

Intro to Programming



What is programming?



**Programming is not a
bunch of crazy numbers!**

**It's giving computers
a set of instructions!**



A Special Language

A language to talk
to dogs!



Programming is a
language to talk to
computers

People are smart! Computers are dumb!

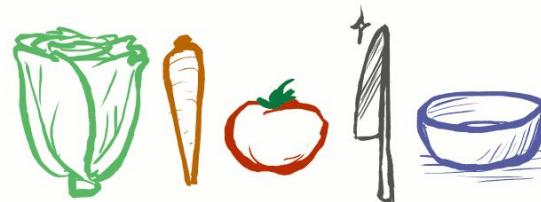
Programming is like a recipe!

Computers do EXACTLY what you say, every time.

Which is great if you give them a good recipe!

SALAD INSTRUCTIONS

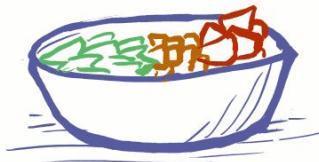
1) GET A LETTUCE HEAD, A CARROT, A TOMATO, A KNIFE, AND A BOWL



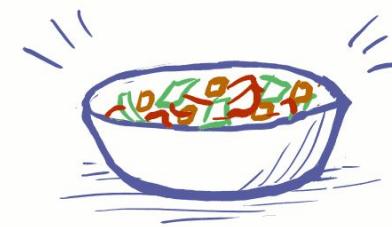
2) USE THE KNIFE TO CUT UP THE LETTUCE HEAD, CARROT, AND TOMATO



3) PUT THE LETTUCE, CARROT AND TOMATO IN THE BOWL



4) MIX THE CONTENTS OF THE BOWL



People are smart! Computers are dumb!

But if you get it out of order....

A computer wouldn't know this recipe was wrong!

SALAD INSTRUCTIONS

1) GET A LETTUCE HEAD, A CARROT, A TOMATO, A KNIFE, AND A BOWL



3) PUT THE LETTUCE, CARROT AND TOMATO IN THE BOWL



2) USE THE KNIFE TO CUT UP THE LETTUCE HEAD, CARROT, AND TOMATO



4) MIX THE CONTENTS OF THE BOWL



People are smart! Computers are dumb!

Computers are bad at filling in the gaps!

A computer wouldn't know something was missing, it would just freak out!

SALAD INSTRUCTIONS

2) USE THE KNIFE TO CUT UP THE LETTUCE HEAD, CARROT, AND TOMATO



But I don't have a knife, lettuce head, carrot, or tomato.

3) PUT THE CHOPPED LETTUCE, CARROT AND TOMATO IN THE BOWL



I don't have a bowl, either!

4) MIX THE CONTENTS OF THE BOWL



Still don't have a bowl...

Everyone/thing has strengths!



- Understand instructions despite:
 - Spelling mistakes
 - Typos
 - Confusing parts
- Solve problems
- Tell computers what to do
- Get smarter every day

- Does exactly what you tell it
- Does it the same every time
- Doesn't need to sleep
- Will work for hours on end
- Doesn't get bored
- Really really fast
- Get smarter when you tell it how

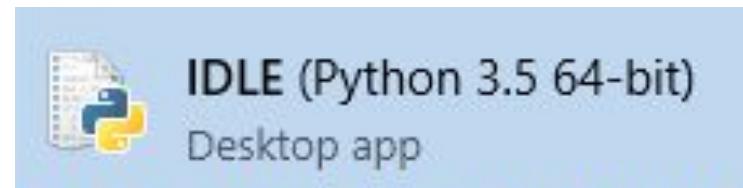
Intro to Python

Let's get coding!



Where do we program? In IDLE

Click the start button and type IDLE!



Make sure the first number after “Python” is 3!

A screenshot of the Python 3.5.1 Shell window. The window title is "Python 3.5.1 Shell". The menu bar includes File, Edit, Shell, Debug, Options, Window, and Help. The main window displays the Python version information: "Python 3.5.1 (v3.5.1:37a07cee5969, Dec 6 2015, 01:54:25) [MSC v.1900 64 bit (AMD64)] on win32". Below this, it says "Type 'copyright', 'credits' or 'license()' for more information." A command prompt line "=>>> |" is visible at the bottom. In the bottom right corner, there is a status bar with "Ln: 3 Col: 4".

Make a mistake!

Type by **button mashing** the keyboard!

Then press enter!

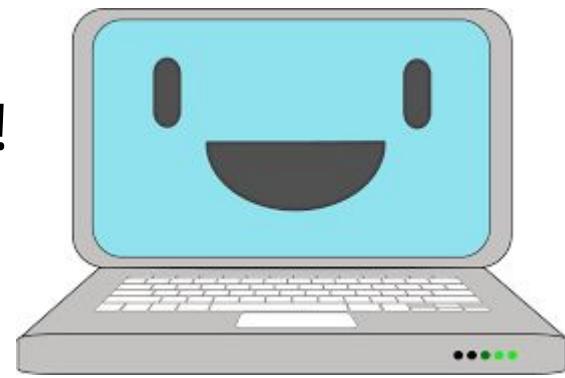
asdf asdjlkj;pa j;k4uroei

Did you get a big red error message?

Mistakes are great!

Good work you made an error!

- Programmers make A LOT of errors!
- Errors give us hints to find mistakes
- Run your code often to get the hints!!
- Mistakes won't break computers!



AttributeError:
`'NoneType' object
has no attribute
'foo'`

**TypeError: Can't
convert 'int' object
to str implicitly**

**KeyError:
'Hairy Potter,'**

**SyntaxError:
Invalid Syntax**

**ImportError:
No module
named humour**

We can learn from our mistakes!

Error messages help us fix our mistakes!

We read error messages from bottom to top

3. Where that code is

Traceback (most recent call last):

File "C:/Users/Madeleine/Desktop/tmp.py", line 9, in <module>
 print("I have " + 5 + " apples")

TypeError: can only concatenate str (not "int") to str

1. What went wrong

2. What code didn't work

Write some code!!

Type this into the window
Then press enter!

```
print('hello world')
```

Did it print:
hello world
???



Tell me more!

We can `print` things in lots of different ways in python!

```
>>> print("Hello world!")
```

```
>>> print("Hello", "world!")
```

```
>>> print("Hello", "world", end=" ! ")
```



Tell me more!

We can `print` things in lots of different ways in python!

```
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Hello world!
```

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Tell me more!

We can `print` things in lots of different ways in python!

```
>>> print("Hello world!")
```

Hello world!

```
>>> print("Hello", "world!")
```

Hello world!

```
>>> print("Hello", "world", end="!")
```

Hello world!

Note that this last one will not have a new line after it!

Tell me more!

We can `print` on many lines at once!

```
>>> print("""Hello world.
```

This is me!

```
Life should be fun for everyone""")
```



Tell me more!

We can `print` on many lines at once!

```
>>> print("""Hello world.
```

This is me!

```
Life should be fun for everyone""")
```

Hello world.

This is me!

```
Life should be fun for everyone
```



Python the calculator!

Try writing some maths into python!

```
>>> 1 + 5
```

```
>>> 2 - 7
```

```
>>> 2 * 8
```

```
>>> 12/3
```



Python the calculator!

