Welcome to the Labs!

Tic Tac Toe

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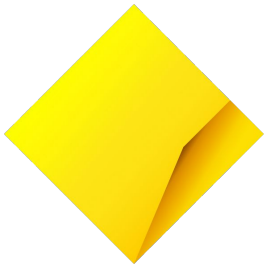


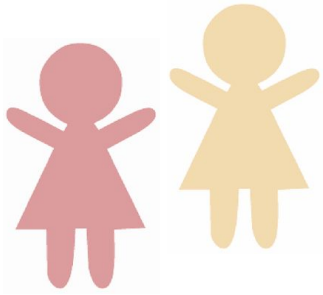
Commonwealth Bank

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

Choose your location

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!

Today's project!

Tic Tac Toe

Introduction to Edstem

Signing up to Edstem

We are shifting all our courses to a new website called “Edstem” so here’s an overview of how to sign up and how to use it.

First let’s go through how to create an account.

1. Follow this link: https://edstem.org/au/join/44m2U2
2. Type in your name and your personal email address
3. Click Create Account
4. Go to your email to verify your account
5. Create a password
6. It should then take you to the courses home page.
7. Click on the one we will be using for this project: →

If you don’t have access to your email account, ask a tutor for a GPN EdStem login

Getting to the lessons

1. Once you are in the course, you'll be taken to a discussion page.
2. Click the button for the lessons page (top right - looks like a book)

The set up of the workbook

The main page:

1. Heading at the top that tells you the project you are in

2. List of “Chapters” called something like **1:Welcome to Tic Tac Toe** They have an icon that looks like this:

3. To complete your project, we will work through the chapters one at a time starting with 1 and continuing on.

Inside a Chapter

Inside a chapter there are two main types of pages:

1. Lesson pages

   The lessons are where you will do your coding. They are called something like **1.1 Welcome!** and have this icon: 

2. Checkpoints

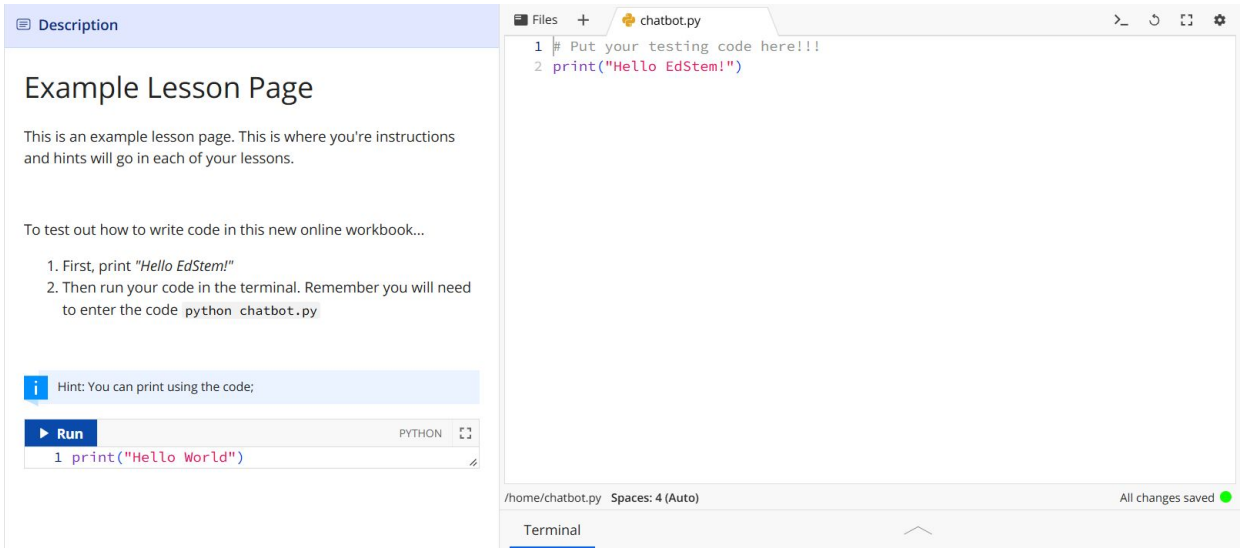
   Each chapter has a checkpoint. Complete the checkpoint to move to the next chapter. Make sure you scroll down to see all the questions listed. Checkpoints look like this:

How to do the work

In each lesson there is:

1. A section on left with instructions for that lesson
2. A section on right for your code

You will need to **copy your code from the last lesson**, then follow the instructions to change your code so that you can work towards finishing the project.

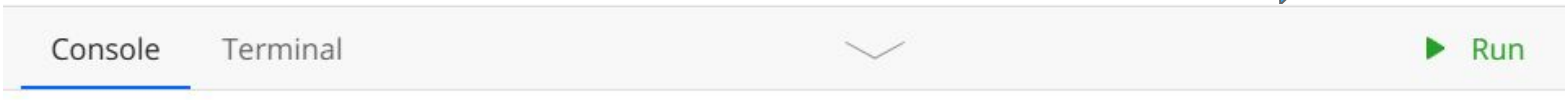


Running your code...

To run your code, you will need to click the button that says Run. It should run automatically and any outputs should be in the "Console" page. You can click the button again to rerun your code.

Don't worry if you forget. Tutors will help!

It should look like this;



Some shortcuts...

There are a couple things you can do to make copying your code from one page to another easier.

- **Ctrl + A** Pressing these keys together will select all the text on a page
- **Ctrl + C** Pressing these keys together will copy anything that's selected
- **Ctrl + V** Pressing these keys together will paste anything you've copied

On Macs use Command (⌘) instead of Ctrl

Project time!

You now know all about the EdStem!

You should now sign up and join our EdStem class. You should also have a look at part 0 of your workbook

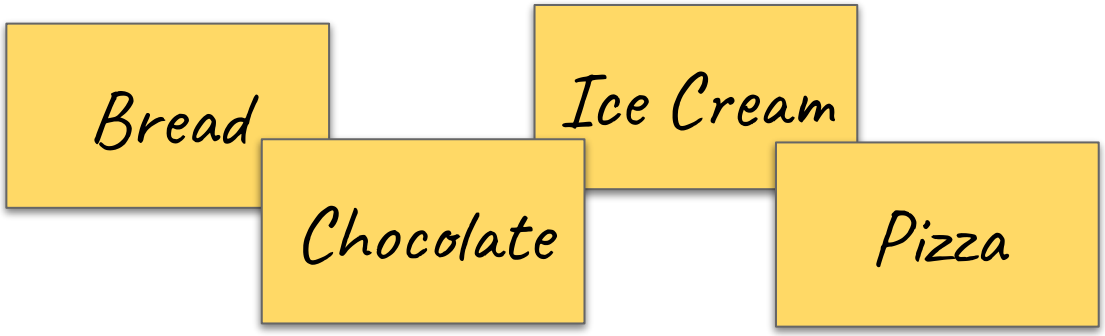
Remember the tutors will be around to help!

