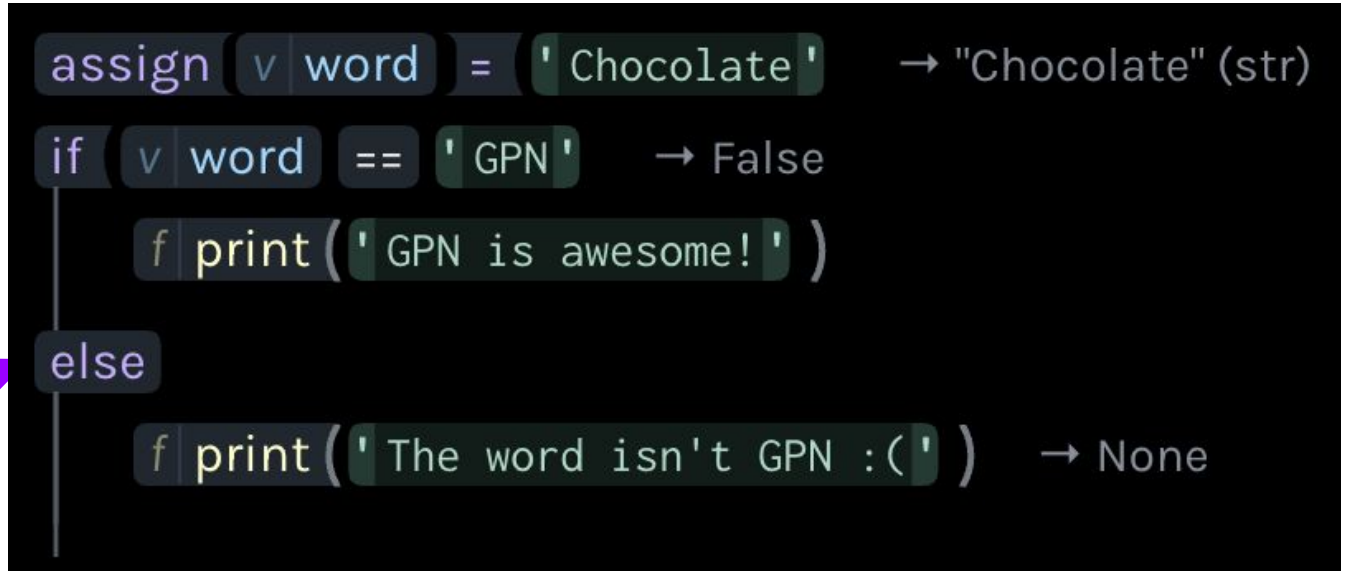
`else` statements means something still happens if the **`if`** statement was **`False`**

```
assign v word = 'Chocolate'
if v word == 'GPN'
    f print('GPN is awesome!')
else
    f print('The word isn't GPN :(')
```

What happens?

Else statements

`else` statements means something still happens if the **`if`** statement was **`False`**



What happens?

```
The word isn't GPN :(
```

Elif statements

`else if` means another **`if`** is checked if the first **`if`** was **`False`**

```
assign v word = 'Chocolate'
if v word == 'GPN'
    f print('GPN is awesome!')
else if v word == 'Chocolate'
    f print('YUMMMMM!')

else
    f print('The word isn't GPN :(')
```

What happens?

Elif statements

`else if` means another **`if`** is checked if the first **`if`** was **`False`**

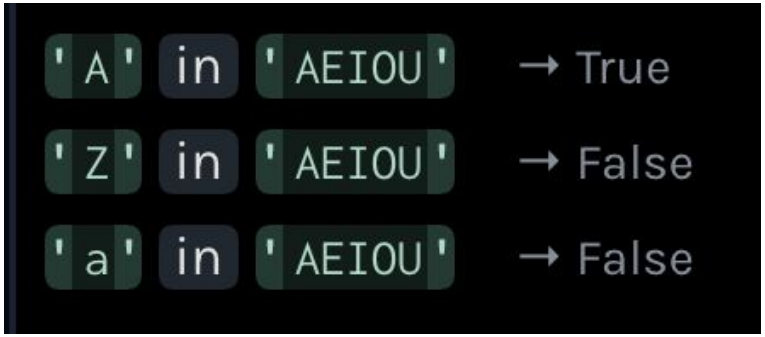
```
assign v word = 'Chocolate'    → "Chocolate" (str)
if v word == 'GPN'    → False
    f print('GPN is awesome!')
else if v word == 'Chocolate'    → True
    f print('YUMMMMM!')    → None
else
    f print('The word isn't GPN :(')
```

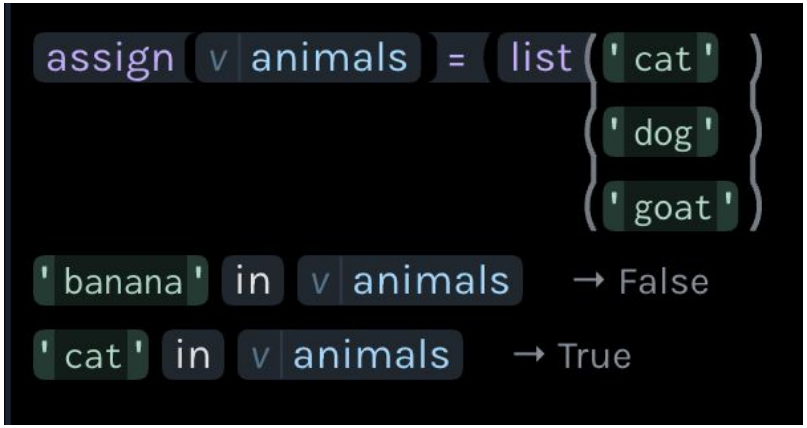
What happens?

```
YUMMMMM!
```

Booleans (True and False)

Python has some special comparisons for checking if something is **`in`** something else. **Try these!**





Project Time!

You now know all about `if`!

See `if` you can do the next Part

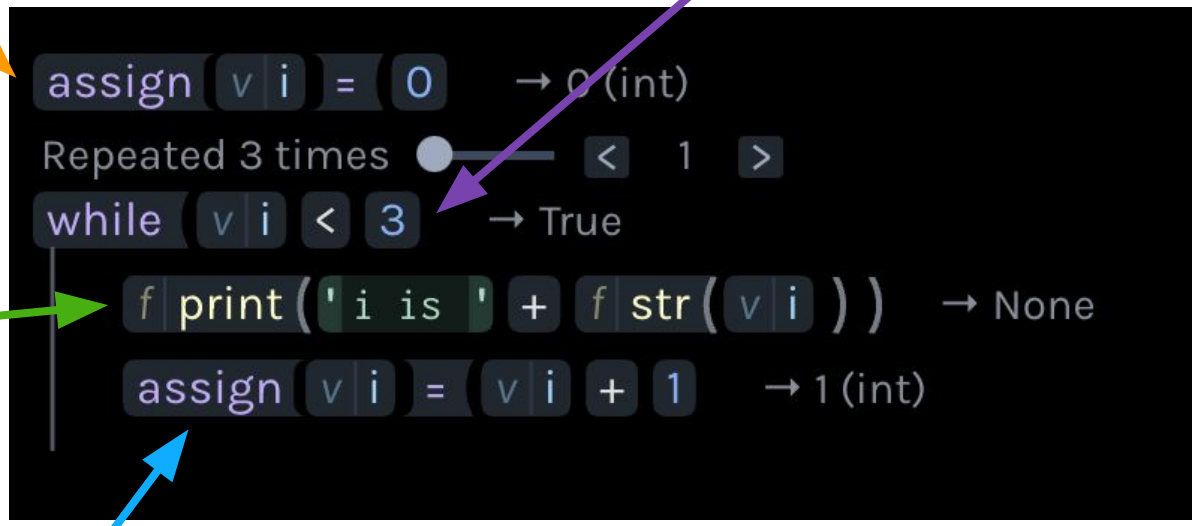
The tutors will be around to help!

While Loops

Introducing … `while` loops!

Initialise the loop variable

Loop condition



Code to repeat

Update the loop variable

```
i is 0
i is 1
i is 2
```

What happens when.....

What happens if we forget to update the loop variable?

```
assign v i = 0

while v i < 3
    f print('i is ' + f str(v i))
```

```
i is 0
i is 0
i is 0
i is 0
i is 0
i is 0
i is 0
i is 0
i is 0
i is 0
i is 0
i is 0
i is 0
i is 0
i is 0
i is 0
i is 0
```

Give me a break!

But what if I wanna get out of a loop early?

That's when we use the break keyword!

```
assign v number = 0

while v number ≠ 42
    assign v number = f input('Guess a number: ')
    if v number == 'I give up'
        f print('The number was 42')
        break

    assign v number = f int(v number)
```

```
Guess a number: 5
Guess a number: 9
Guess a number: 45
Guess a number: 32
Guess a number: 80
Guess a number: I give up
The number was 42
```

Continuing on

How about if I wanna skip the rest of the loop body and loop again? We use continue for that!

```
assign v number = 0

while v number ≠ 42
    assign v number = f input('Guess a number: ')
    if not v number.isnumeric()
        f print('That's not a number. Try again.')
        continue

    assign v number = f int(v number)
```

```
Guess a number: 5
Guess a number: five
That's not a number. Try again.
Guess a number: I give up
That's not a number. Try again.
Guess a number: 45
Guess a number: 42
```

Project Time!

while we're here:

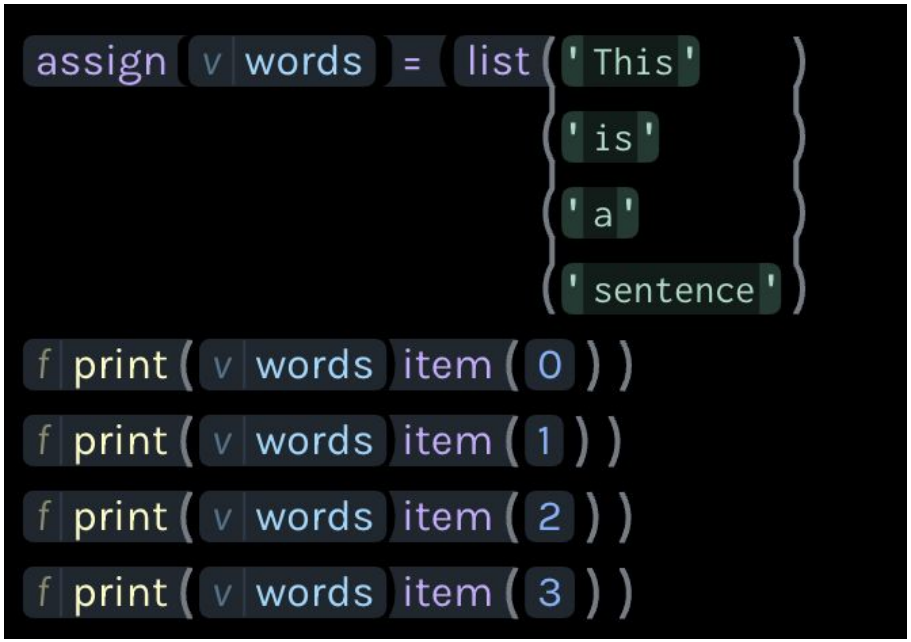
Try to do the next Parts!

The tutors will be around to help!

For Loops

Looping through lists!

What would we do if we wanted to print out this list, one word at a time?

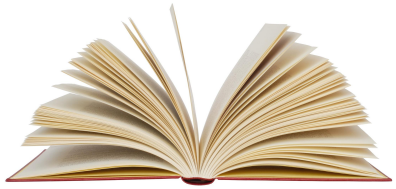


What if it had a 100 items??? That would be **BORING!**

For Loops

For loops allow you to do something for **each** item in a **group** of things

There are many real world examples, like:

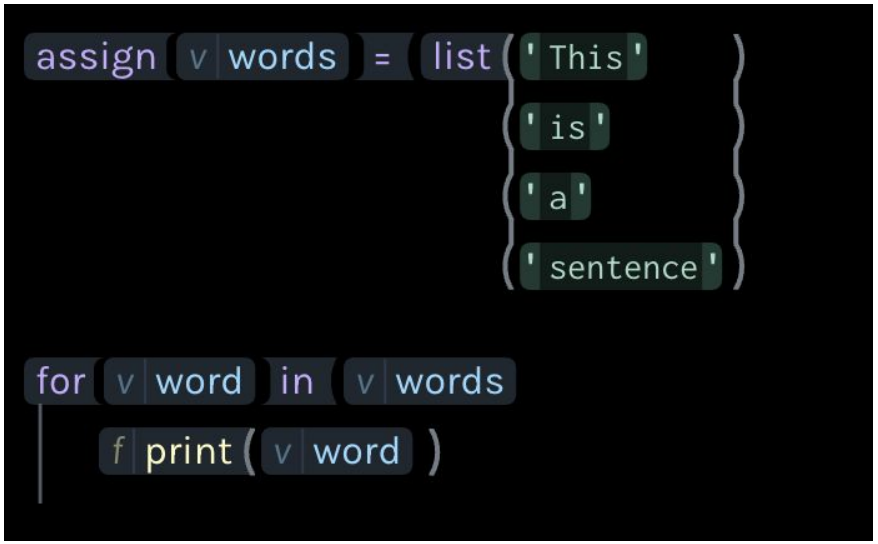


For each page in this book:
    Read page

For each chip in this bag of chips:
    Eat chip

Looping over a list of ints

We can loop through a list:



What's going to happen?