Try writing some maths into python!

```
>>> 1 + 5
```

```
6
```

```
>>> 2 - 7
```

```
>>> 2 * 8
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```
>>> 12/3
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```
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```
>>> 1 + 5
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```
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```
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```

```
16
```

```
>>> 12/3
```



Python the calculator!

Try writing some maths into python!

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>>> 1 + 5
```

```
6
```

```
>>> 2 - 7
```

```
-5
```

```
>>> 2 * 8
```

```
16
```

```
>>> 12/3
```

```
4
```



A calculator for words!

What do you think these bits of code do?
Try them and see!

```
>>> "cat" + "dog"
```

```
>>> "tortoise" * 3
```



A calculator for words!

What do you think these bits of code do?
Try them and see!

```
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catdog

```
>>> "tortoise" * 3
```



A calculator for words!

What do you think these bits of code do?

Try them and see!

```
>>> "cat" + "dog"
```

catdog

```
>>> "tortoise" * 3
```

tortoisetortoisetortoise



Strings!

Str*ings* are things with "qu*otes*"

To python they are essentially just a bunch of pictures!

Adding :



Multiplying (3 lots of tortoise!):



Strings!

Str*in*gs can have any letters in them, even just spaces!

"Hello, world!"

"bla bla bla"

" :)"

" "

' I can use single quotes too! '

"^-__(ツ)_/^-"

"asdfghjklqwertyuiopzxcvbnm"

"DOGS ARE AWESOME!"

" !@#\$%^&*()_+-=[]|\\:; ' <>, ./? "

Strings and Ints!

Integers are numbers in python.

We can do maths with integers but not strings

```
>>> 5 + "5"
```

We can turn a string into an integer using int()

```
>>> 5 + int("5")
```

Similarly, we turn an integer into a string using str()

```
>>> str(5) + "5"
```



Strings and Ints!

Integers are numbers in python.

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

```
10
```

Similarly, we turn an integer into a string using str()

```
>>> str(5) + "5"
```

```
'55'
```

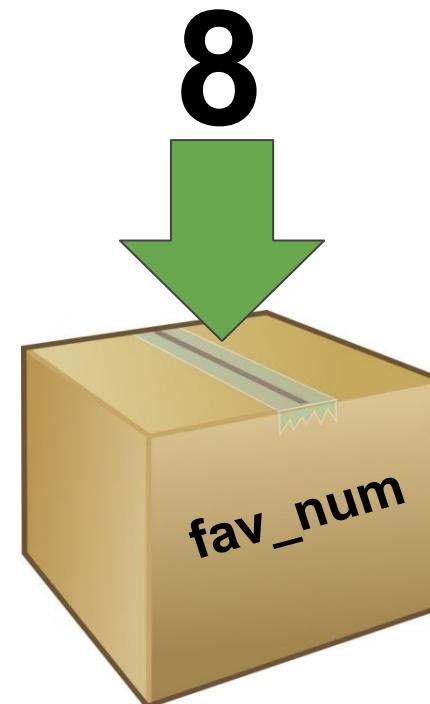


No Storing is Boring!

It's useful to be able to remember things for later!
Computers remember things in "**variables**"

Variables are like putting things
into a **labeled cardboard box**.

**Let's make our favourite
number 8 today!**



Variables

Instead of writing the number 8, we can write fav_num.



$$\begin{aligned} \text{fav_num} - 6 \\ => 2 \end{aligned}$$

$$\begin{aligned} \text{fav_num} + 21 \\ => 29 \end{aligned}$$

$$\begin{aligned} \text{fav_num} * 2 \\ => 16 \end{aligned}$$

$$\begin{aligned} \text{fav_num} / 2 \\ => 4 \end{aligned}$$

Variables

Instead of writing the number 8, we can write fav_num.



$$\text{fav_num} - 6 \\ \Rightarrow 2$$

$$\text{fav_num} + 21 \\ \Rightarrow 29$$

$$\text{fav_num} * 2 \\ \Rightarrow 16$$

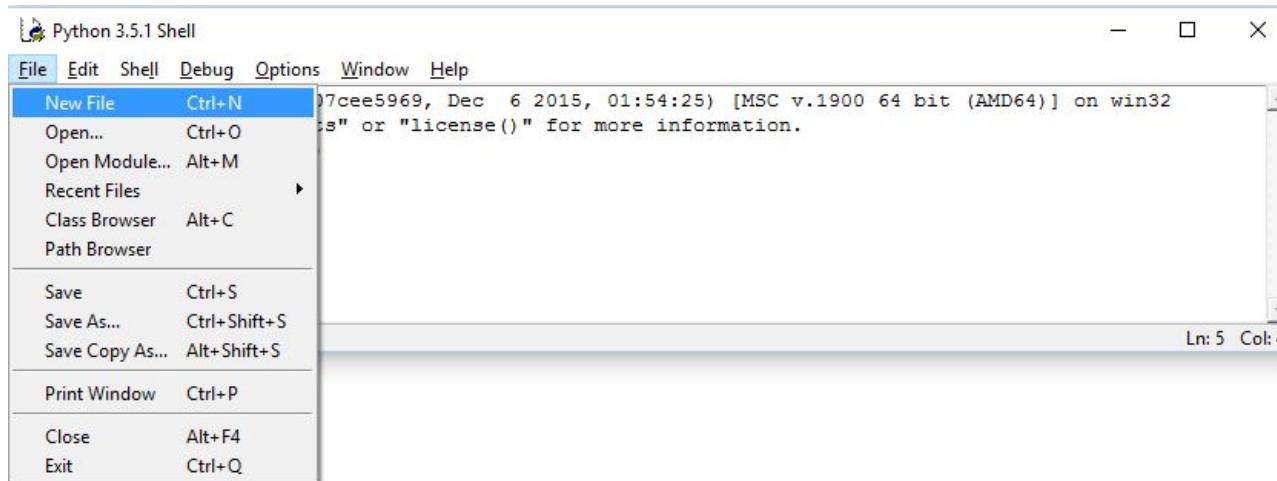
We'll come back to this later!

But writing 8 is
much shorter than
writing fav_num???



Coding in a file!

Code in a file is code we can run multiple times! Make a reusable “hello world”!



1. Make a new file called `hello.py`, like the picture
2. Put your `print('hello world')` code in it
3. Run your file using the F5 key

Adding a comment!

Sometimes we want to write things in our file that the computer doesn't look at. We can use **comments** for that!

Sometimes we want to write a note for a people to read

```
# This code was written by Vivian
```

And sometimes we want to not run some code (but don't want to delete it!)