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

```
>>> shopping_item1 = "Bread"
>>> shopping_item2 = "Chocolate"
>>> shopping_item3 = "Ice Cream"
>>> shopping_item4 = "Pizza"
```

So much repetition!

Instead we use a python list!

```
>>> shopping_list = ["Bread", "Chocolate", "Ice Cream",
"Pizza"]
```

You can put (almost) anything into a list

- You can have a list of integers

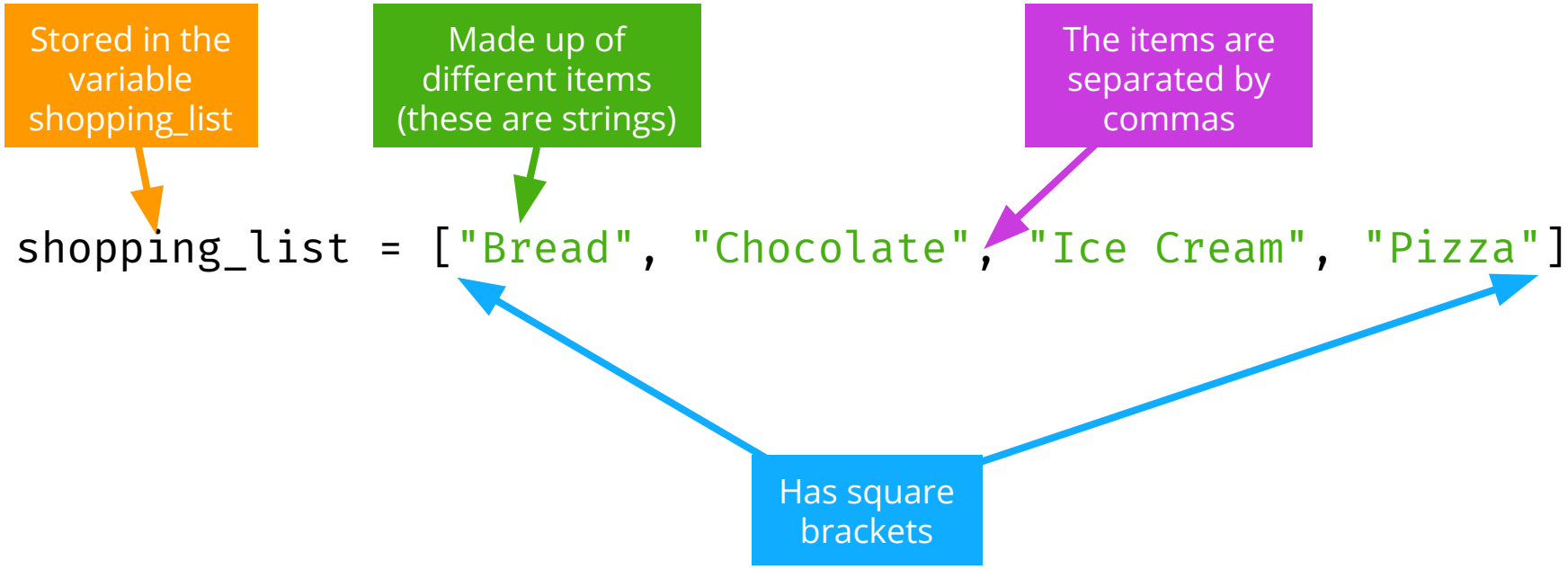
```
>>> primes = [1, 2, 3, 5, 11]
```

- You can have lists with mixed integers and strings

```
>>> mixture = [1, 'two', 3, 4, 'five']
```

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

List anatomy



Accessing Lists!

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

```
faves = ['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]`:

```
>>> faves[0]
'books'
```

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]`:

```
>>> faves[0]
'books'
```

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

```
>>> faves[1]
'butterfly'
```

0 **[1]** 2 3

Going Negative

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

```
>>> faves[-1]
'skateboard'
```

What would `faves[-2]` return?




Going Negative

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

```
>>> faves[-1]
'skateboard'
```

What would `faves[-2]` return?

```
>>> faves[-2]
'chocolate'
```

-4

-3

[-2]

-1

Falling off the edge

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

```
>>> faves = ['books', 'butterfly', 'chocolate',
             'skateboard']
>>> faves[4]


Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
IndexError: list index out of range
```

Updating items!

We can also update things in a list:

```
>>> faves = ['books', 'butterfly',
                 'chocolate', 'skateboard']
>>> faves[2]
'chocolate'
>>> faves[2] = 'lollipops'
>>> faves
```




Updating items!

We can also update things in a list:

```
>>> faves = ['books', 'butterfly',
                 'chocolate', 'skateboard']
>>> faves[2]
'chocolate'
>>> faves[2] = 'lollipops'
>>> faves
['books', 'butterfly', 'lollipops', 'skateboard']
```




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!

```
tennis_pairs = [
    ["Alex", "Emily"], ["Kass", "Annie"], ["Amara", "Viv"]
]
```

Get the first pair in the list

```
>>> first_pair = tennis_pairs[0]
>>> ["Alex", "Emily"]
```

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