Looping over a list of ints

We can loop through a list:

```
assign v words = list( 'This'
                       'is'
                       'a'
                       'sentence' )

for v word in v words
    f print( v word )
```

```
This
is
a
sentence
```

- Each item of the list takes a turn at being the variable **word**
- Do the body once for each item
- We're done when we run out of items!

Project Time!

Now you know how to use a for loop!

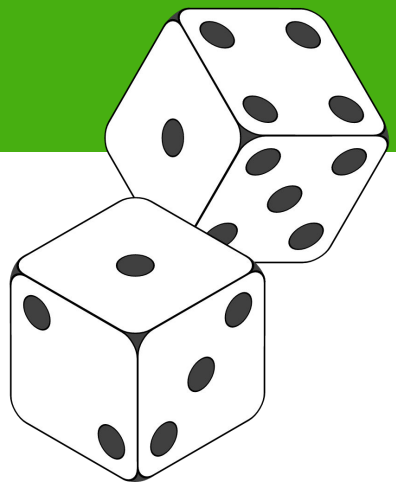
Try to do Part 5

...if you are up `for` it!

The tutors will be around to help!

Random!

That's so random!



There's lots of things in life that are up to chance or random!

We want the computer to be random sometimes!

Python lets us **import** common bits of code people use! We're going to use the **random** module!

Using the random module

Let's choose something randomly from a list!

This is like drawing something out of a hat in a raffle!

1. Import the random module!

```
import random
```

2. Make a shopping list:

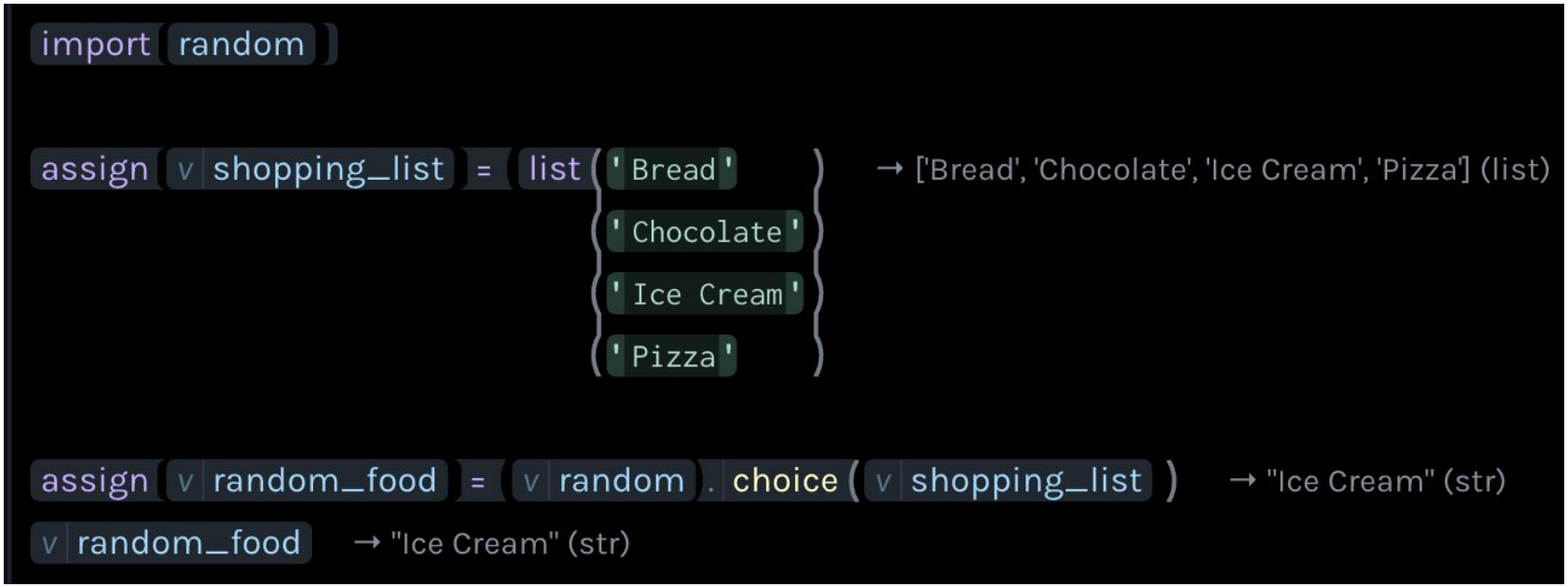
```
assign v shopping_list = list ( 'Bread'
                                'Chocolate'
                                'Ice Cream'
                                'Pizza' )
```

3. Choose randomly! Try it a few times!

```
v random . choice ( v shopping_list )
```

Using the random module

You can also assign your random choice to a variable



Project Time!

Raaaaaaaaaandom! Can you handle that?

Let's try use it in our project!

Try to do the next Part

The tutors will be around to help!

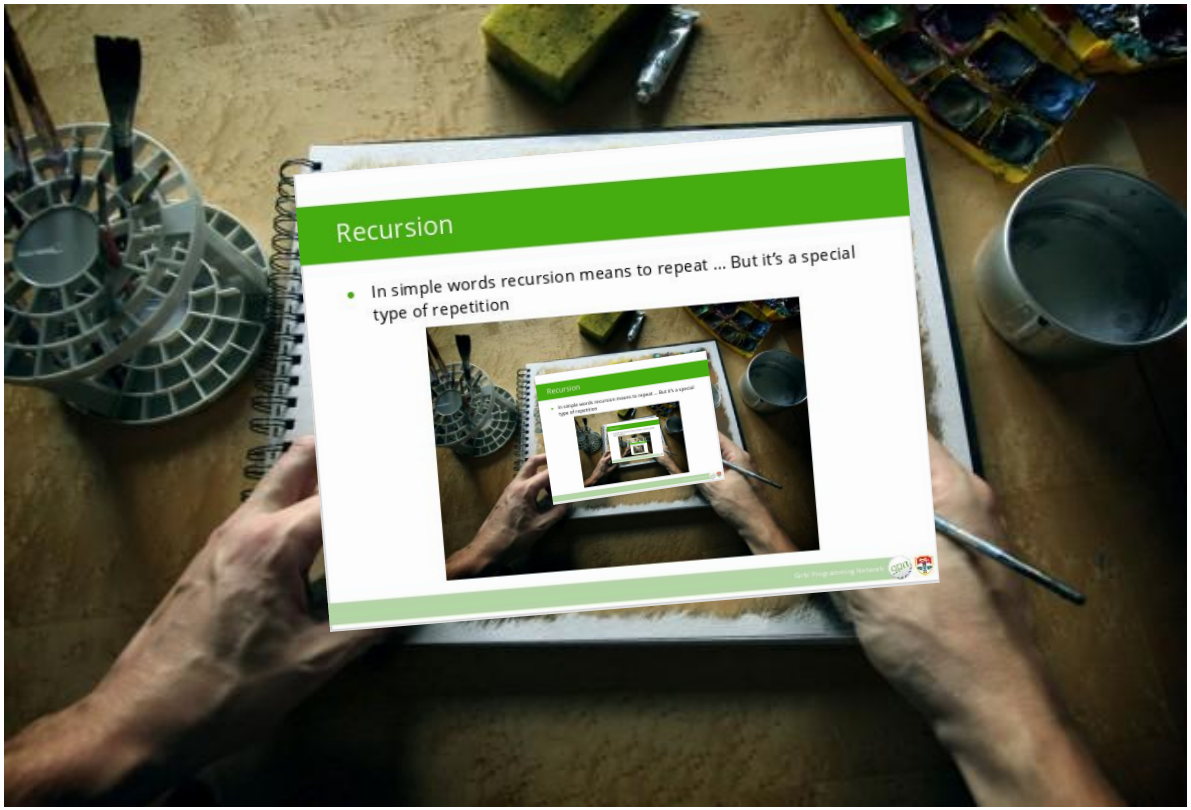
Recursion

Outline

1. What is recursion
2. Recursive function

Recursion

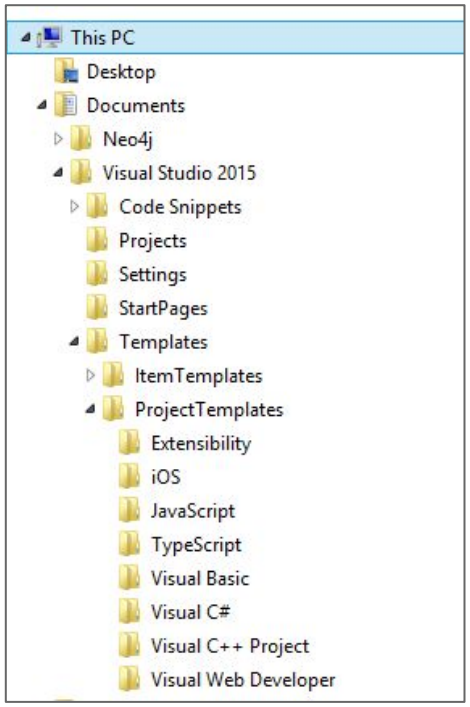
- In simple words recursion means to repeat … But it’s a special type of repetition



Examples

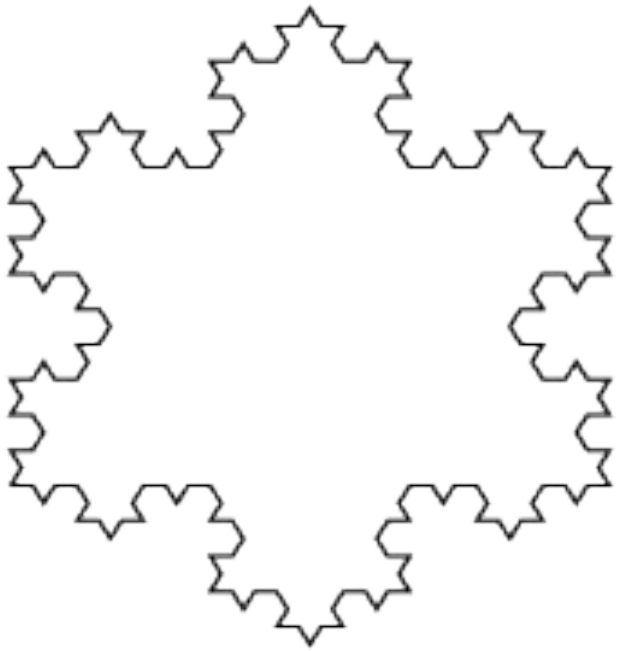
Recursion means “defining something in terms of itself” usually at some smaller scale, perhaps multiple times, to achieve your objective.

“A folder is a structure that holds files and (smaller) folders”



Drawing a snowflake

- How could we draw a snowflake using recursion?



Drawing a snowflake

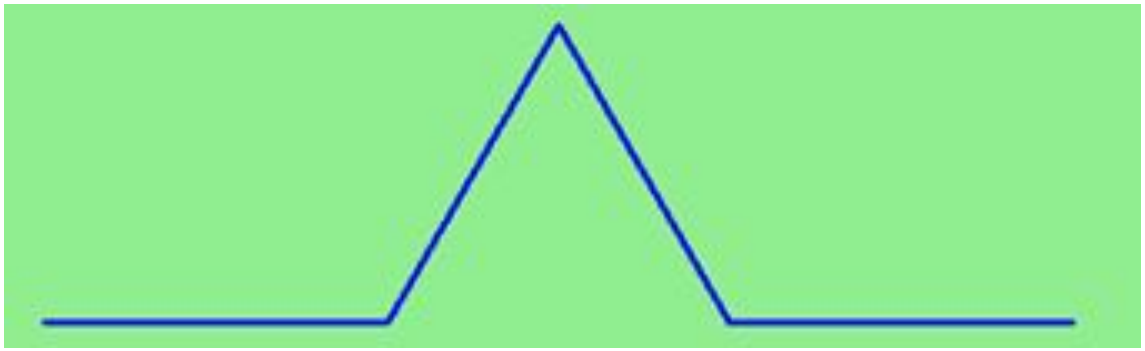
1

Let’s start by finding the simplest shape in the snowflake:
a straight line

Drawing a snowflake

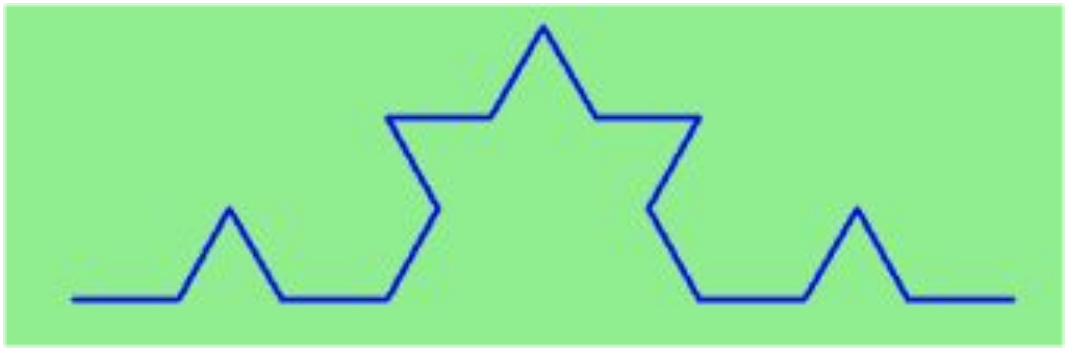
2

Then, we create a bump in the middle of the straight line



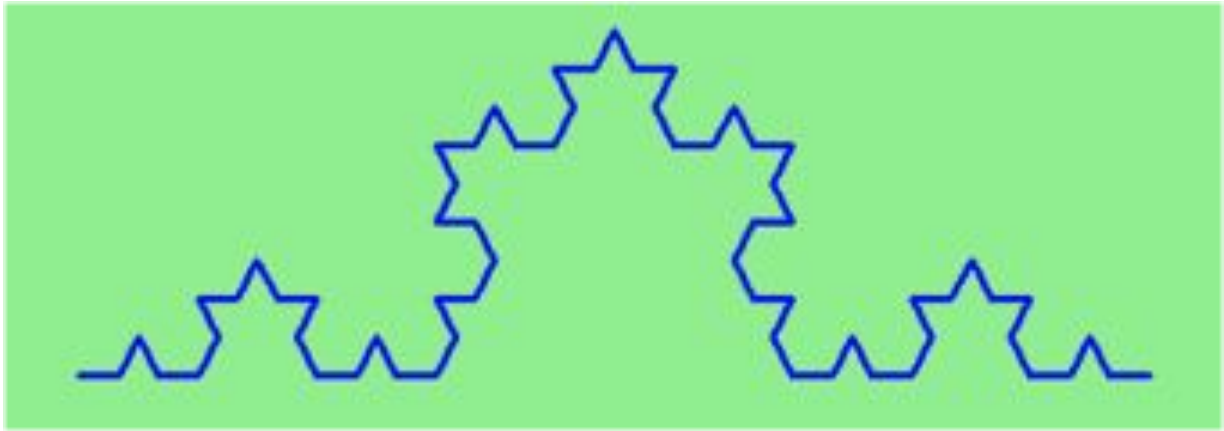
Drawing a snowflake

- What would happen if we repeated steps 1 and 2?
  - (1) Find straight lines
  - (2) Create a bump in the middle of the straight line



Drawing a snowflake

- Repeat steps 1 and 2 again?
  - (1) Find straight lines
  - (2) Create a bump in the middle of the straight line



What is a *recursive* function?