```
# print("Goodbye world!")
```

Try it!

1. Add a comment to your hello.py file
2. Run your code to make sure it doesn't do anything extra!

Project time!

You now know all about printing and variables!

Let's put what we learnt into our project

Try to do the next Part!

The tutors will be around to help!

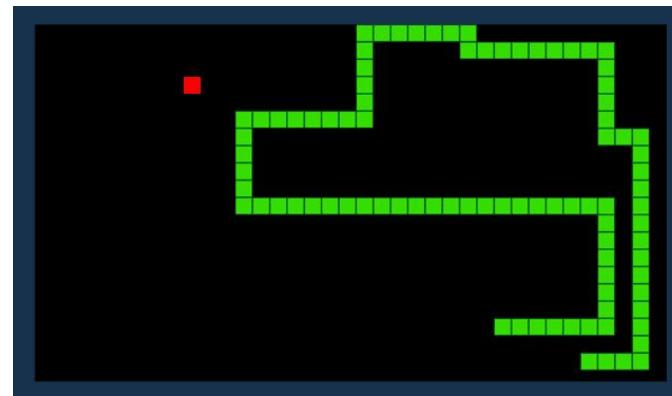
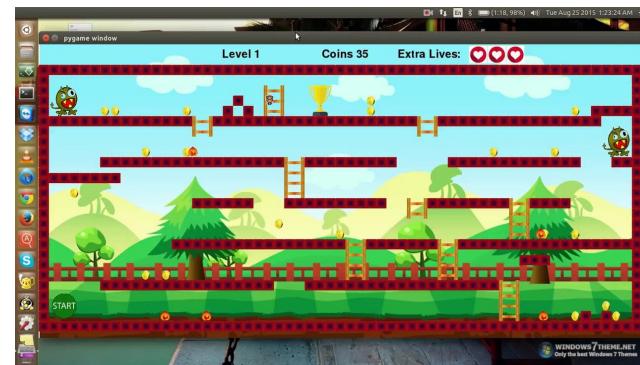


Intro to Pygame



What is Pygame?

Pygame is a tool we can use to make cool games using Python like these:



How do we use it?

First we need to tell Python that we want to use Pygame,
and tell it to start the game

```
from pygame import *
```

```
init()
```

This line tells
Python that we
want to use pygame

This line starts
Pygame

Make a scene!

We can make a screen to show our game

```
screen = display.set_mode(500, 400)
```



This line makes a screen
that is 500 pixels wide and
400 pixels high



Make a scene!

Once we have a screen we can put images on it!

```
cat_image = image.load("cat.png")  
screen.blit(cat_image, (30, 40))  
  
display.update()
```

This line loads an image into our game so we can use it

Make a scene!

Once we have a screen we can put images on it!

```
cat_image = image.load("cat.png")  
screen.blit(cat_image, (30, 40))  
display.update()
```

This line puts the image on the screen at the coordinates 30, 40

This line loads an image into our game so we can use it

Make a scene!

Once we have a screen we can put images on it!

```
cat_image = image.load("cat.png")  
  
screen.blit(cat_image, (30, 40))  
  