```
>>> fist_player = first_pair[0]
>>> "Alex"
```

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!

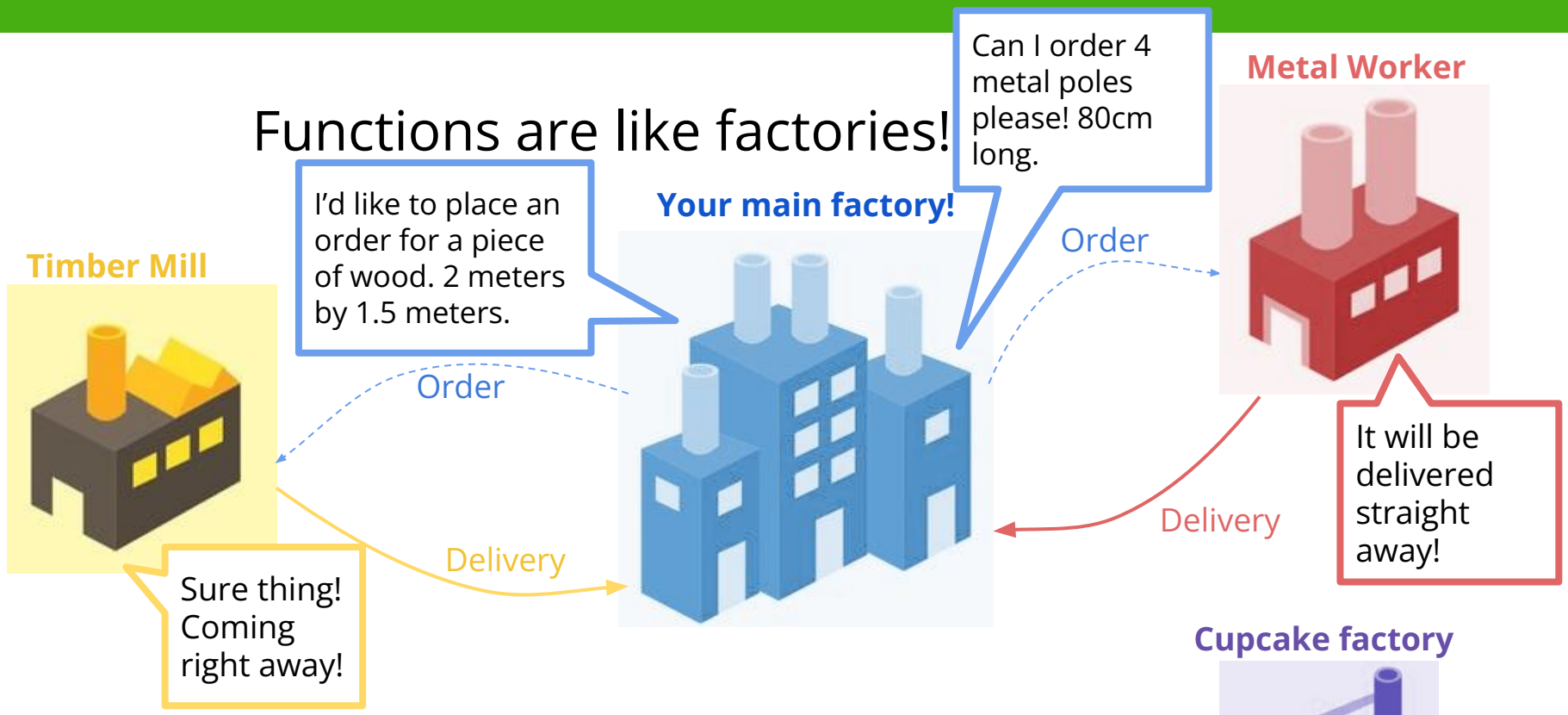
Timber Mill

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!



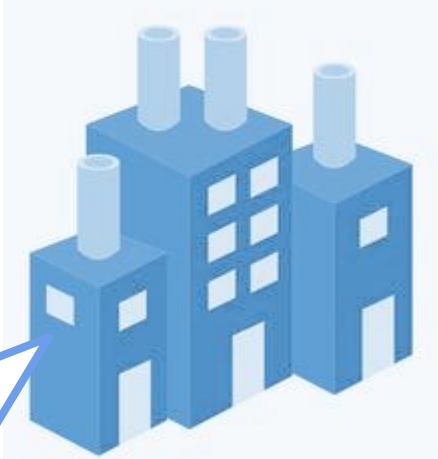
Asking other factories to do some work for you makes your main task simper. You can focus on the assembly!

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!

```
>>> len("Hello world")
11
```

Try these:

```
>>> name = "Renee"
>>> len(name)
5

>>> int("6")
6

>>> str(6)
"6"
```

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

Then you can use your function by calling it!

```
def cat_print():
    print("""
                          #
                           #
                           #
                 ^..^ #####
                 =TT=      ;
                  #########
                  # #   # #
                  M M   M M """)


cat_print()
cat_print()
```

Which will do this!

```
                          #
                           #
                           #
                 ^..^ #####
                 =TT=      ;
                  #########
                  # #   # #
                  M M   M M
                          #
                           #
                           #
                 ^..^ #####
                 =TT=      ;
                  #########
                  # #   # #
                  M M   M M
```

Defining your own functions

Then you can use your function by calling it!

```
def cat_print():
    print("""
                        #
                         #
                         #
                ^..^ #####
                =TT=      ;
                 #########
                 # #   # #
                 M M   M M
                        #
                         #
                         #
                ^..^ #####
                =TT=      ;
                 #########
                 # #   # #
                 M M   M M
                        #
                         #
                         #
                ^..^ #####
                =TT=      ;
                 #########
                 # #   # #
                 M M   M M
    """)

cat_print()
cat_print()
```

When using a function in a **script** make sure you define the function first.

It doesn't matter if you call it from inside another function though!

Which will do this!

```
                        #
                         #
                         #
                ^..^ #####
                =TT=      ;
                 #########
                 # #   # #
                 M M   M M
                        #
                         #
                         #
                ^..^ #####
                =TT=      ;
                 #########
                 # #   # #
                 M M   M M
```

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)

```
>>> def hello(person):
...     print('Hello, ' + person + ', how are you?')
>>> hello('Alex')
Hello, Alex, how are you?
```

Here, we give the hello() function a name

Any string will work

```
>>> hello('abcd')
Hello, abcd, how are you?
```

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.

```
>>> def add(x, y):
...     print(x + y)
>>> add(3, 4)
7
```

Arguments stay inside the function

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

```
>>> def hello(person):
...     print('Hello, ' + person + '!')
>>> print(person)
Traceback (most recent call last):
File "<stdin>", line 1, in <module>
NameError: name 'person' is not defined
```

Variables stay inside the function

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

```
>>> def add(x, y):
...     z = x + y
...     print(z)
>>> add(3, 4)
7
>>> z
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'z' is not defined
```

Global variables are not affected

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

```
>>> z = 1
>>> def add(x, y):
...     z = x + y
...     print(z)
>>> add(3, 4)
7
```

Global variables are not affected

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

```
>>> z = 1
>>> def add(x, y):
...     z = x + y
...     print(z)
>>> add(3, 4)
7
```

What's the value of z now?