1. **A recursive function calls itself** with a slightly different argument each time forming layers of repeated function calls that each produce their own result.

2. **There is an end-case** that breaks the recursion and brings you back to the first layer, producing one final result.

Code example

Let’s imagine we want to write a function that works out if a word is a Palindrome

```
anna banana kayak rotator water gpn
```

Code example

Let’s imagine we want to write a function that works out if a word is a Palindrome

A Palindrome is a word that is the same forwards and backwards!

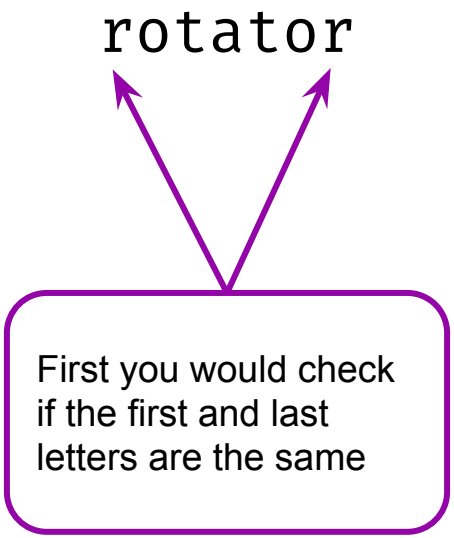
Code example

How would you work this out by hand? Let's use this word as an example:

`rotator`

Code example

How would you work this out by hand? Let's use this word as an example:



Code example

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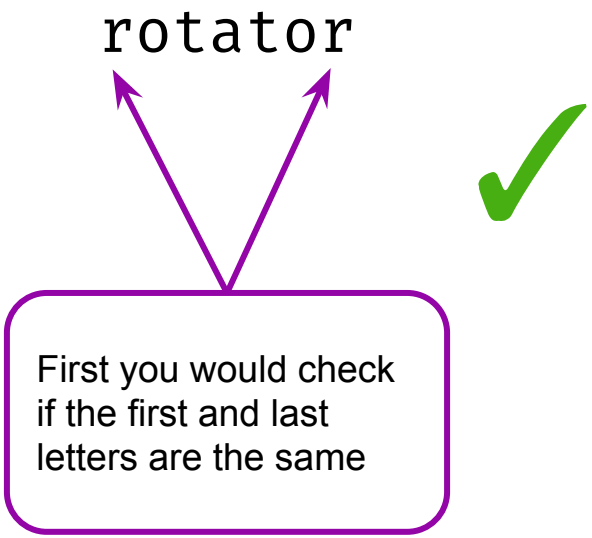

Code example

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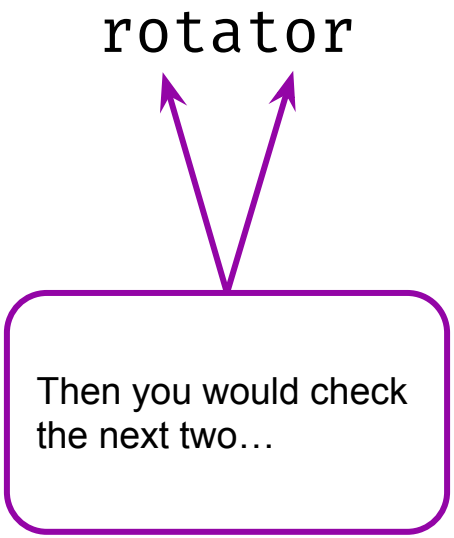
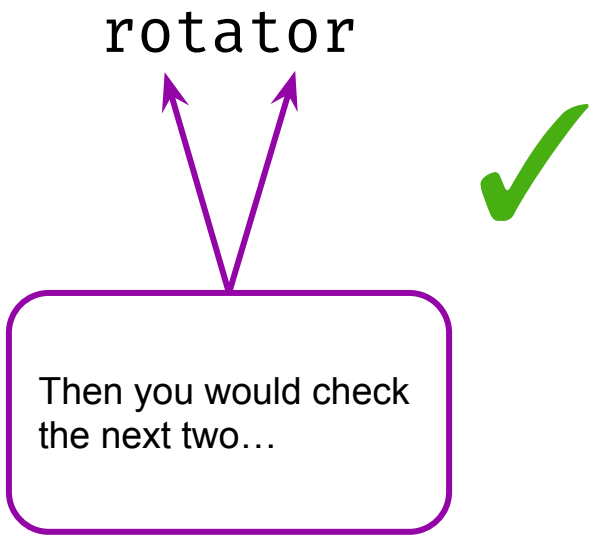


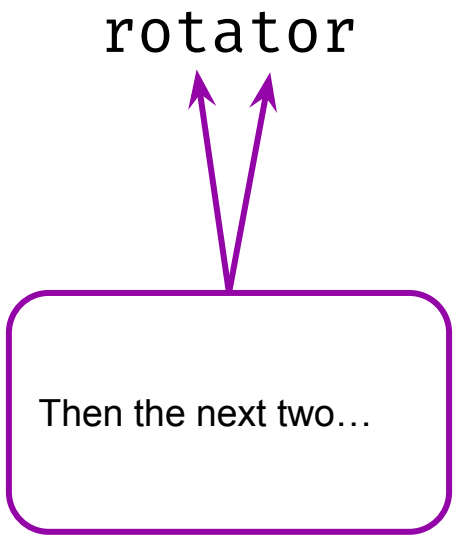
Code example

How would you work this out by hand? Let's use this word as an example:



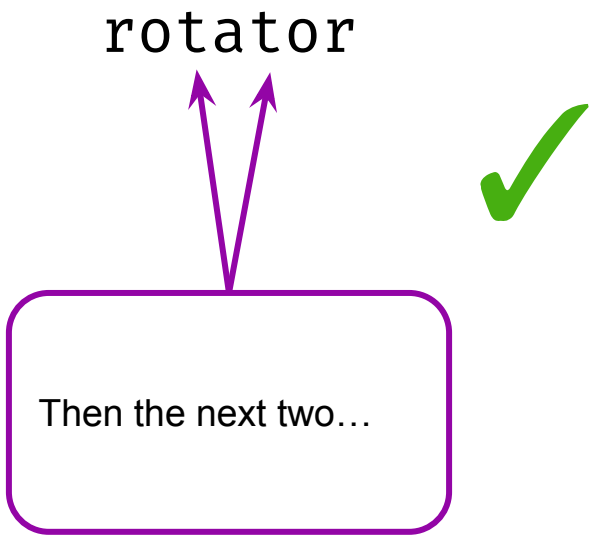
Code example

How would you work this out by hand? Let's use this word as an example:



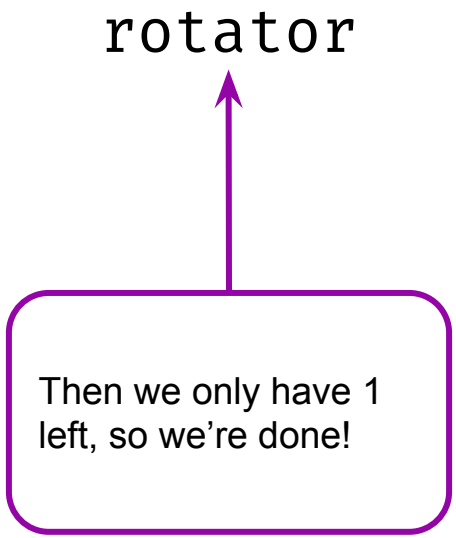
Code example

How would you work this out by hand? Let's use this word as an example:



Code example

How would you work this out by hand? Let's use this word as an example:



Code example

How would you work this out by hand? Let's use this word as an example:

`rotator`

So how would you write this in code? 🤔

Code example

How would you work this out by hand? Let's use this word as an example:

`rotator`

So how would you write this in code? 🤔

You *could* use a loop to figure this out, but we're going to use ✨***recursion*** ✨

Code example

How would you work this out by hand? Let's use this word as an example:

`rotator`

The best way to start with recursion is to think about when you want to STOP.

When did we stop checking if the word was a palindrome?

Code example

How would you work this out by hand? Let's use this word as an example:

`rotator`

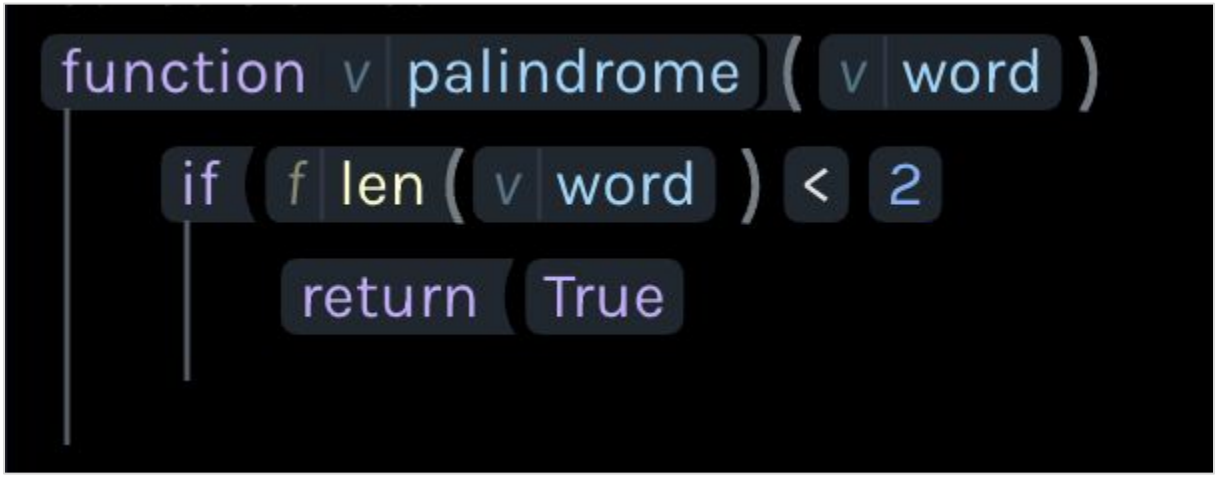
The best way to start with recursion is to think about when you want to STOP.

When did we stop checking if the word was a palindrome?

When we got to just one letter!

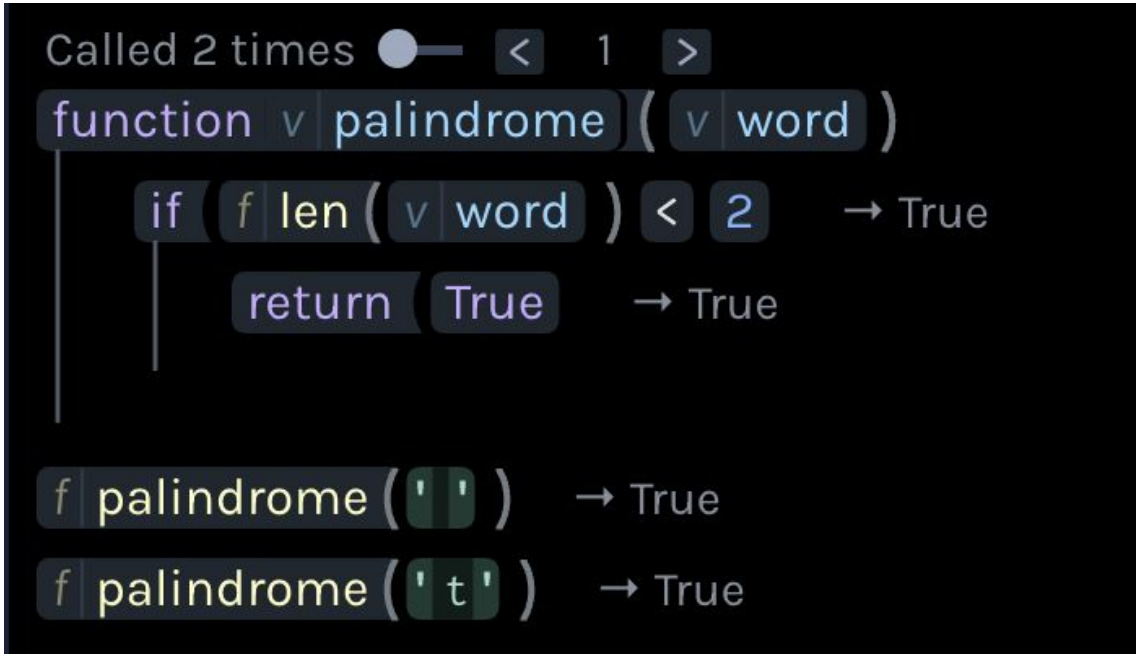
Code example

Here is what we call our “base case” - this means that this is the smallest problem our function can solve.