display.update()
```

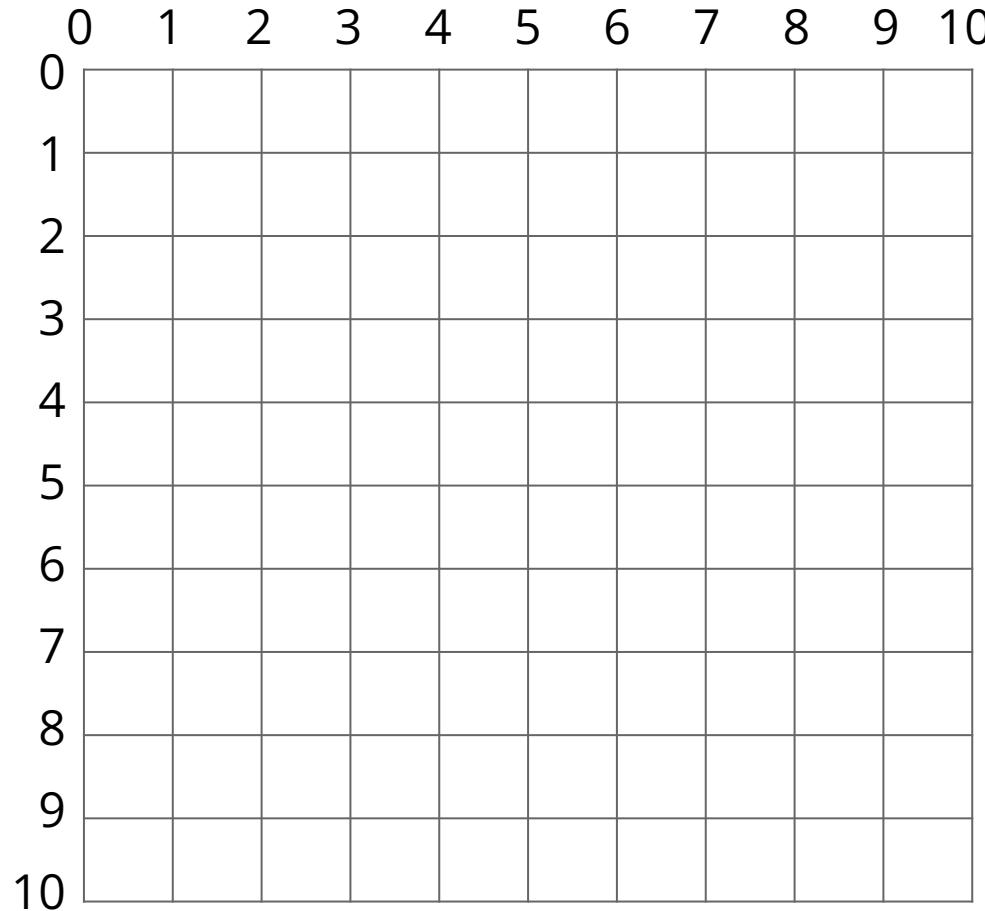
This line tells Pygame to update our display, which will show our new image

This line puts the image on the screen at the coordinates 30, 40

This line loads an image into our game so we can use it

Pygame Coordinates

Coordinates
in Pygame
are a little
strange...



Because they
start at the top
left instead of
the bottom left

Pygame Coordinates

When you have an image in pygame like this:



Pygame Coordinates

When you have an image in pygame like this:



Pygame thinks of it like a rectangle like this:



Pygame Coordinates

When you have an image in pygame like this:



Pygame thinks of it like a rectangle like this:

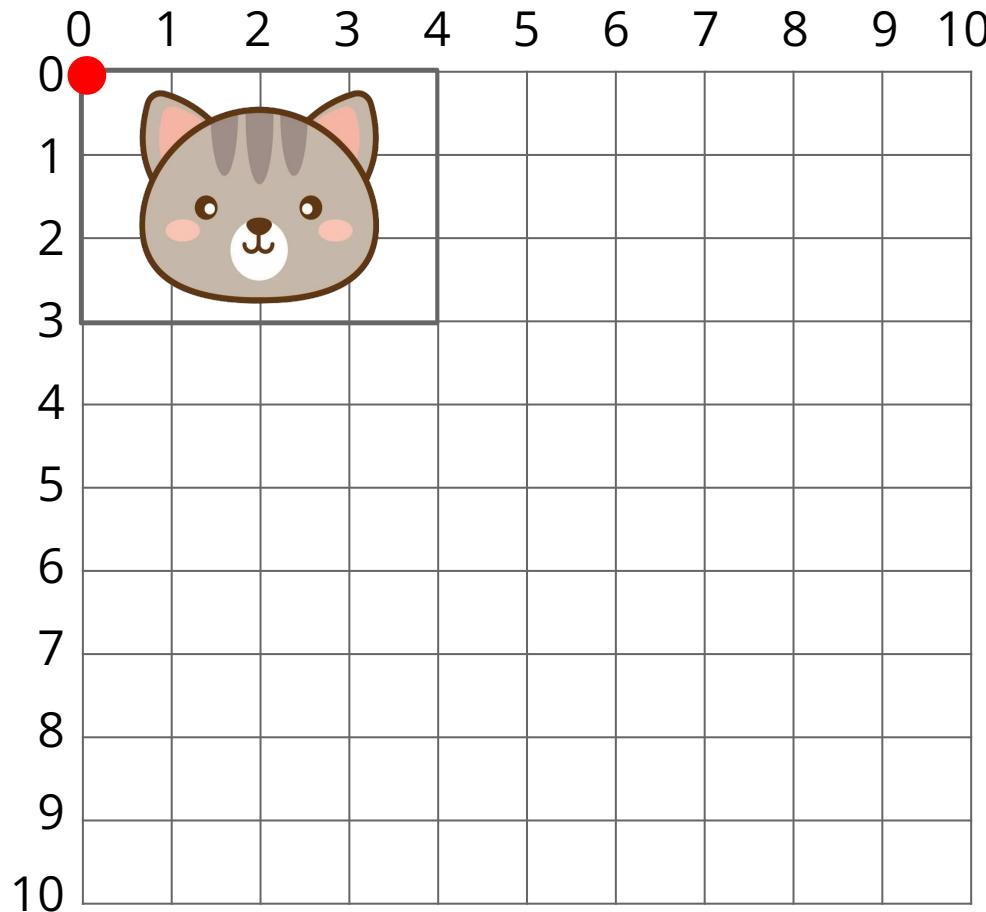


And the coordinates for the image are the top left corner like this:



Pygame Coordinates

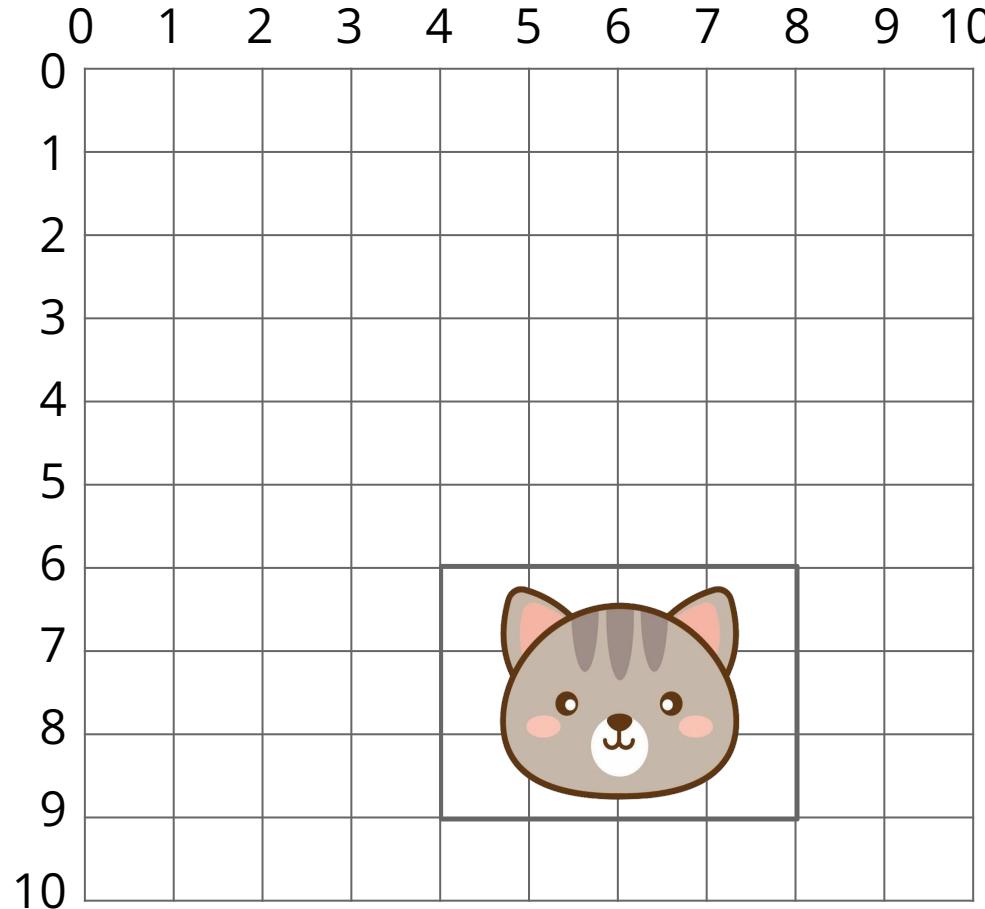
So to if we wanted our cat image to be on the top left we would use the coordinates (0, 0)



That means that the top left corner of the image will be in the top left corner of the screen

Pygame Coordinates

What are the coordinates of our image now?

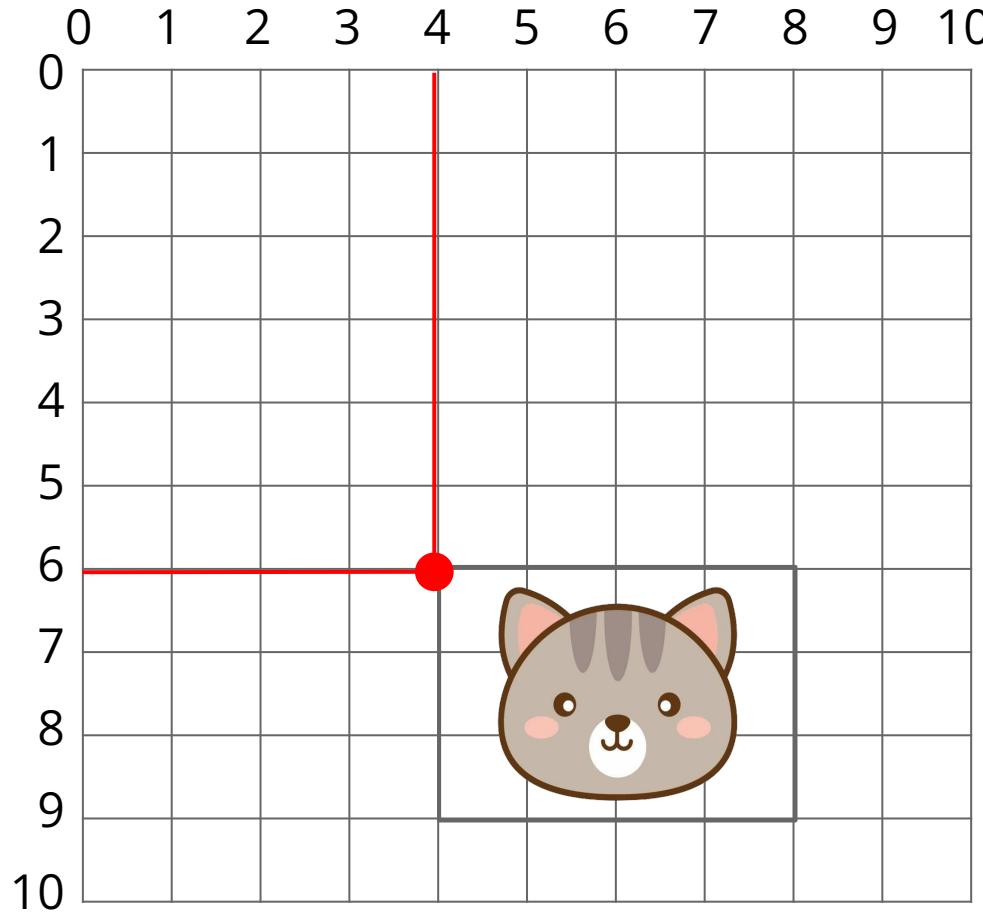