```
>>> print(z)
```

Global variables are not affected

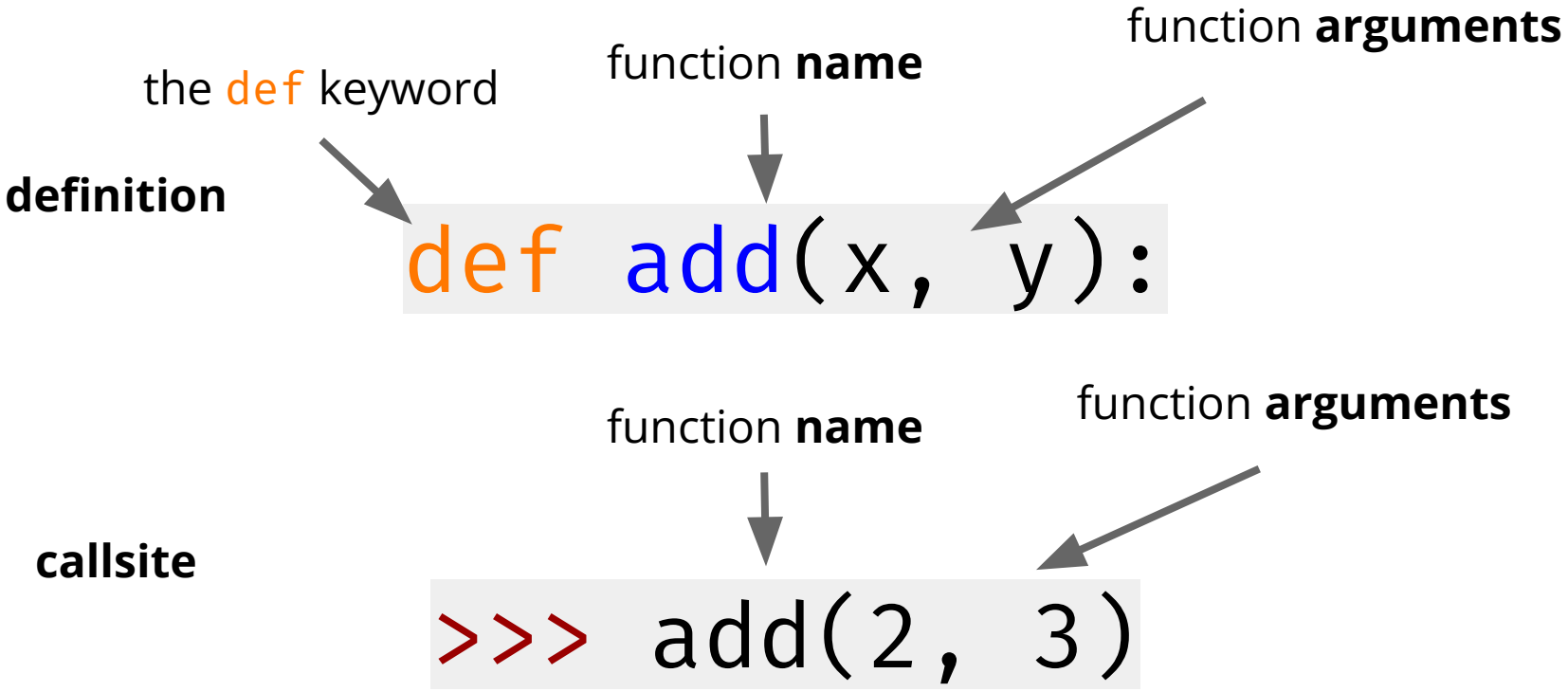
Changing a variable in a function **only changes it *inside* the function.**

```
>>> z = 1
>>> def add(x, y):
...     z = x + y
...     print(z)
>>> add(3, 4)
7
```

What's the value of z now?

```
>>> print(z)
1
```

Recap: A function signature



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()

```
>>> def add(x, y):
...     print(x + y)
>>> sum = add(1, 3)
4
>>> sum
```

sum has no value!

Giving something back

Using `return` in a function immediately returns a result.

```
>>> def add(x, y):
...     z = x + y
...     return z
...
>>> sum = add(1, 3)
>>> sum
4
```

Giving something back

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

```
>>> def add(x, y):
...     print('before the return')
...     z = x + y
...     return z
...     print('after the return')
>>> sum = add(1, 3)
before the return
>>> sum
4
```

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`!

```
fave_num = 5
if fave_num < 10:
    print("that's a small number")
```

Else statements

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

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

What happens?

Else statements

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

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

What happens?

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

Elif statements

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

```
word = "Chocolate"
if word == "GPN":
  print("GPN is awesome!")
elif word == "Chocolate":
  print("YUMMM Chocolate!")
else:
  print("The word isn't GPN :(")
```

What happens?

Elif statements

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

```
word = "Chocolate"
if word == "GPN":
  print("GPN is awesome!")
elif word == "Chocolate":
  print("YUMMM Chocolate!")
else:
  print("The word isn't GPN :(")
```

What happens?

```
>>> YUMMM Chocolate!
```

Booleans (True and False)

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

```
>>> "A" in "AEIOU"
>>> "Z" in "AEIOU"
>>> "a" in "AEIOU"
```

```
>>> animals = ["cat", "dog", "goat"]
>>> "banana" in animals
>>> "cat" in animals
```

```
>>> phone_book = {"Maddie": 111, "Lucy": 222, "Julia": 333}
>>> "Maddie" in phone_book
>>> "Gabe" in phone_book
>>> 333 in phone_book
```

Booleans (True and False)

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

```
True  "A" in "AEIOU"
False "Z" in "AEIOU"
False "a" in "AEIOU"
```

```
>>> animals = ["cat", "dog", "goat"]
False "banana" in animals
True  "cat" in animals
```