Code example

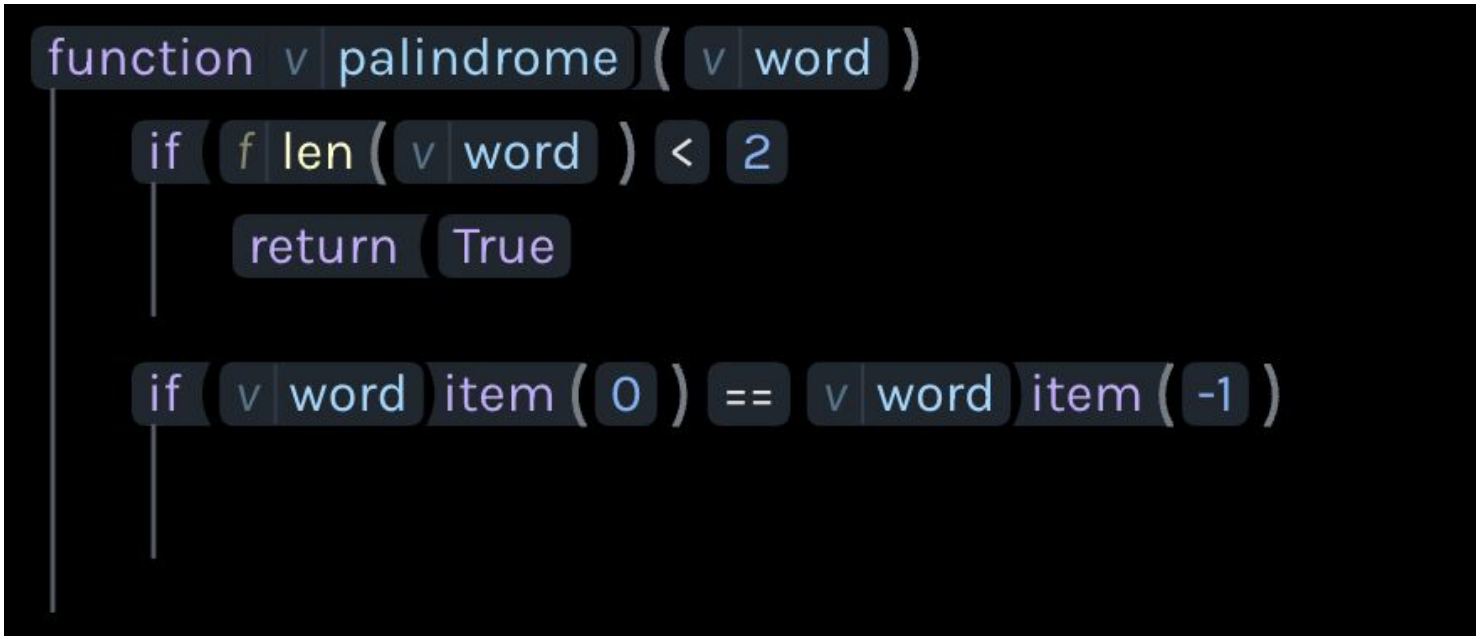
Here is what we call our “base case” - this means that this is the smallest problem our function can solve.
E.g. the word “t” is a palindrome (and this function knows it!)



Next we need to think about the next size up for our problem.

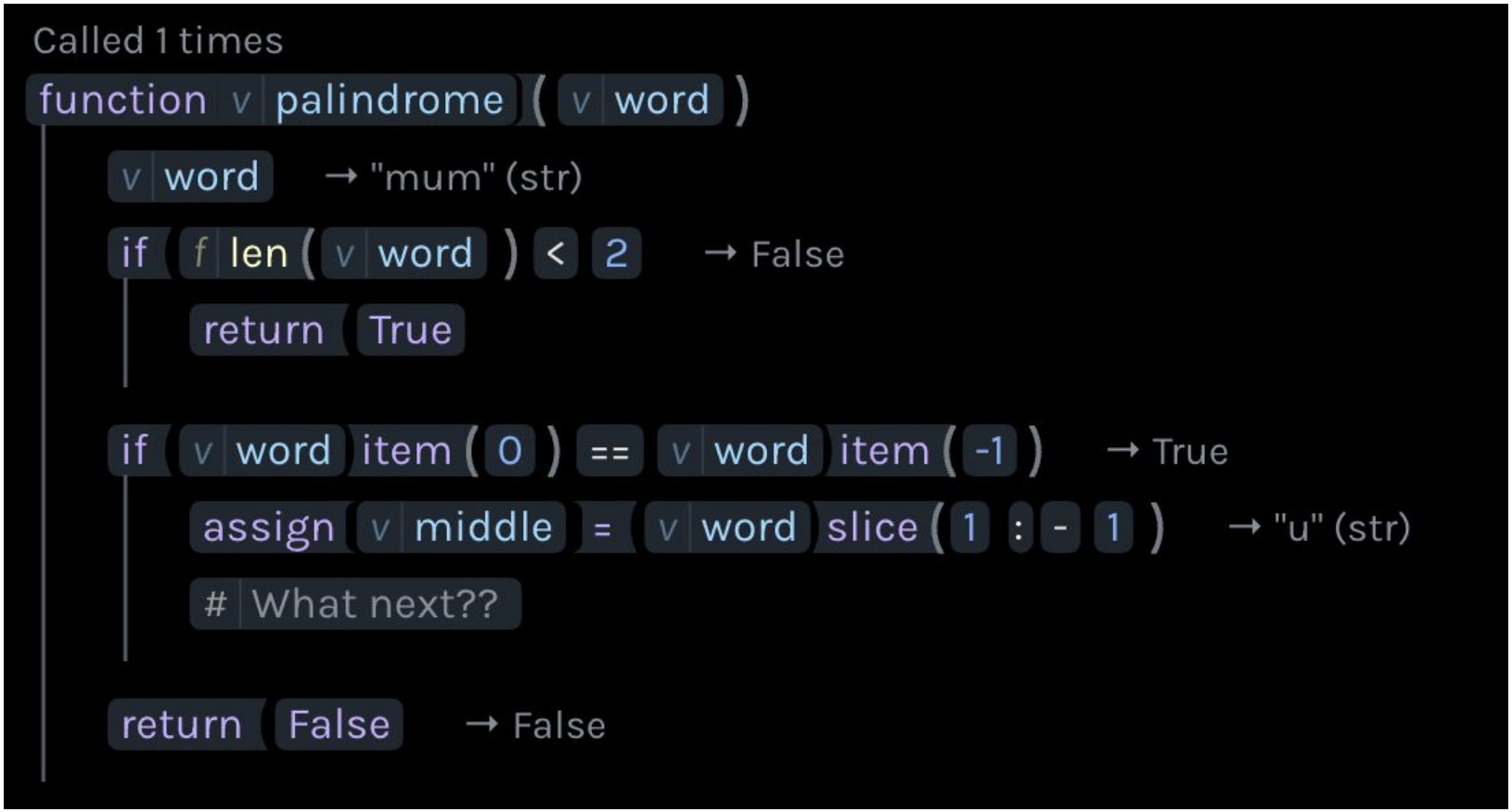
Code example

Now we are checking the letters on the outside of the word. What do we do next? (hint: this is where the recursion happens)

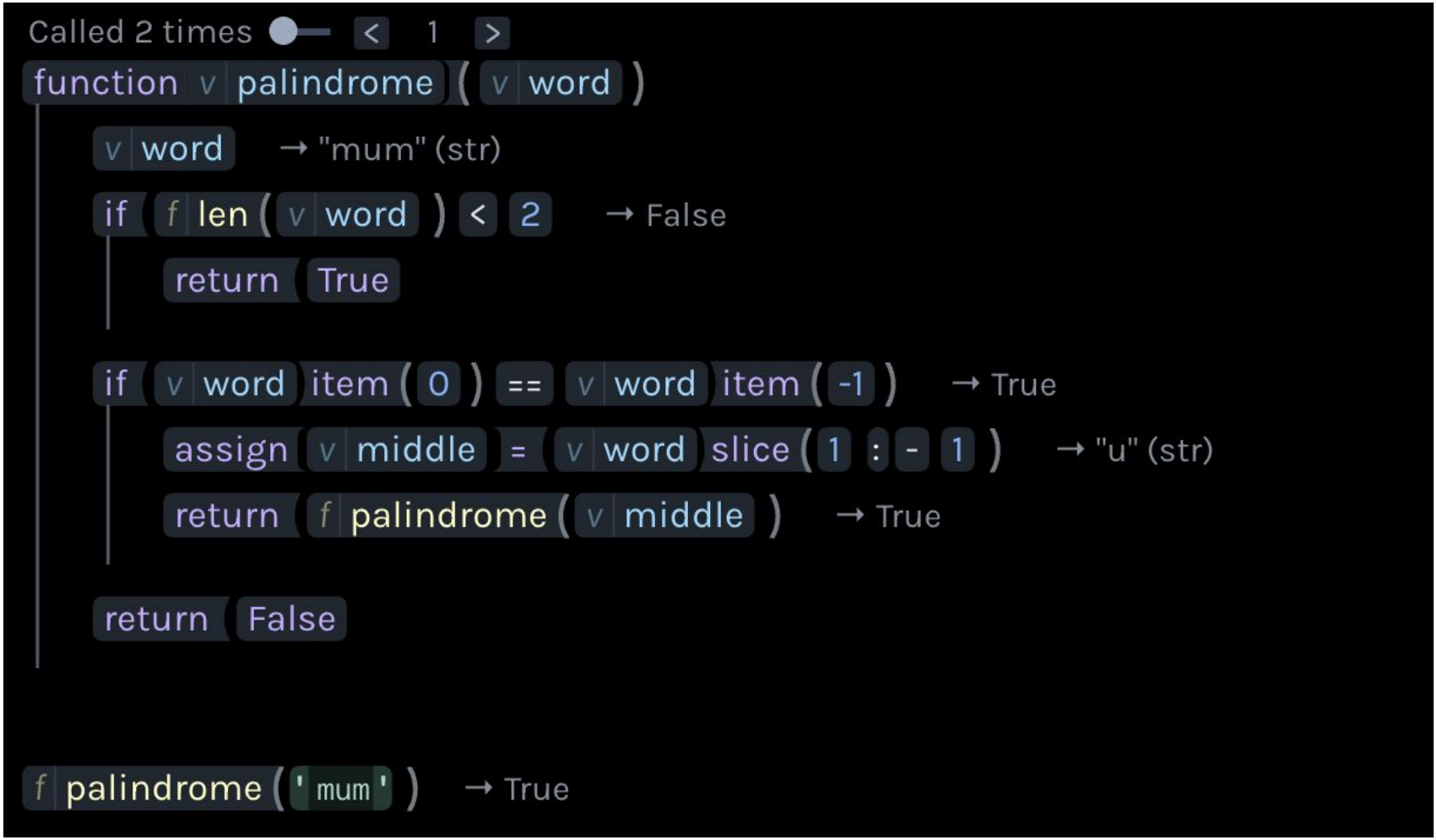


Code example

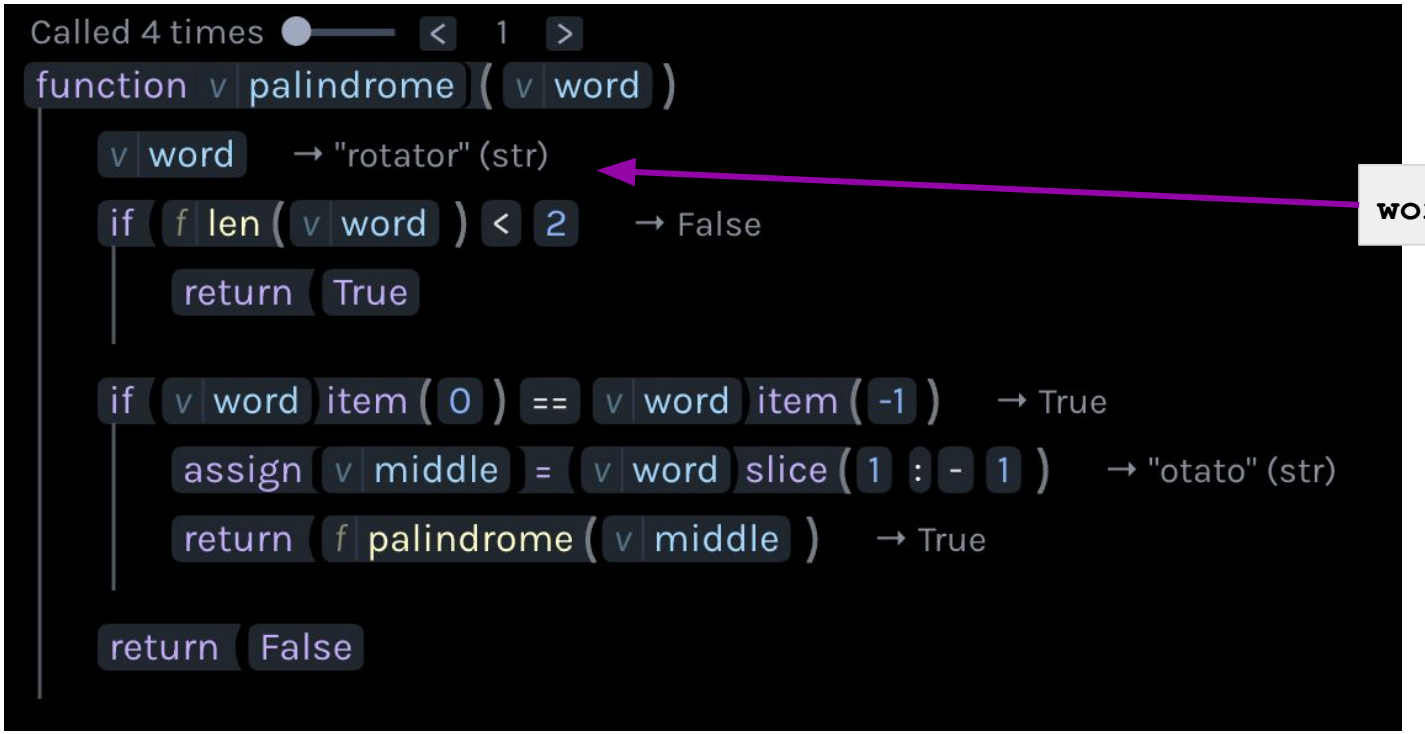
Now we are checking the letters on the outside of the word. What do we do next? (hint: this is where the recursion happens)