Remember that when we write coordinates we say the x (horizontal) number first and the y (vertical) number second

Pygame Coordinates

What are the coordinates of our image now?

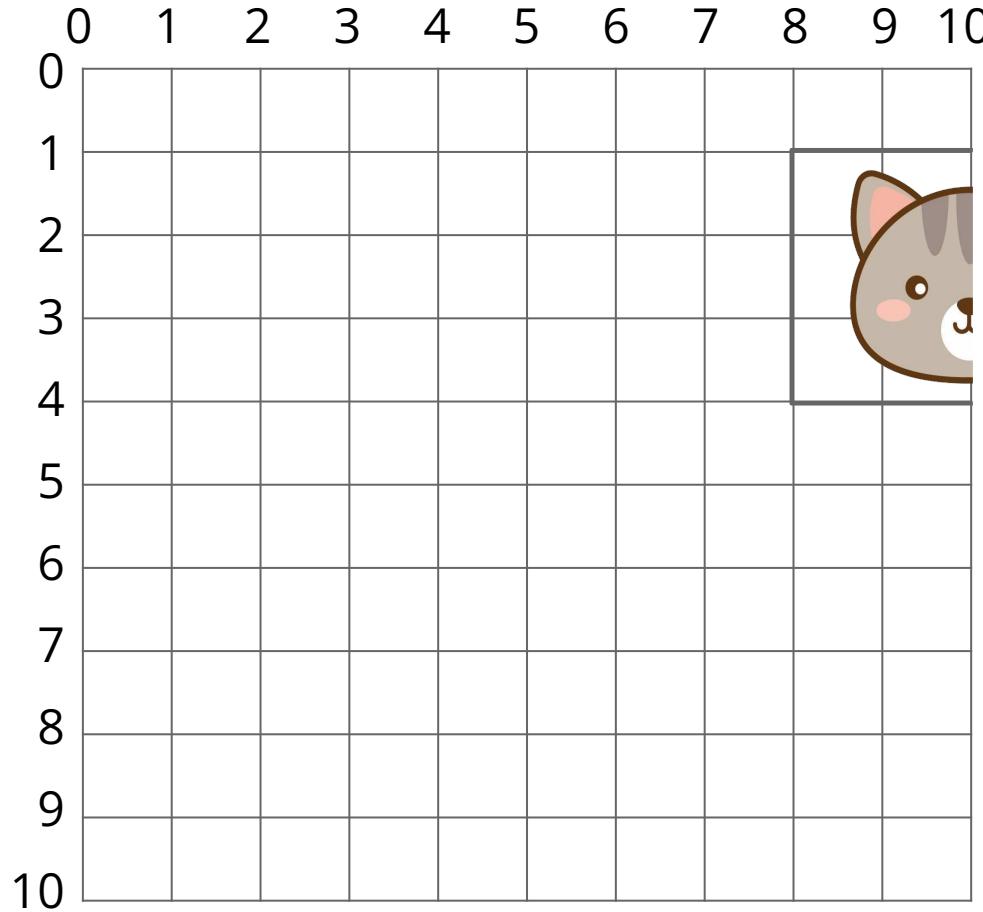
They are:
 $(4, 6)$



Remember that when we write coordinates we say the x (horizontal) number first and the y (vertical) number second

Pygame Coordinates

What are the coordinates of our image now?

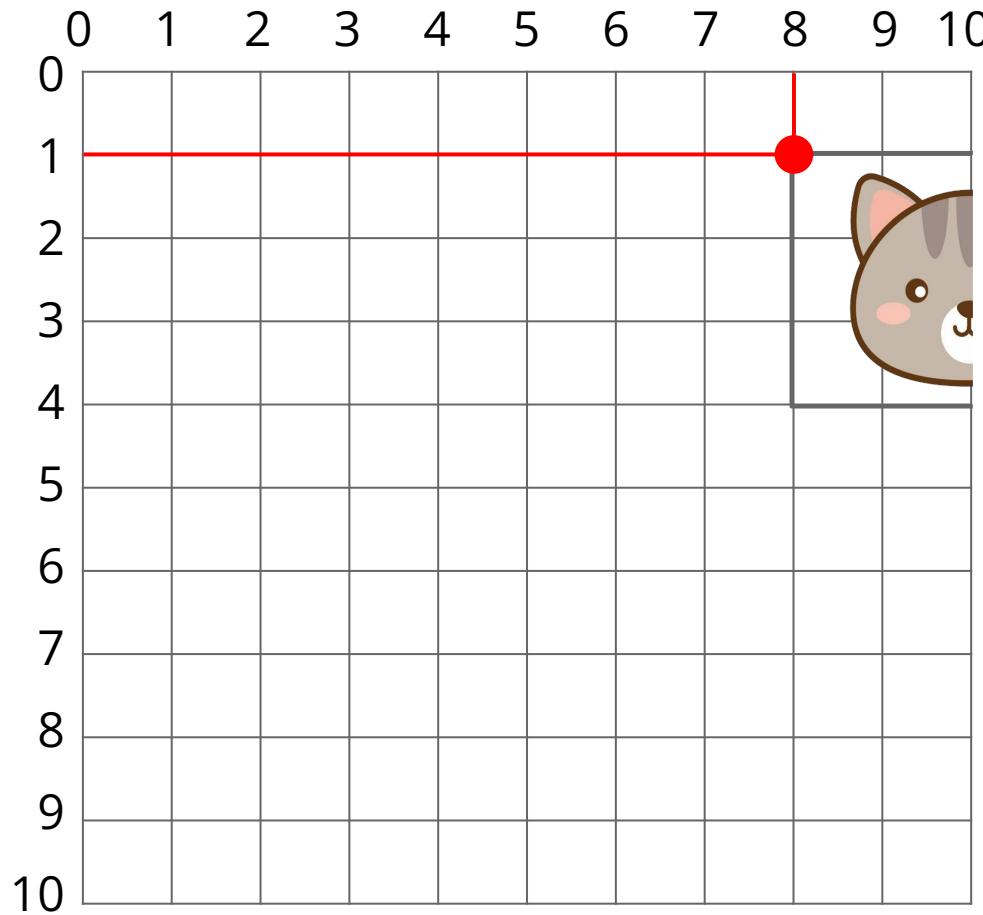


Sometimes we can put the image off the screen by giving coordinates that are far to the bottom or the right

Pygame Coordinates

What are the coordinates of our image now?

They are:
 $(8, 1)$



Sometimes we can put the image off the screen by giving coordinates that are far to the bottom or the right

Project time!

Now that you've **updated** your knowledge...

Try to do the next Part!

The tutors will be around to help!



Pygame Events!



Pygame Events

Pygame can do more than just show images on a screen!

We can use it to figure out if the mouse moved or if a keyboard button was pressed!

These actions are called “events”! Let’s learn how to use them



How do we use it?

First we need to ask Pygame to tell us what has happened recently