```
>>> phone_book = {"Maddie": 111, "Lucy": 222, "Julia": 333}
True  "Maddie" in phone_book
False "Gabe" in phone_book
False 333 in phone_book
```

It only checks in the keys!

Project Time!

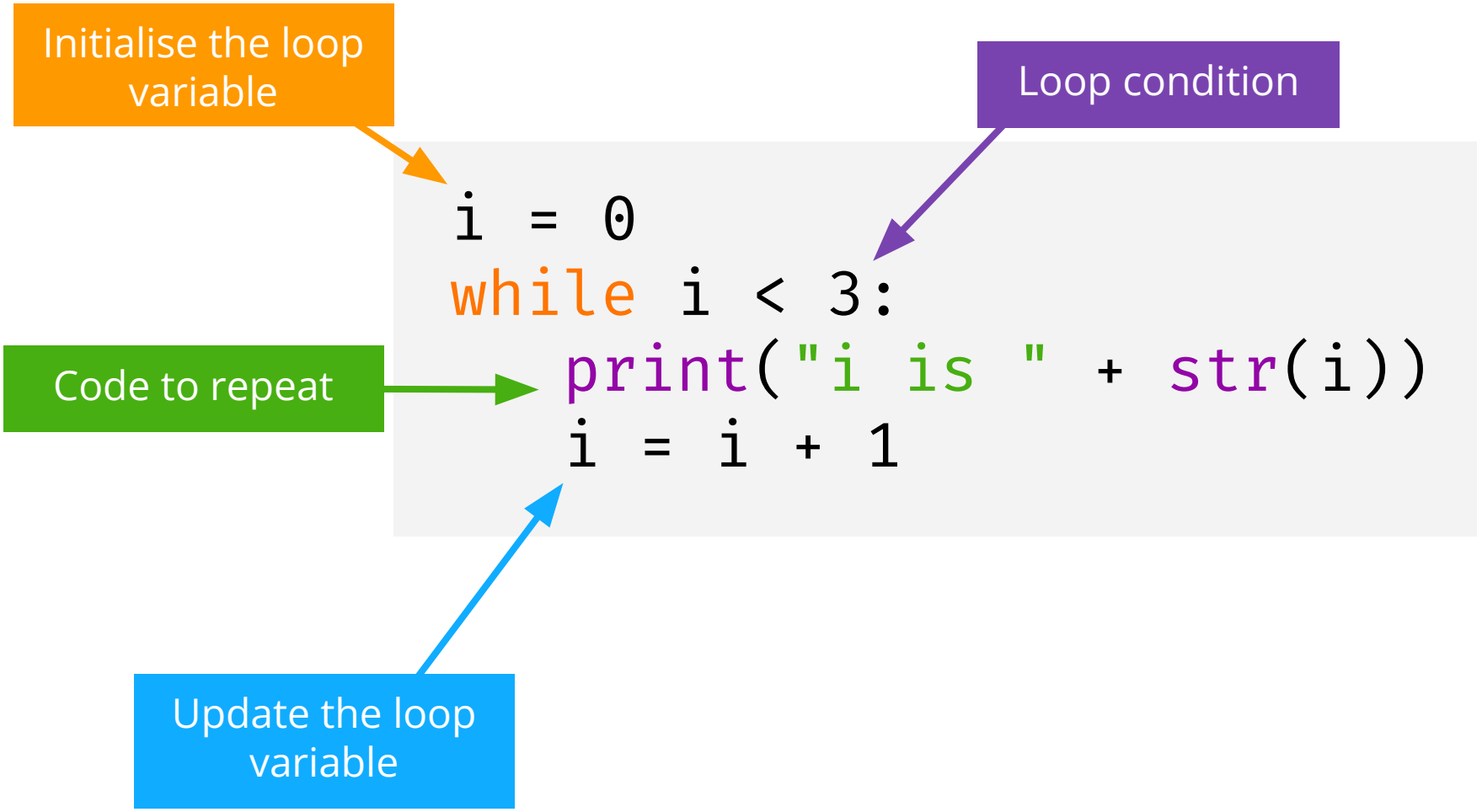
You now know all about `if`!

See `if` you can do the next Part

The tutors will be around to help!

While Loops

Introducing ... `while` loops!



What happens when.....

What happens if we forget to update the loop variable?

```
i = 0
while i < 3:
    print("i is " + str(i))
```

What happens when.....

What happens if we forget to update the loop variable?

```
i = 0
while i < 3:
    print("i is " + str(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
```

Give me a break!

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

That's when we use the break keyword!

```
number = 0
while number != 42 :
    number = input("Guess a number: ")

    if number = "I give up":
        print("The number was 42")
        break

    number = int(number)
```

Continuing on

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

```
number = 0
while number != 42 :
    number = input("Guess a number: ")

    if not number.isnumeric():
        print("That's not a number!")
        print("Try again")
        continue

    number = int(number)
```

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?

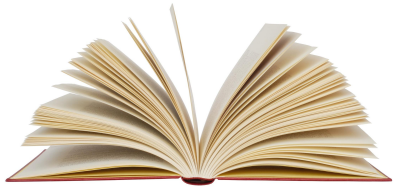
```
words = ['This', 'is', 'a', 'sentence']


print(words[0])
print(words[1])
print(words[2])
print(words[3])
```

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:

```
numbers = [1, 2, 3, 4]
for i in numbers:
    print(i)
```

What's going to happen?

Looping over a list of ints

We can loop through a list:

```
numbers = [1, 2, 3, 4]
for i in numbers:
    print(i)
```

What's going to happen?

```
>>> 1
>>> 2
>>> 3
>>> 4
```

- Each item of the list takes a turn at being the variable i
- 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!

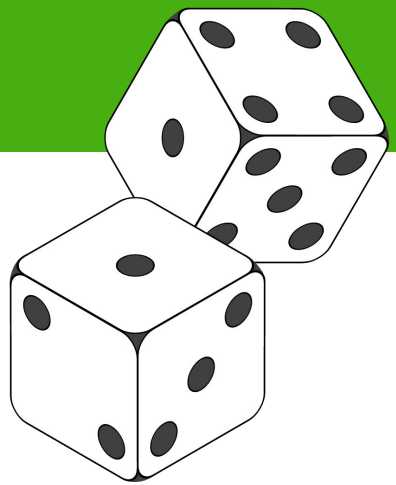
Try to do Part 5

...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!

Try this!

1. Import the random module!

```
>>> import random
```

2. Copy the shopping list into IDLE

```
>>> shopping_list = ["Bread", "Chocolate", "Ice Cream",
    "Pizza"]
```

3. Choose randomly! Try it a few times!

```
>>> random.choice(shopping_list)
```

Using the random module

You can also assign your random choice to a variable