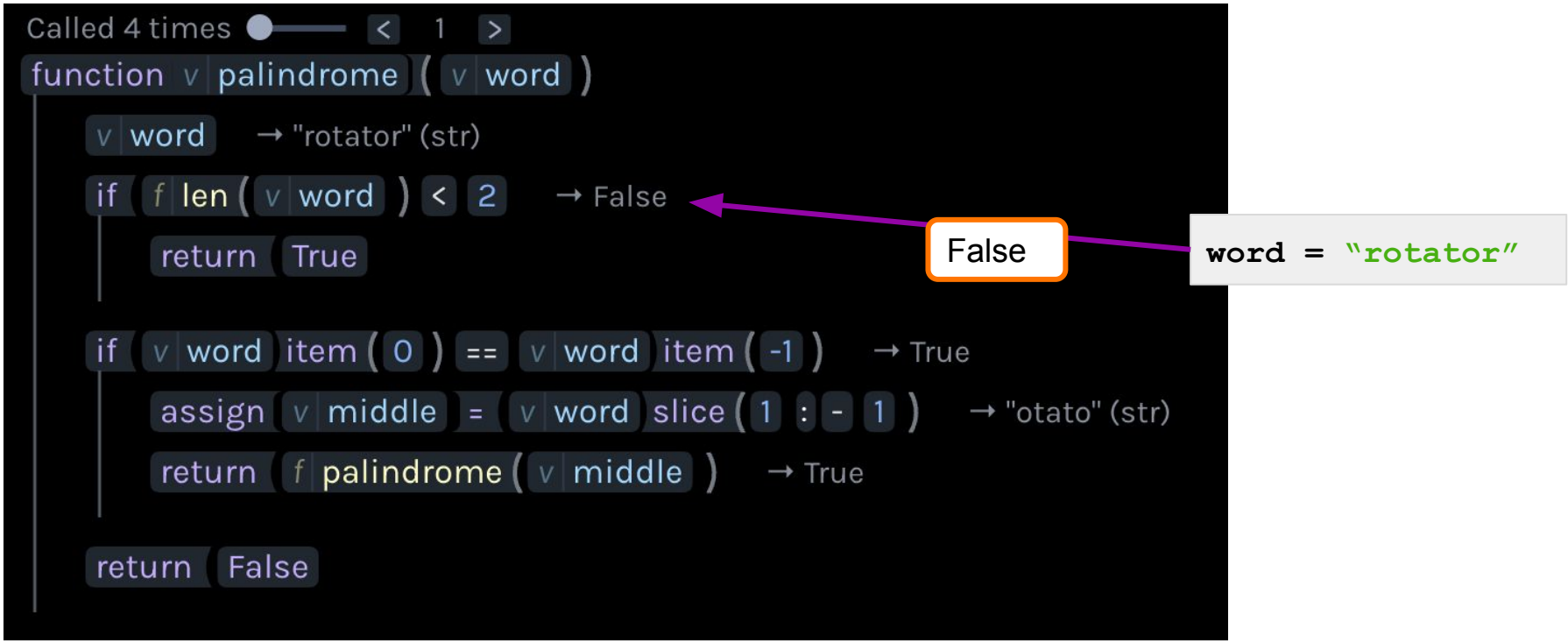
Code example



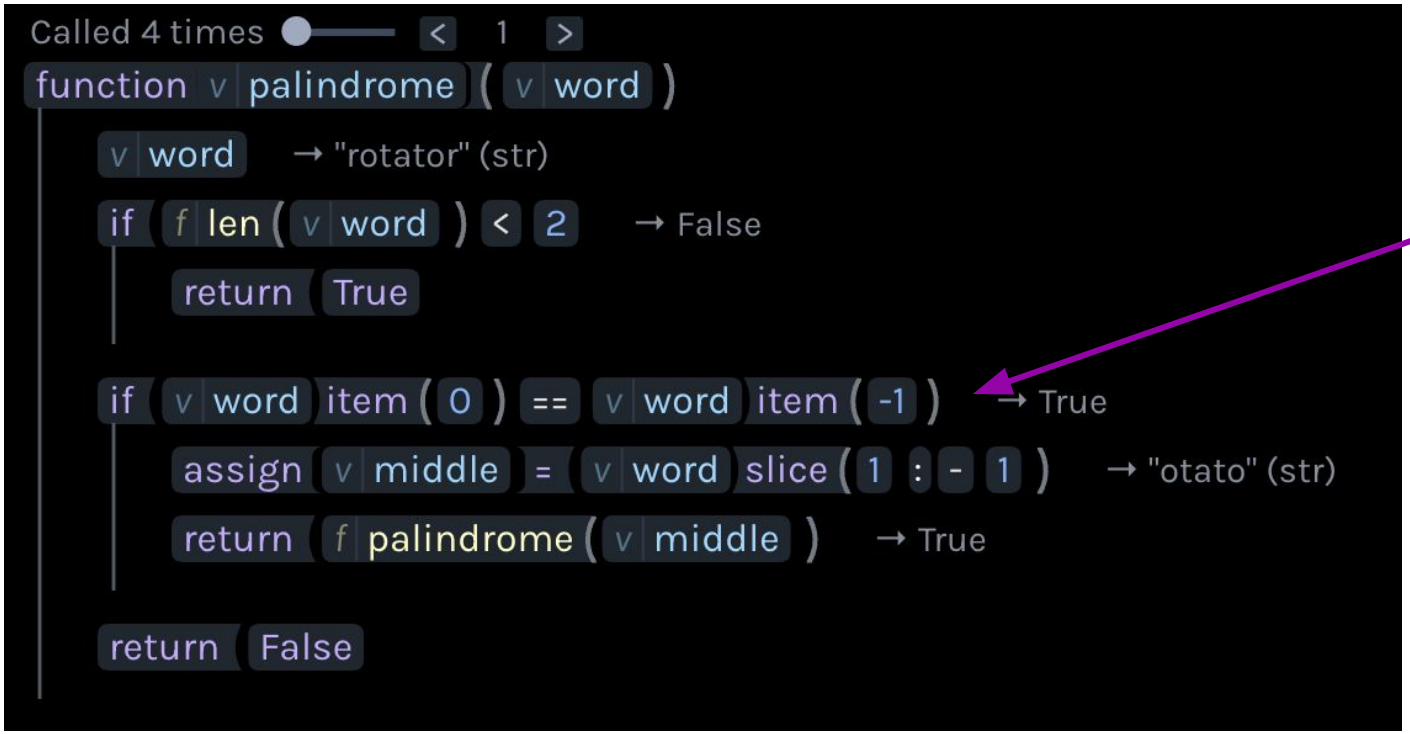
Code example



Code example

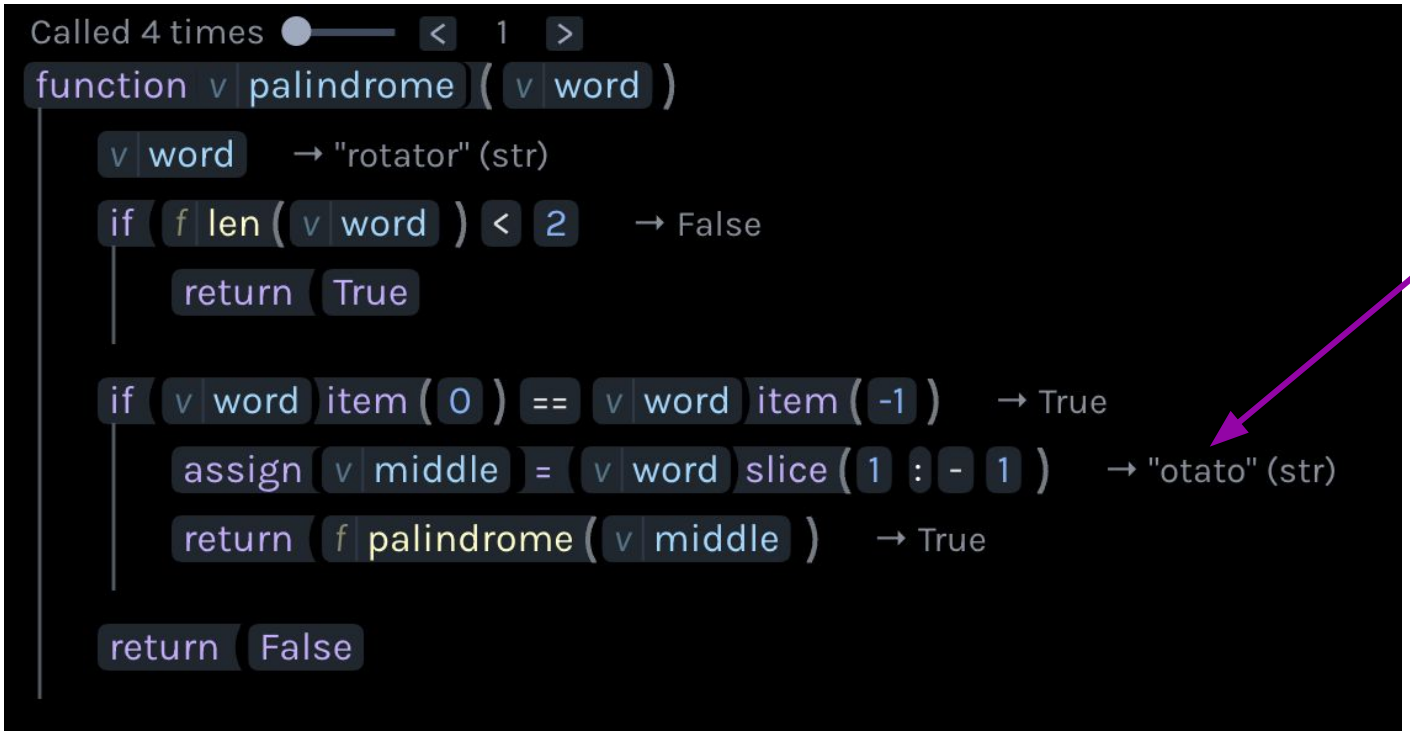


Code example



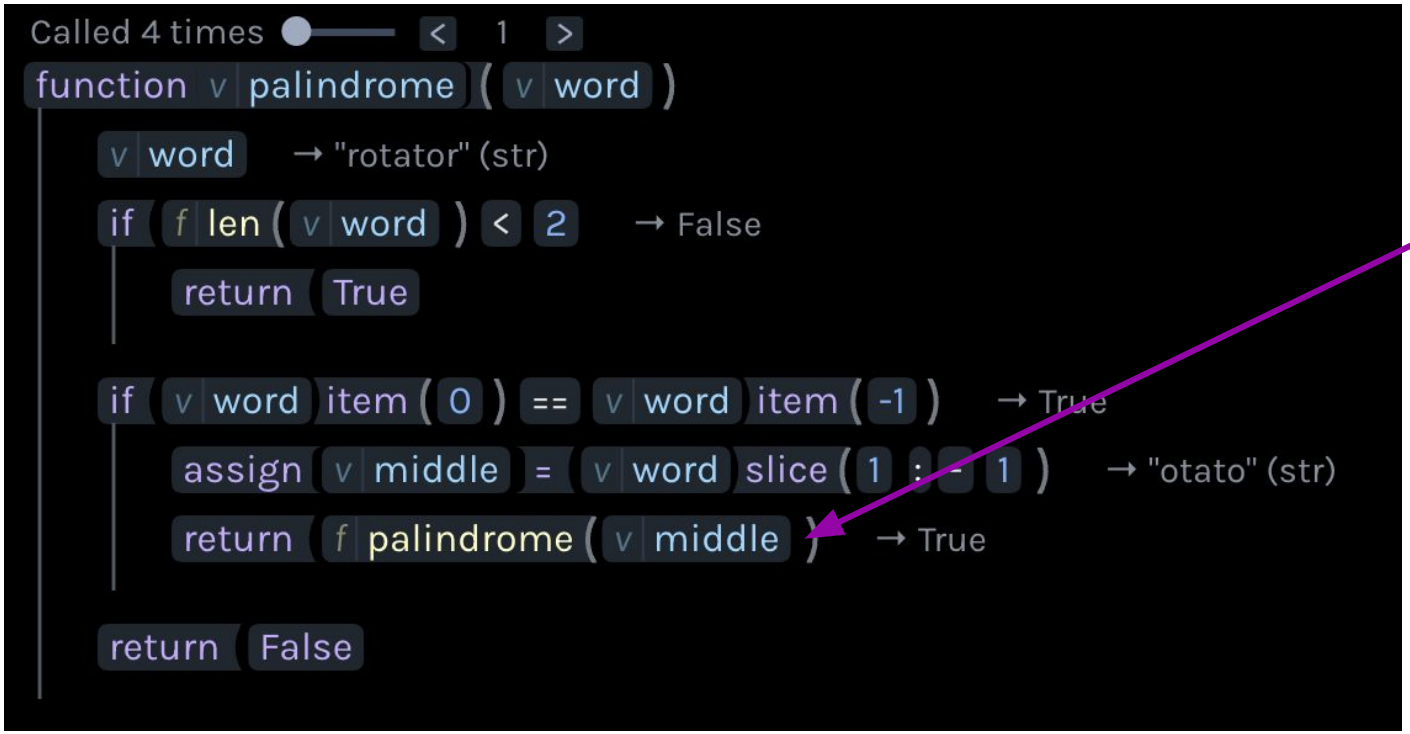