```
while True:  
    new_event = event.poll()
```



This line checks to see if there is a new event and saves it in a variable called new_event

How do we use it?

First we need to ask Pygame to tell us what has happened recently

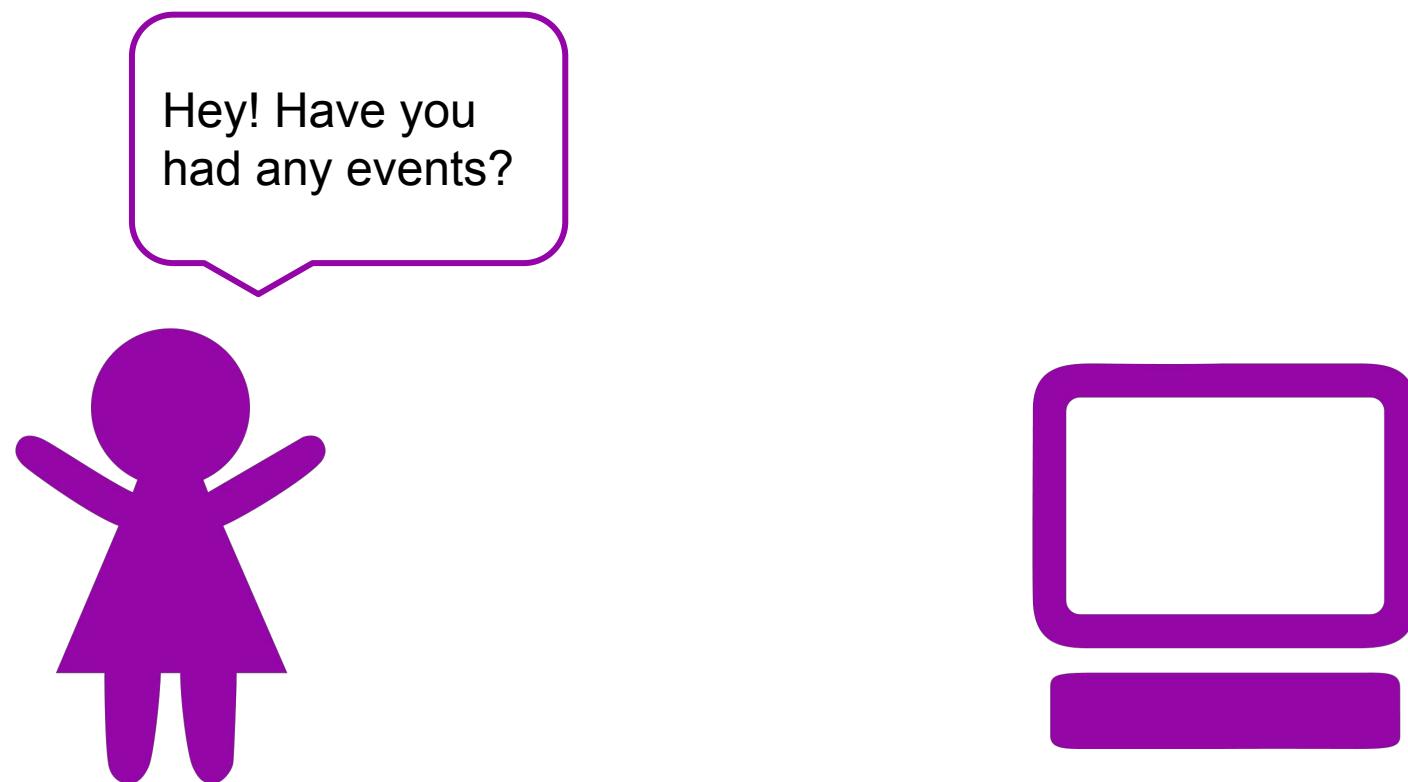
```
while True:  
    new_event = event.poll()
```

But what does this line do??

This line checks to see if there is a new event and saves it in a variable called new_event

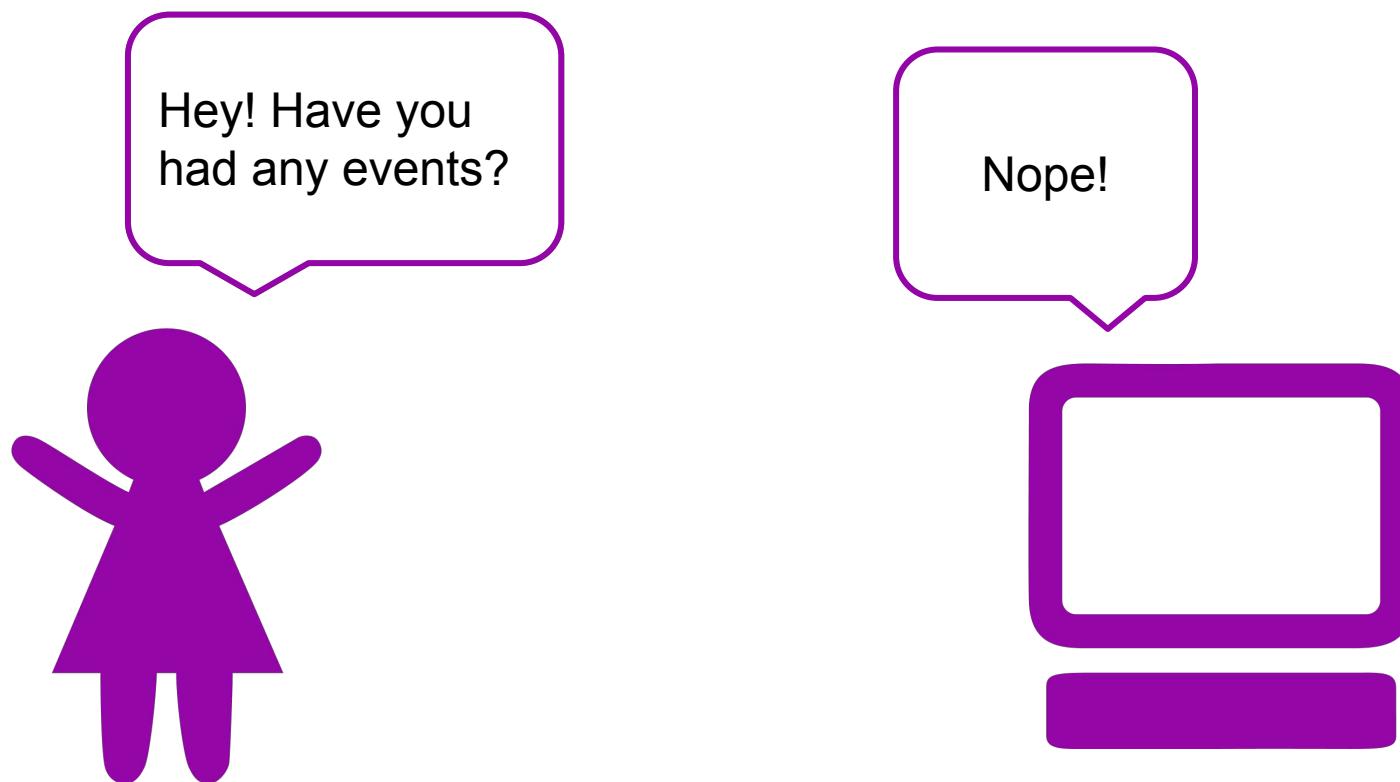
Looking for Events

Let's think of how Pygame checks for events like this:



Looking for Events

Let's think of how Pygame checks for events like this:



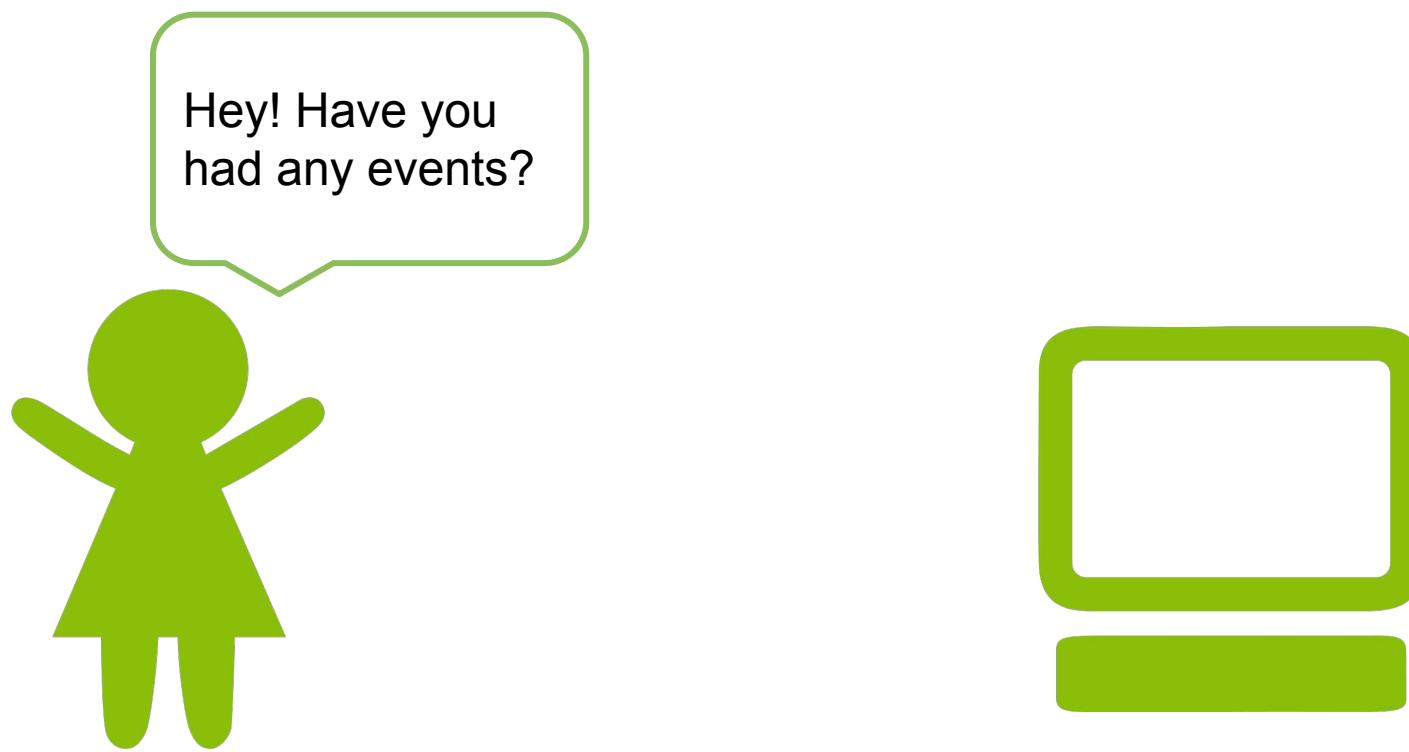