```
>>> import random
>>> shopping_list = ["Bread", "Chocolate", "Ice Cream",
    "Pizza"]
>>> random_food = random.choice(shopping_list)
>>> print(random_food)
```

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!

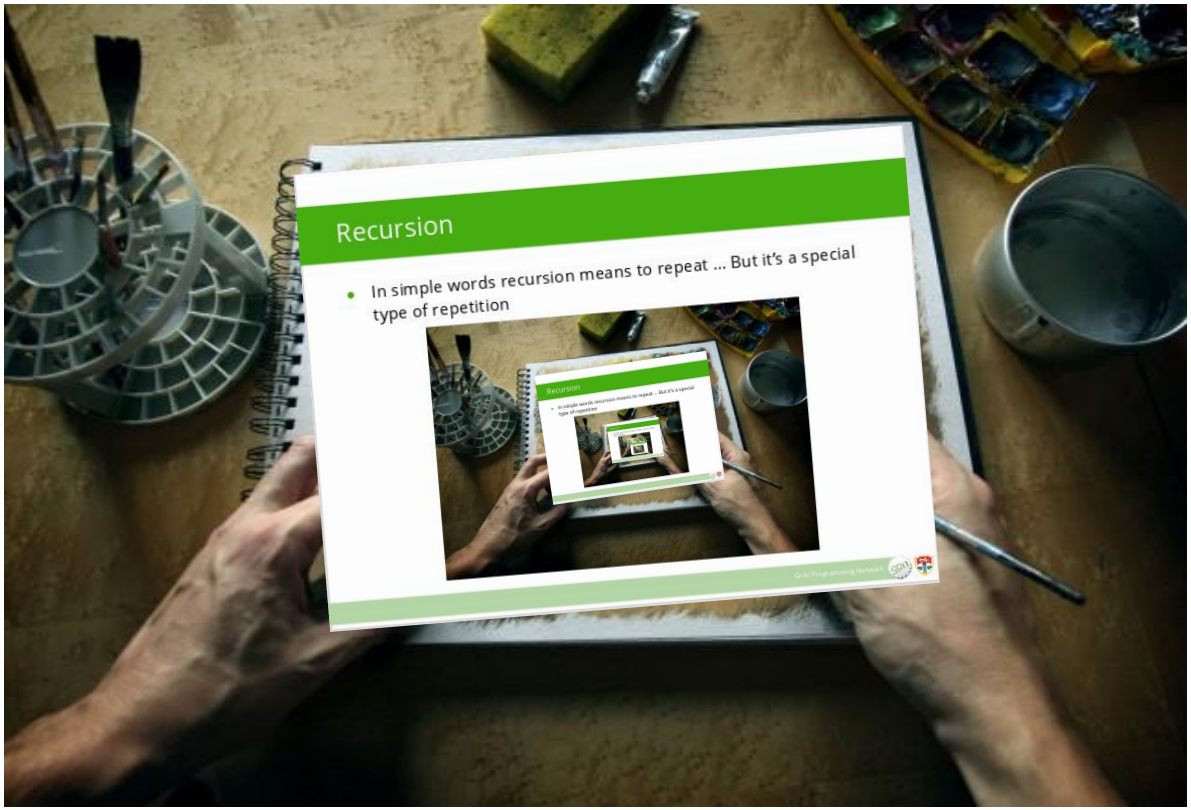
Recursion

Outline

1. What is recursion
2. Recursive function

Recursion

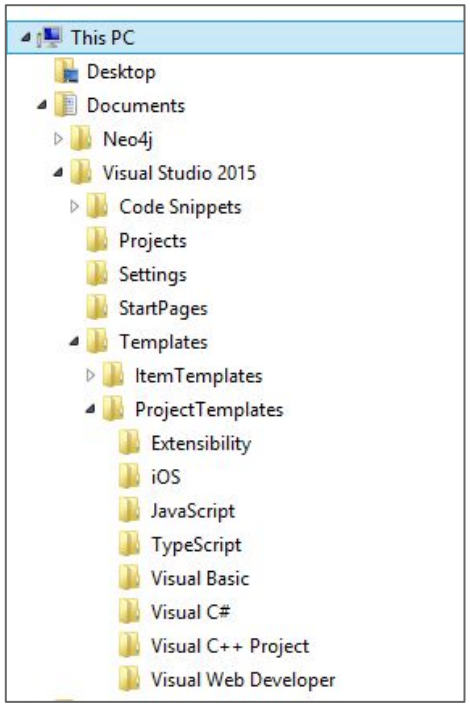
- In simple words recursion means to repeat … But it’s a special type of repetition



Examples

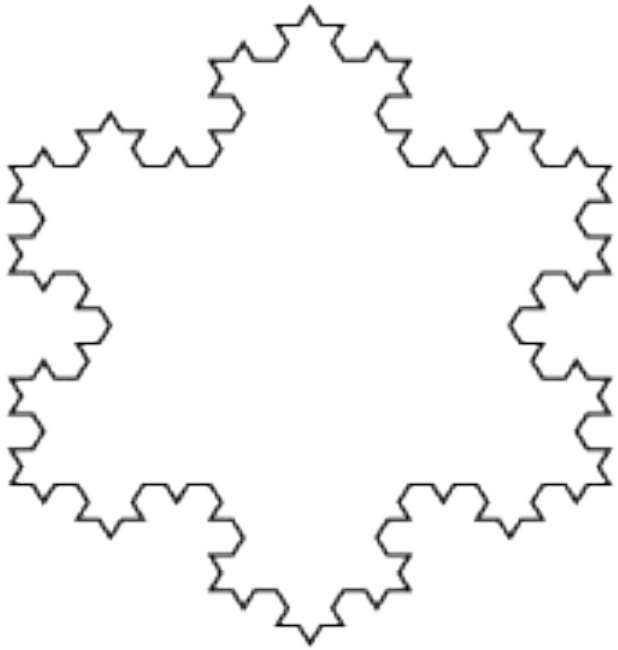
Recursion means “defining something in terms of itself” usually at some smaller scale, perhaps multiple times, to achieve your objective.

“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

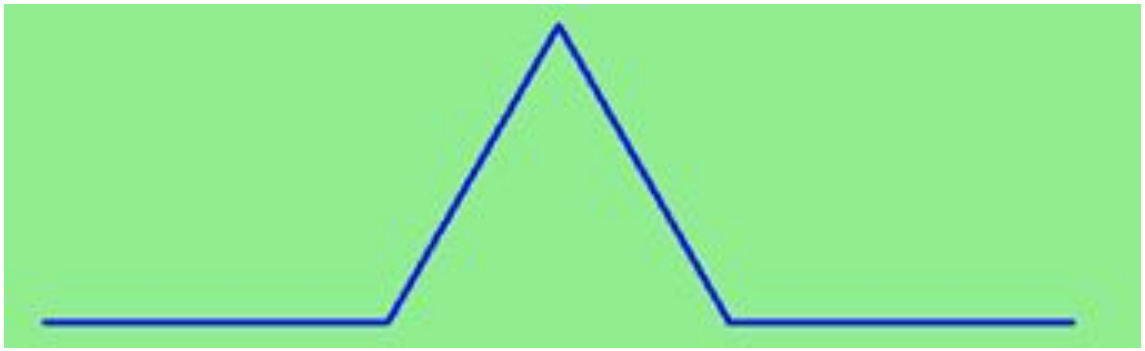
1

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

Drawing a snowflake

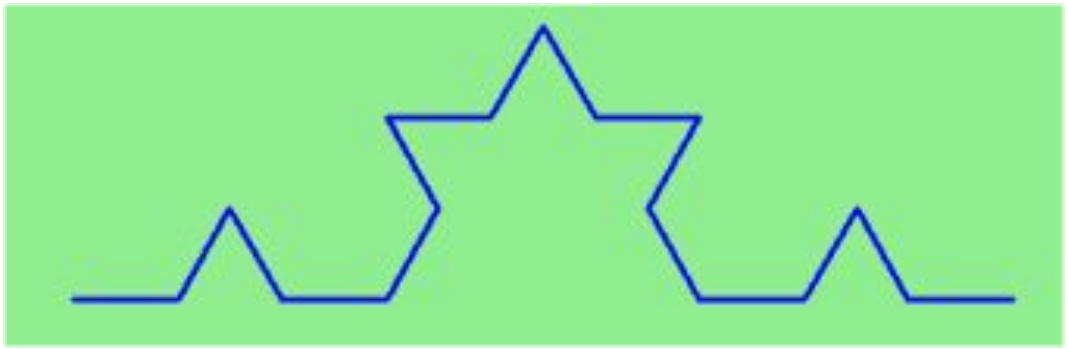
2