First and last letters match

Code example



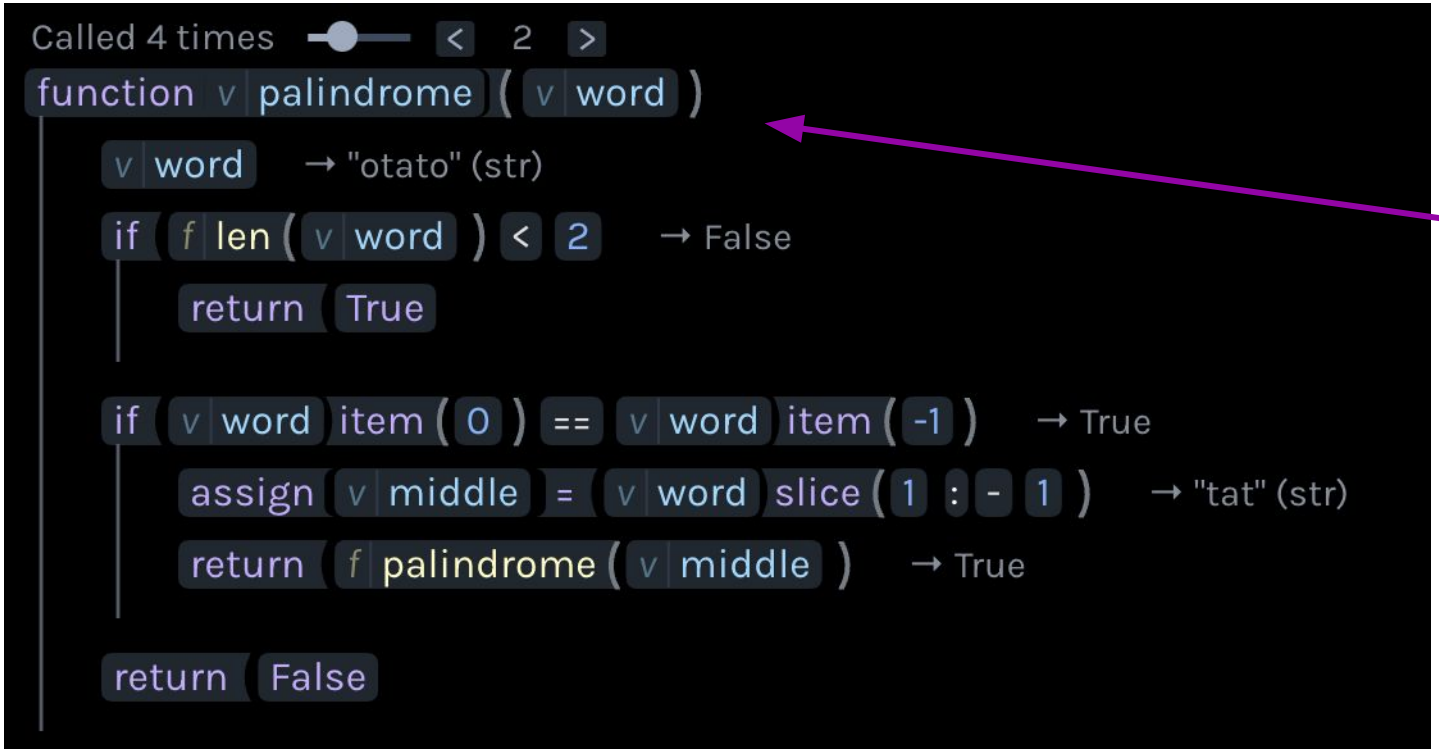
Middle bit is "otato"

Code example



Call the palindrome function again!

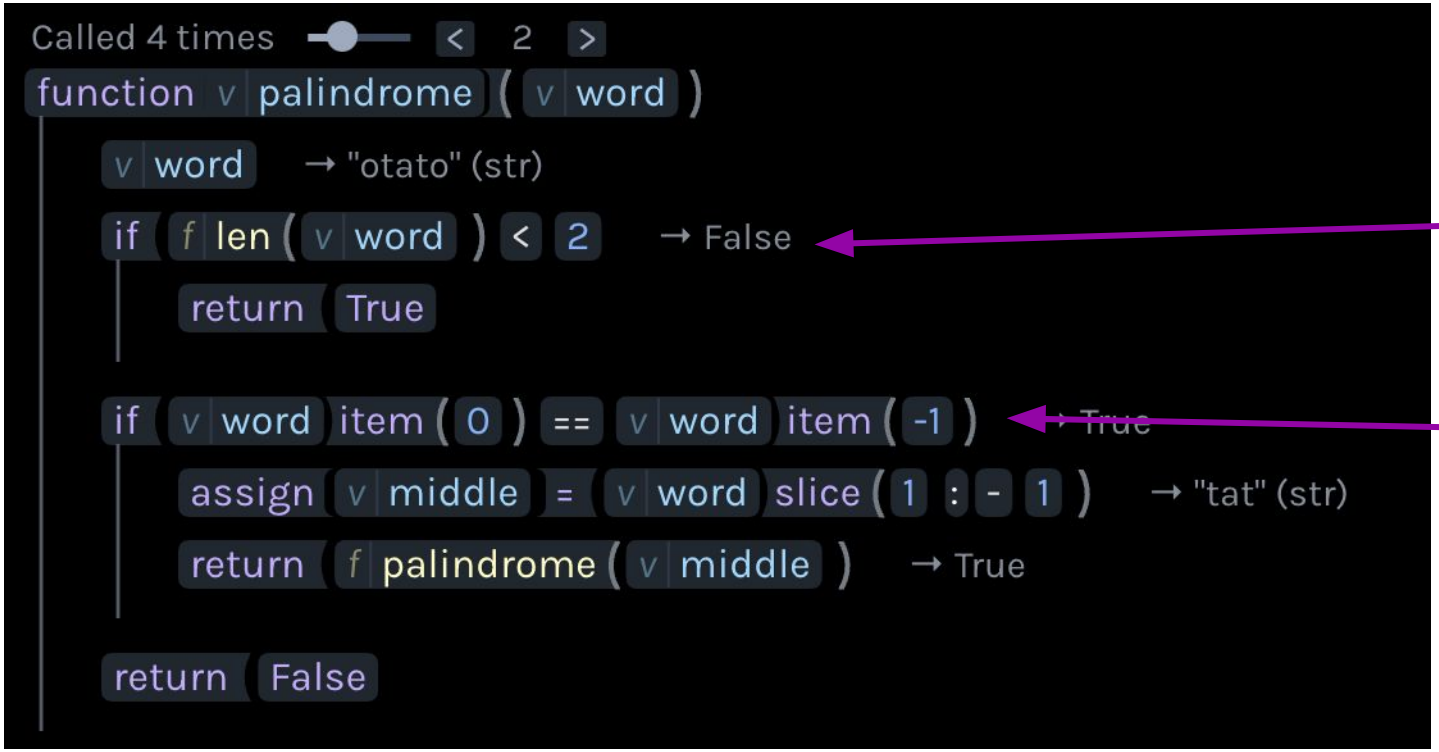
Code example



Second time around!

word is "otato"