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



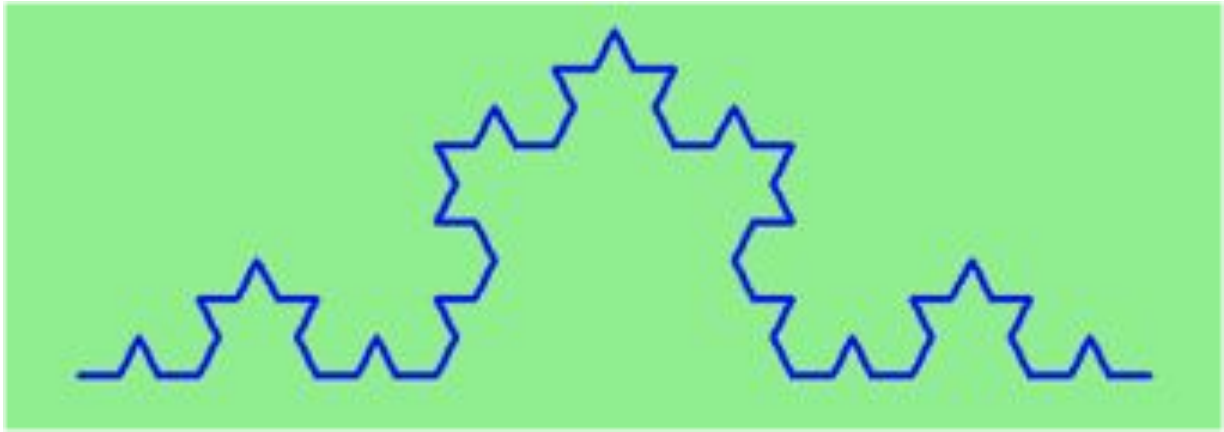
Drawing a snowflake

- 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

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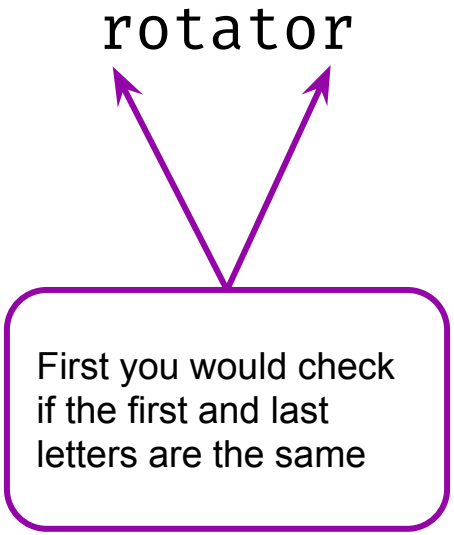

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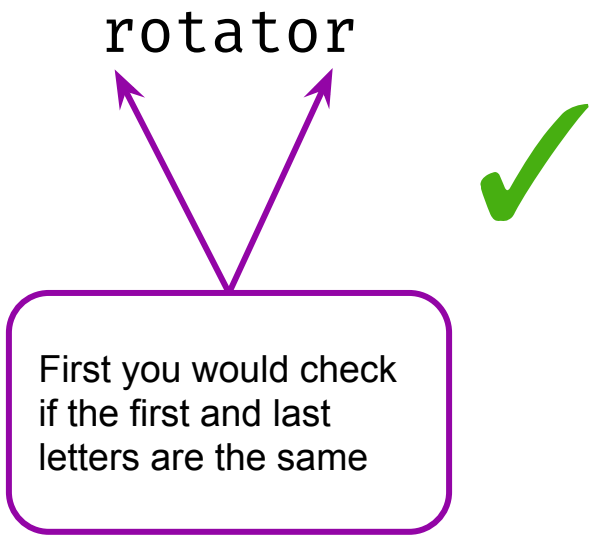

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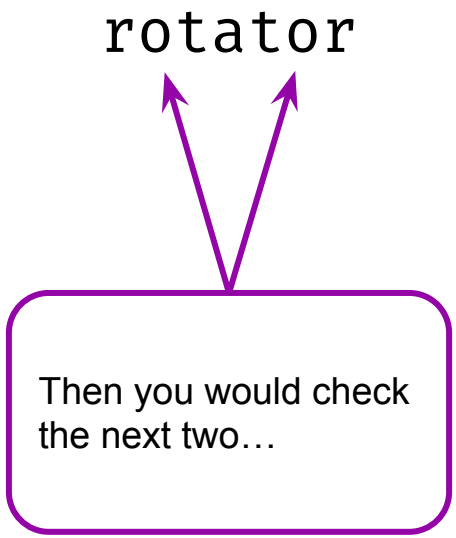

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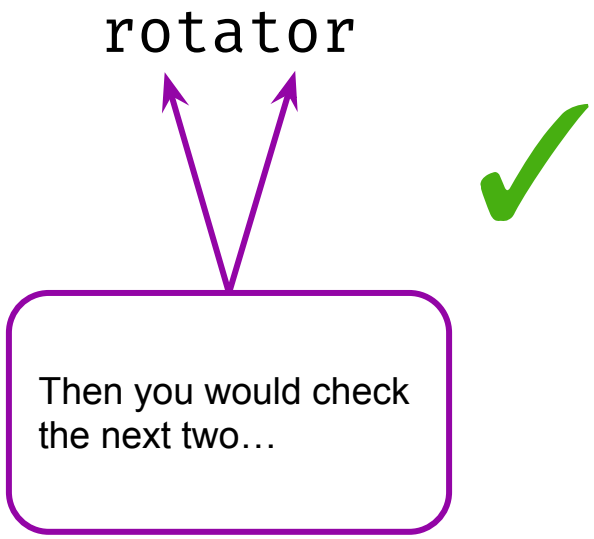

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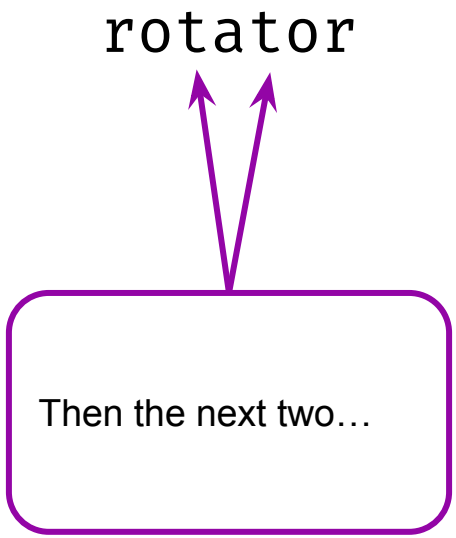

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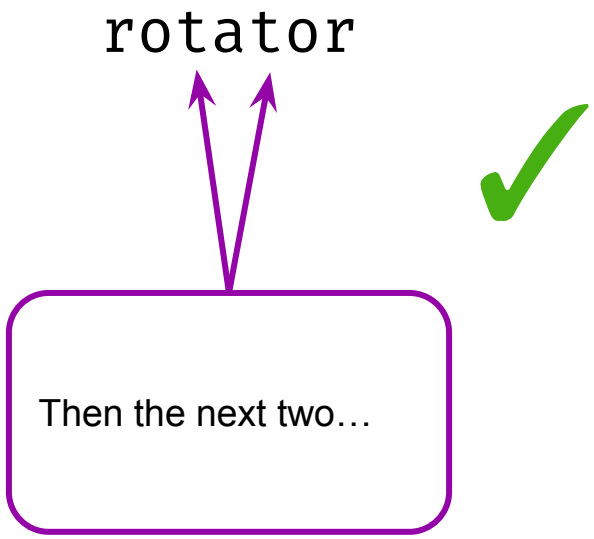

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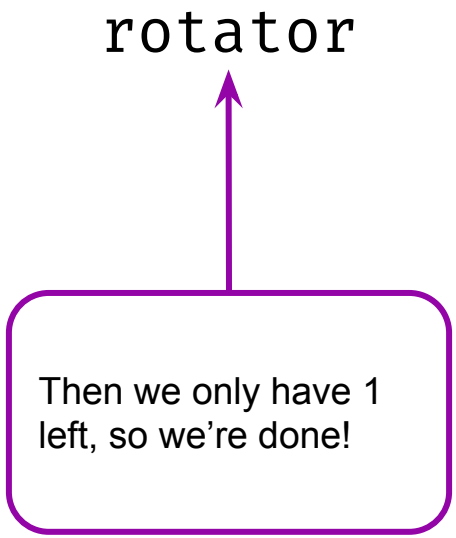

Code example

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.