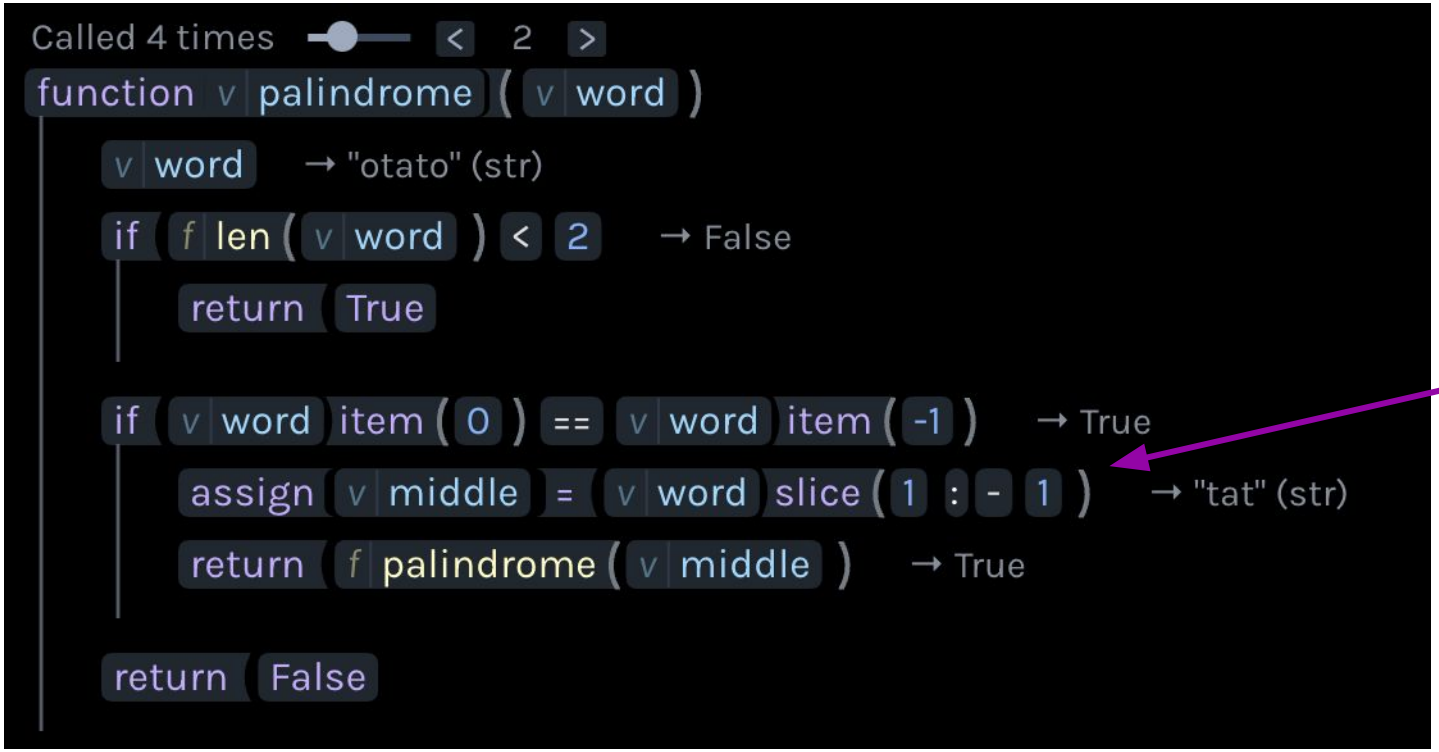
Code example



Length not less than 2

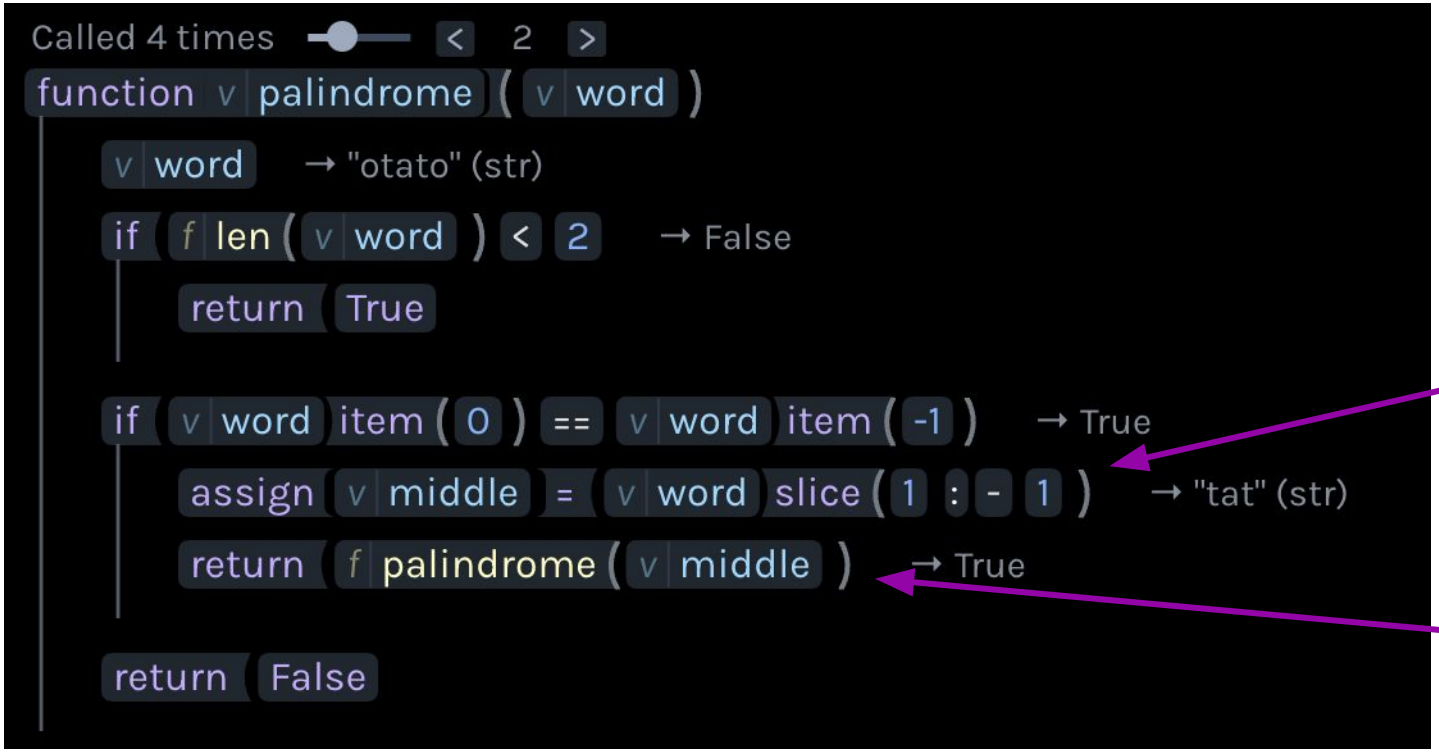
First and last letters match again

Code example




```
Middle of the
word is "tat"
```

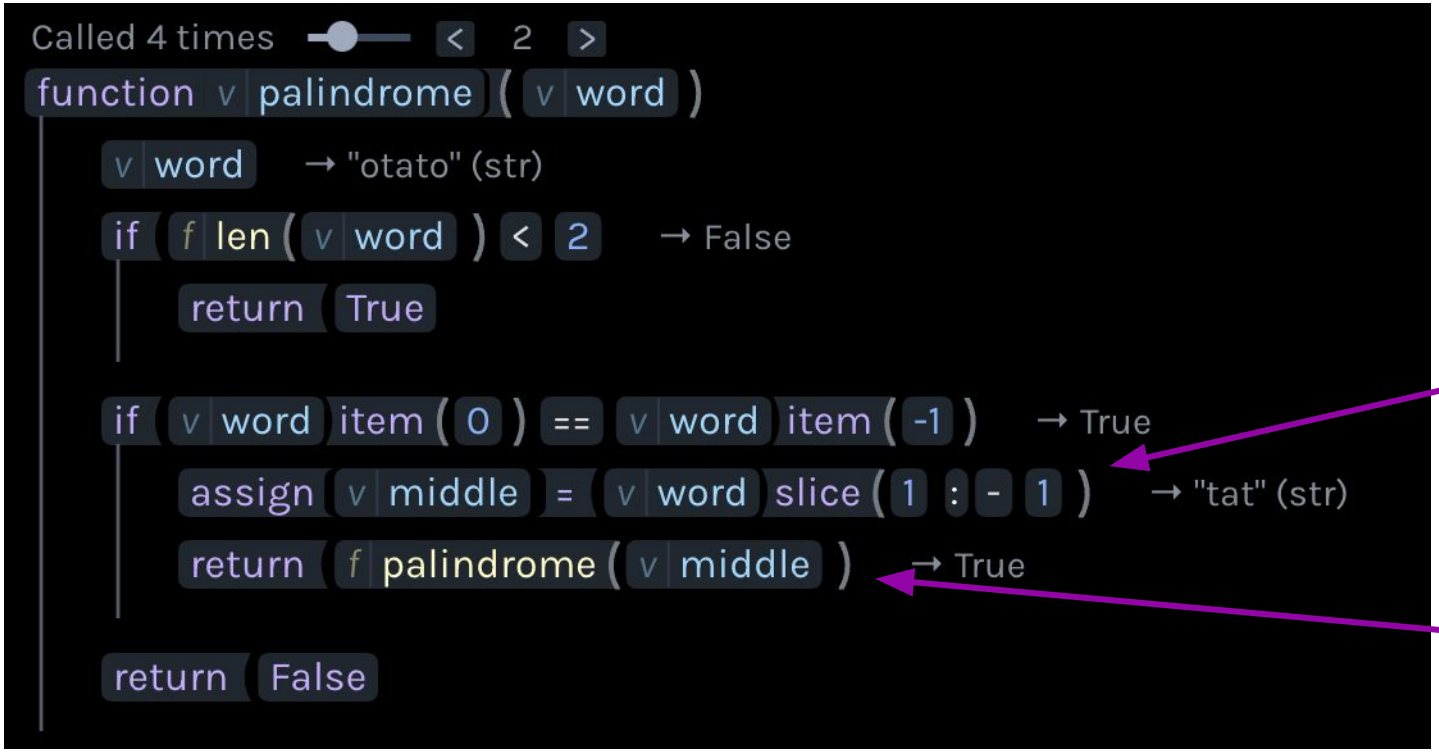
Code example



Middle of the word is "tat"

Call palindrome function again with the word "tat"

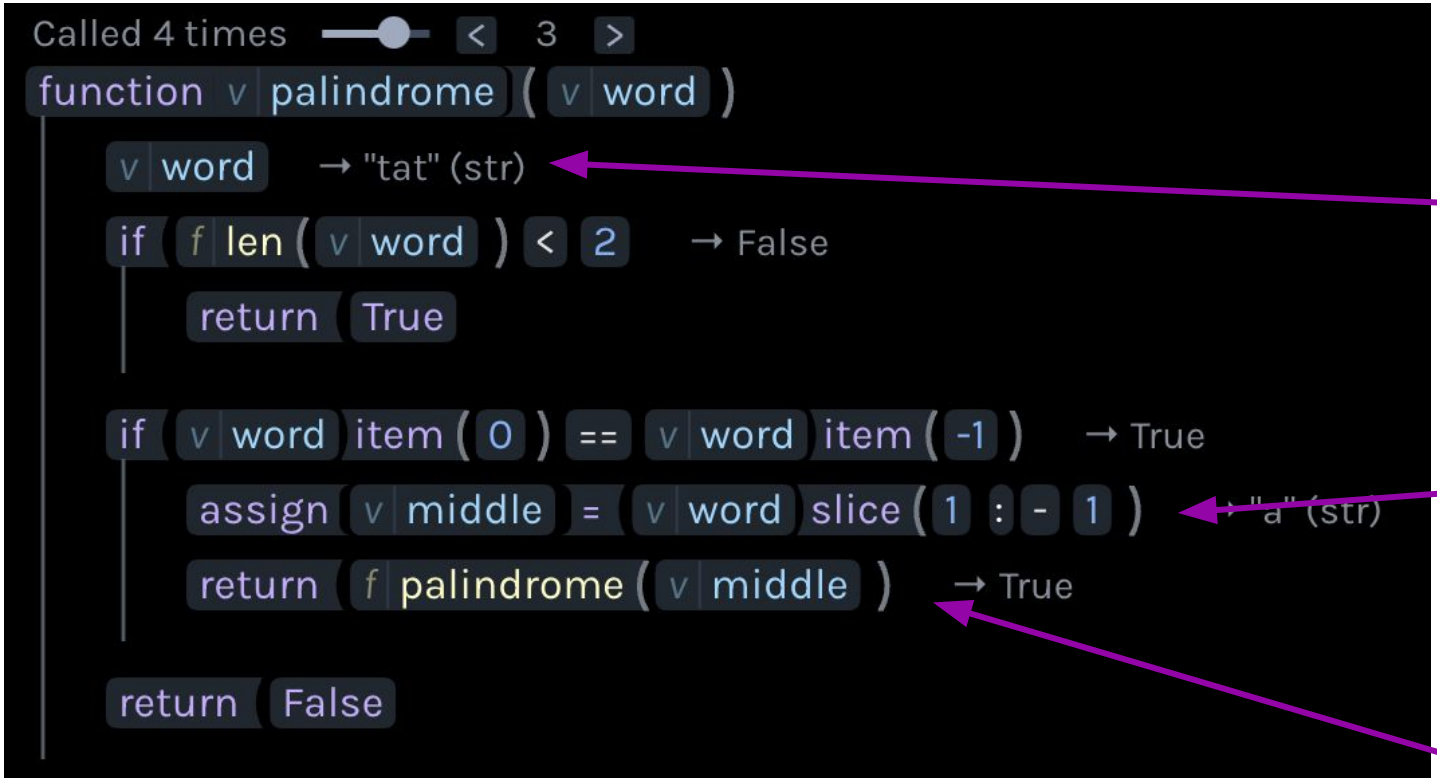
Code example



Middle of the word is "tat"

Call palindrome function again with the word "tat"

Code example

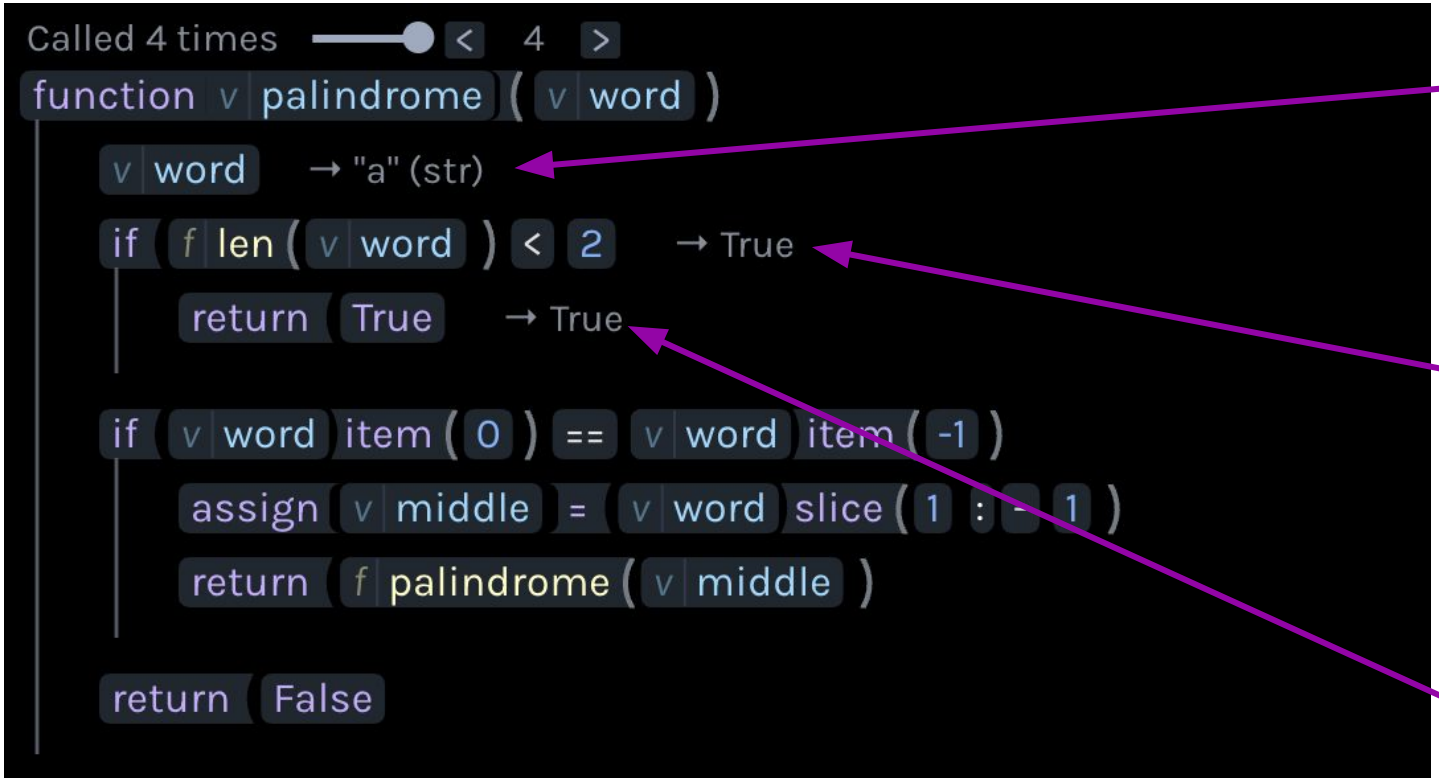


Now the word is "tat" it still has more than 2 letters

The middle of the word is just "a"

Call the palindrome function again!

Code example



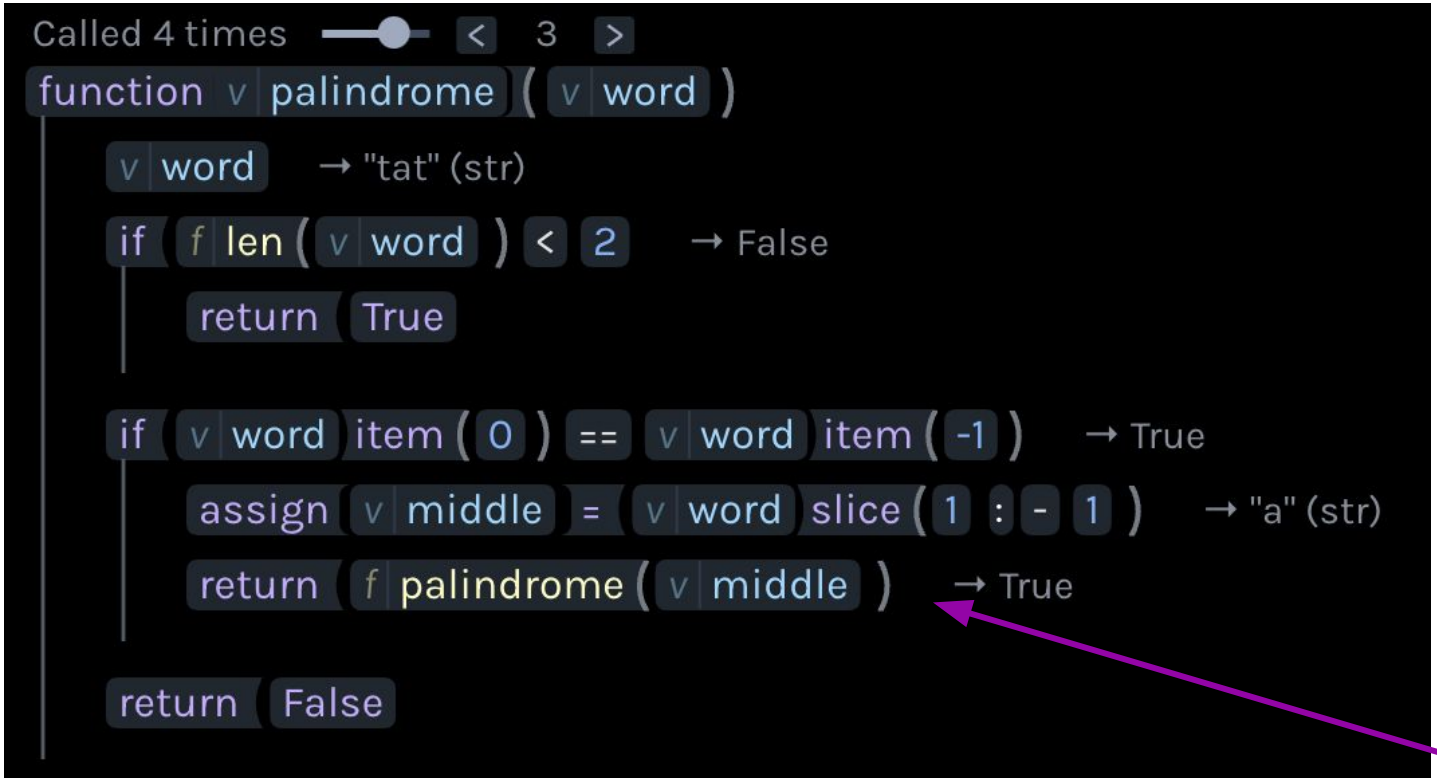
Now the word is "a"

This time it has less than 2 letters!!!

Return True!

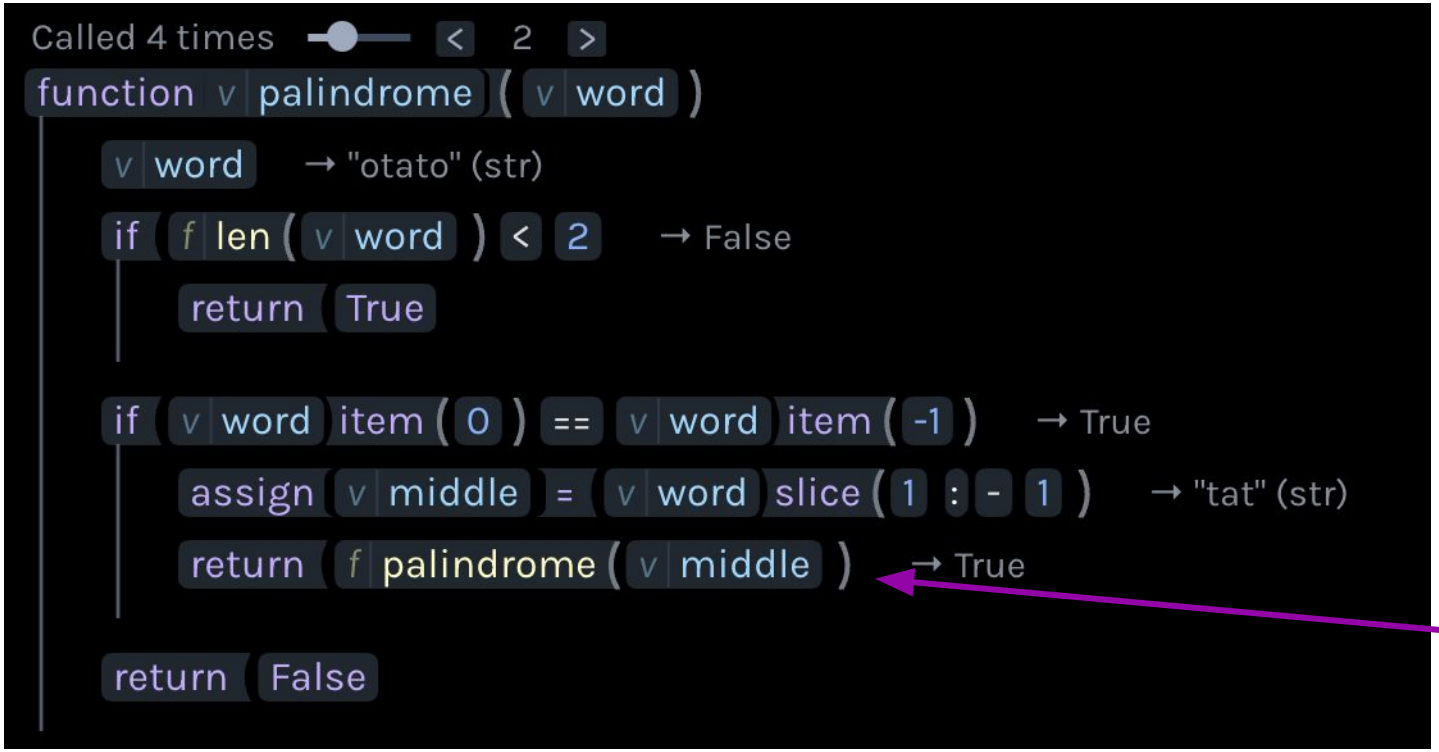
This must be a palindrome!

Code example



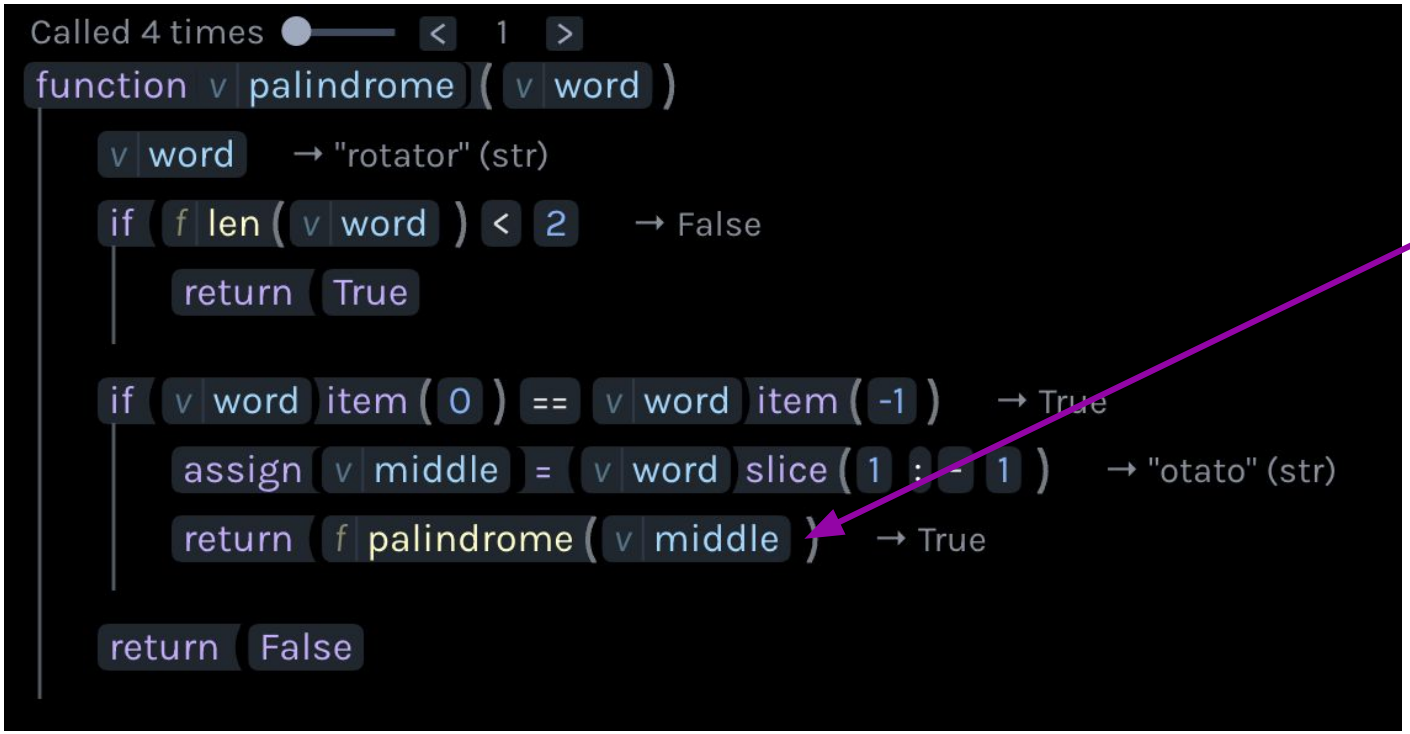
Which means it returns True for "tat"

Code example



Which means it returns True for "otato"

Code example



AND that means it returns True for "rotator" too!

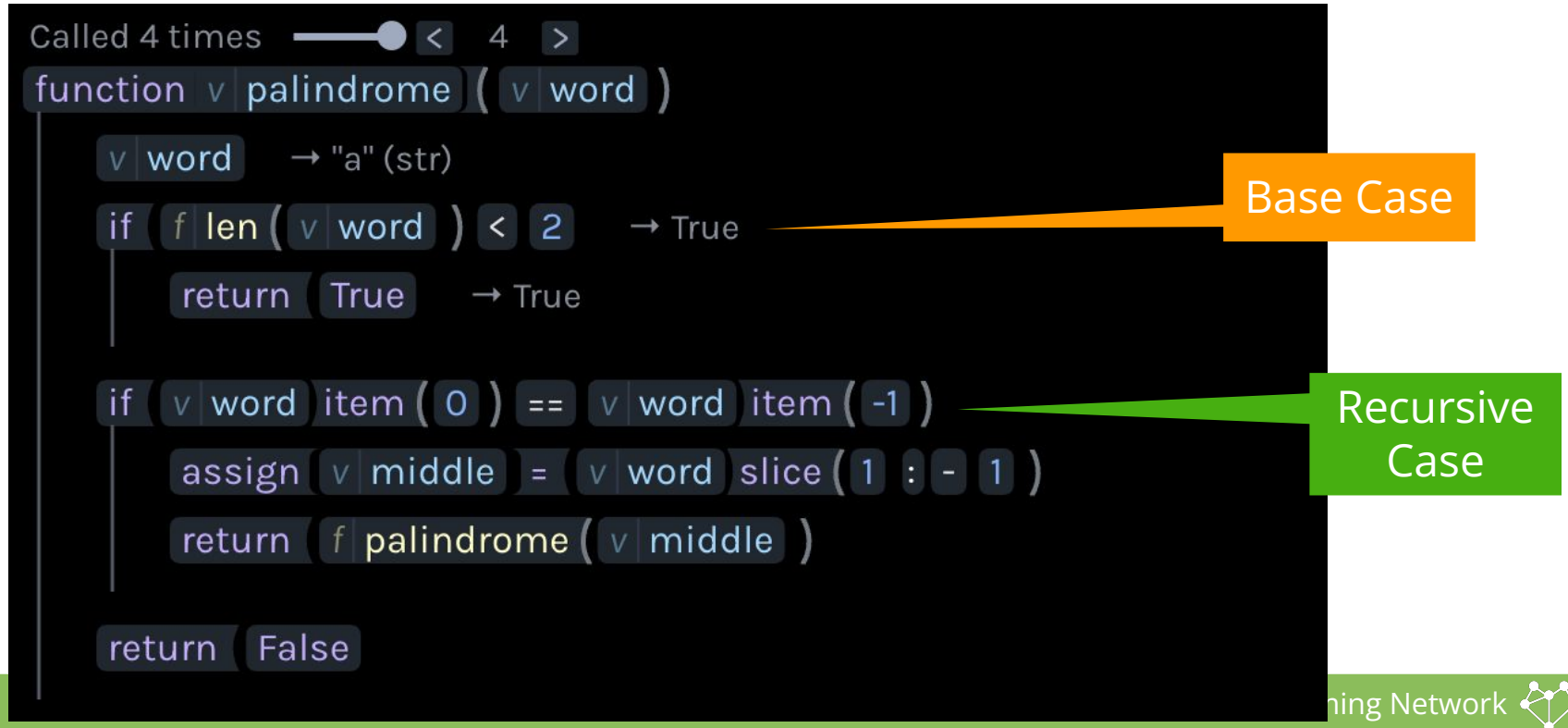
After all those layers,

we now know that "rotator" is a palindrome!

Base case

So if recursion keeps solving smaller and smaller versions of a problem, when does it stop?

We use a **base case** to tell the function when to stop recursing.



Project Time!

Let’s get on to the next thing

Try to do the next Part!

The tutors will be around to help!