```
def is_a_palindrome(word):
    if len(word) < 2:
        return True
```

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 “a” is a palindrome (and this function knows it!)

```
def is_a_palindrome(word):
    if len(word) < 2:
        return True
```

Next we need to think about the next size up for our problem.
E.g. the word “wow”

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)

```
def is_a_palindrome(word):
    if len(word) < 2:
        return True
    if word[0] == word[-1]:
        ???
```

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)

```
def is_a_palindrome(word):
    if len(word) < 2:
        return True
    if word[0] == word[-1]:
        return is_a_palindrome(word[1:-1])
    else:
        return False
```

We recursively call our function, making the word smaller and smaller until we reach the base case.

Let's look at it in more detail!

Code example

```
def is_a_palindrome(word):
    if len(word) < 2:
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Code example

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```

False

```
word = "rotator"
```

Code example

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```

```
word = "rotator"
```

Equal?
True!

Code example

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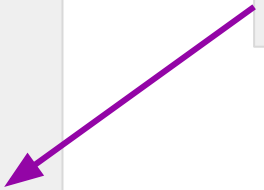

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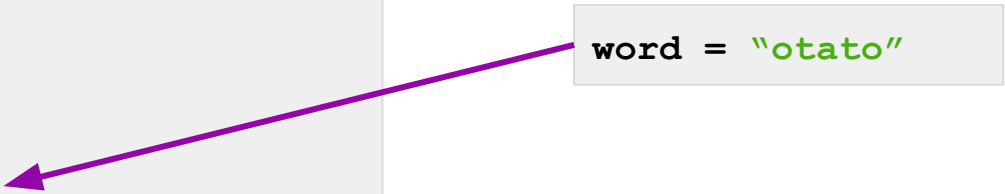

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word = "otato"
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Equal?
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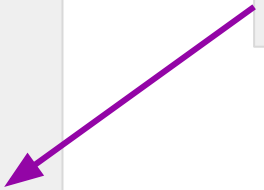

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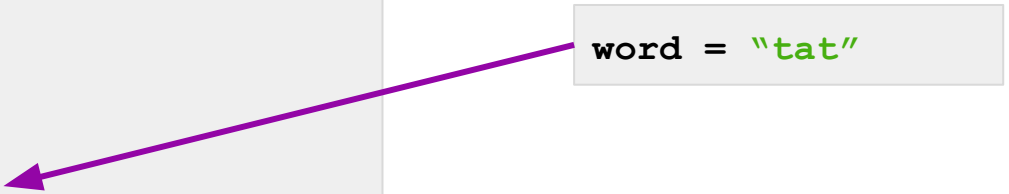

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Equal?
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Code example

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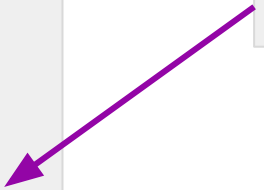
```
word = "tat"
```



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word = "rotator"
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Code example

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    else:
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```

```
word = "rotator"
```

True

"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.

```
def is_palindrome(word) :
    if len(word) < 2:
        return True
    if word[0] == word[-1]:
            return is_palindrome(word[1:-1])
```

Base Case

Recursive Case

Project Time!

Let’s get on to the next thing

Try to do the next Part!

The tutors will be around to help!