Looking for Events

If we only ask once then we won't know if an event happens later



Looking for Events

We need to keep asking over and over again!



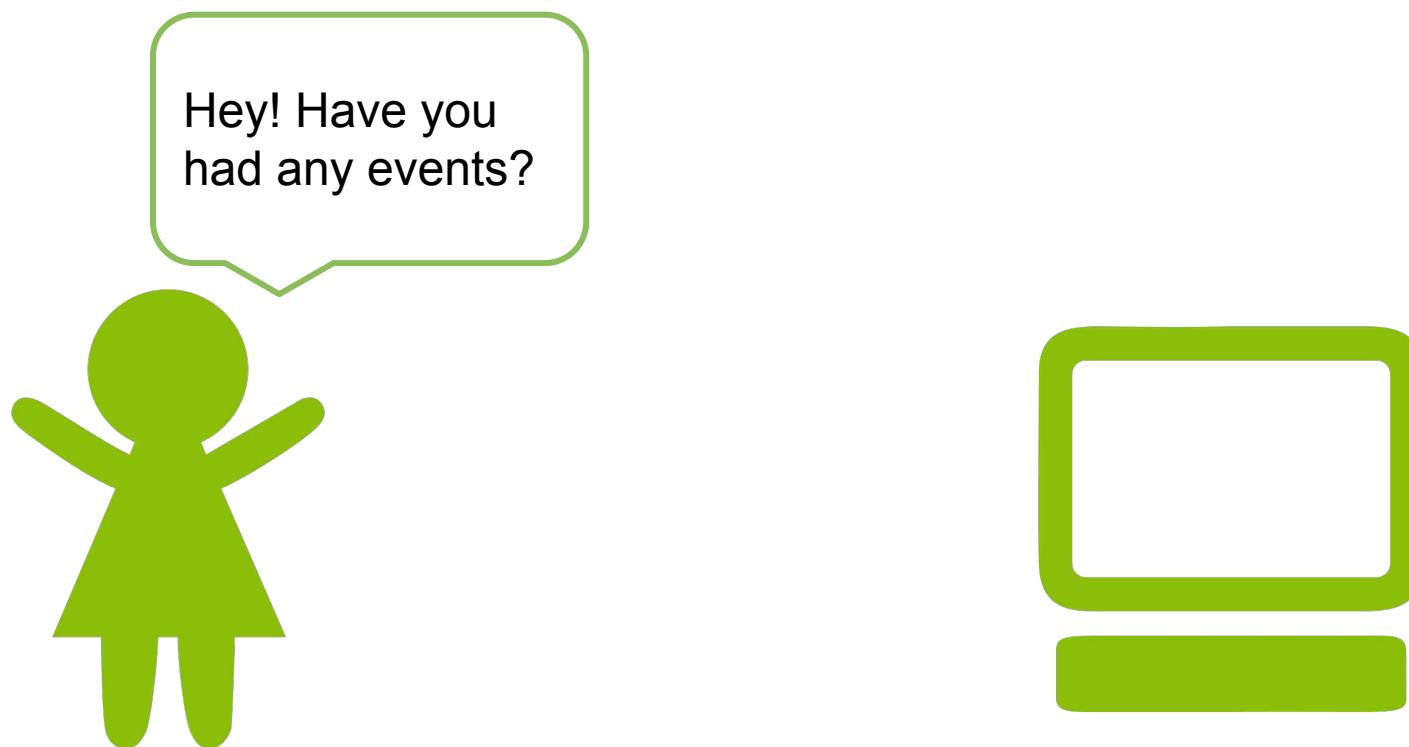
Looking for Events

We need to keep asking over and over again!



Looking for Events

We need to keep asking over and over again!



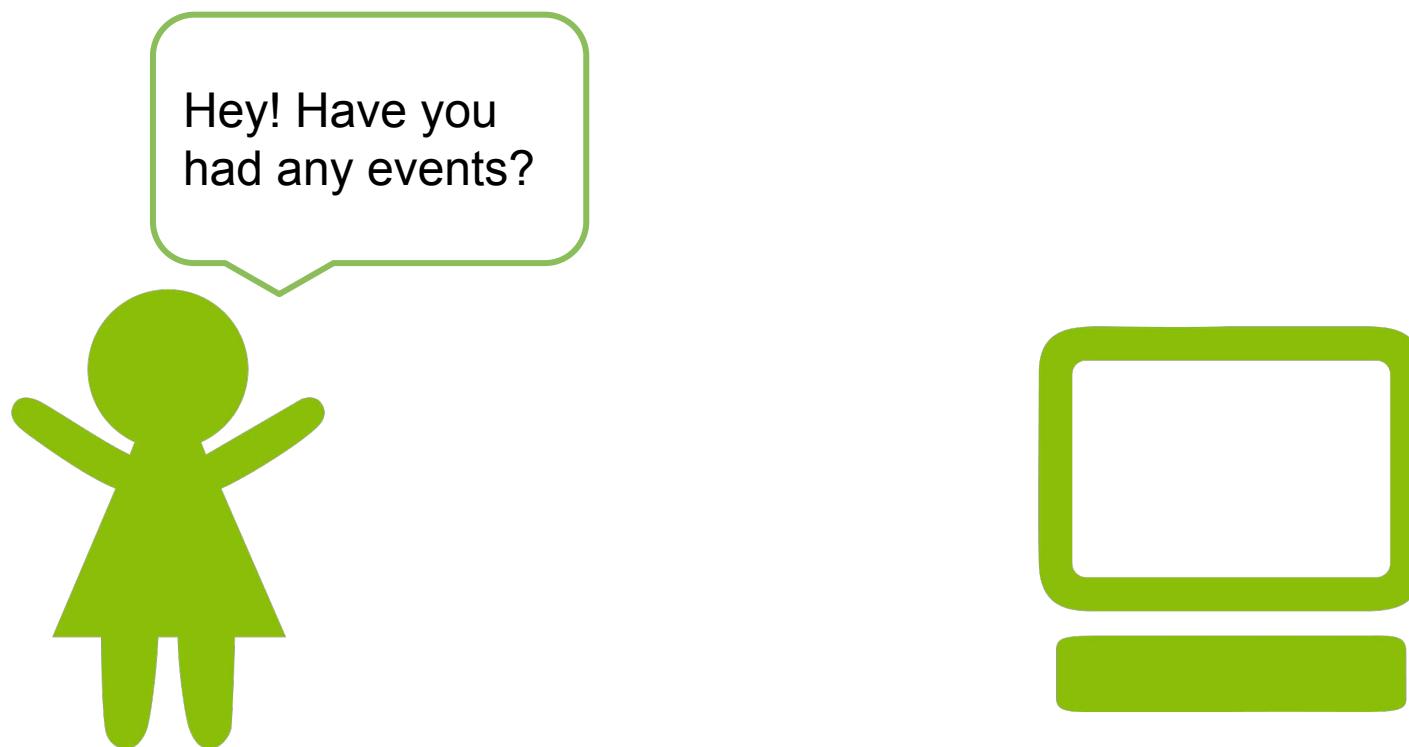
Looking for Events

We need to keep asking over and over again!



Looking for Events

We need to keep asking over and over again!



Looking for Events

We need to keep asking over and over again!



Yes!
Someone
clicked the
mouse!



Loops

We can do something over and over again in our code using Loops! Like this:

```
while True:  
    print("Hello")
```

What do you think this code does?



Loops

We can do something over and over again in our code using Loops! Like this:

```
while True:  
    print("Hello")
```

What do you think this code does?

Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello



Loops

We can do something over and over again in our code using Loops! Like this:

```
while True:  
    print("Hello")
```

It prints “Hello” forever! Let’s have a look at what it’s doing



Loops

```
while True:  
    print("Hello")
```

First, it checks to see if it should go into the loop. Because we wrote True here it will **always** go into the loop

Loops

```
while True:  
    print("Hello")
```

Then we do whatever is
inside the loop - we
print "Hello"

Loops

```
while True:  
    print("Hello")
```

Then we go back to the top and see if we should do the loop again

Loops

```
while True:  
    print("Hello")
```

Because we wrote True here
it will **always** go into the
loop



Loops

```
while True:  
    print("Hello")
```

Then we do whatever is
inside the loop - we
print "Hello"

Loops

```
while True:  
    print("Hello")
```

Then we go back to the top and see if we should do the loop again

Loops

This pattern keeps going on and on forever! (or until you quit the program)

```
while True:  
    print("Hello")
```



Looking for Events

Now that we understand that we need to keep asking over and over, let's have another look at that code!



Looking for Events

Now that we understand that we need to keep asking over and over, let's have another look at that code!

```
while True:  
    new_event = event.poll()
```



This line checks to see if there is a new event and saves it in a variable called `new_event`

Looking for Events

Now that we understand that we need to keep asking over and over, let's have another look at that code!

```
while True:  
    new_event = event.poll()
```

This line tells python to do it over and over. It's called a loop!

This line checks to see if there is a new event and saves it in a variable called new_event

Looking for Events

```
while True:  
    new_event = event.poll()
```

First we enter
the loop here



Looking for Events

```
while True:  
    new_event = event.poll()
```

Hey! Have you
had any events?



Then we ask if
there is a new
event



Looking for Events

```
while True:  
    new_event = event.poll()
```

Nope!

Then we ask if
there is a new
event



Looking for Events

```
while True:  
    new_event = event.poll()
```

Then we go
back to the top
and do it again



Looking for Events

```
while True:  
    new_event = event.poll()
```

Hey! Have you
had any events?

Now we're
doing this line
again!



Looking for Events

```
while True:  
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```

Nope!

Now we're
doing this line
again!



Finding Events

Okay so now we know how to ask for new Events. But what do we do when we find one?



Finding Events

Okay so now we know how to ask for new Events. But what do we do when we find one?

```
while True:  
    new_event = event.poll()  
    if new_event.type == KEYDOWN:  
        print("You pressed a key!")
```

This if statement checks if the type of event was a KEY on the keyboard being pressed DOWN

Finding Events

```
while True:  
    new_event = event.poll()  
    if new_event.type == KEYDOWN:  
        print("You pressed a key!")
```

First we check if there are any events

Hey! Have you had any events?



Finding Events

```
while True:  
    new_event = event.poll()  
    if new_event.type == KEYDOWN:  
        print("You pressed a key!")
```

Then we check what type of event it was

Yep! It was a
KEYDOWN
event



Finding Events

```
while True:  
    new_event = event.poll()  
    if new_event.type == KEYDOWN:  
        print("You pressed a key!")
```

If it's the event we want then we print this line

You pressed
a key!



Pressing Keys

But we want to know *which* key they pressed! Not just if they pressed any key on the keyboard!



Pressing Keys

But we want to know *which* key they pressed! Not just if they pressed any key on the keyboard!

```
while True:  
    new_event = event.poll()  
    if new_event.type == KEYDOWN and new_event.key == K_SPACE:  
        print("You pressed the space key!")
```

This now also checks if the key was the SPACE key

Finding Events

```
while True:  
    new_event = event.poll()  
    if new_event.type == KEYDOWN and new_event.key == K_SPACE:  
        print("You pressed the space key!")
```

First we check if there are any events

Hey! Have you had any events?



Finding Events

```
while True:  
    new_event = event.poll()  
    if new_event.type == KEYDOWN and new_event.key == K_SPACE:  
        print("You pressed the space key!")
```

Then we check what type of event it was

Yep! It was a KEYDOWN event using the SPACE key!

And we check what key was pressed



Finding Events

```
while True:  
    new_event = event.poll()  
    if new_event.type == KEYDOWN and new_event.key == K_SPACE:  
        print("You pressed the space key!")
```

Now we know
what the event
is we can print

You pressed
the space key!



Project time!

The **key** to doing the next part was all in these slides

Try to do the next Part

In the **event** of confusion, the tutors will be around to help!



Pygame Collisions!



Pygame Collisions

Our game is looking great so far! But it would be even better if the things in our game could react when something collides with them!

Pygame already knows how to work this out, let's learn how to do it!



Cat & Mouse

Let's have a look at this example where we have a game where the cat has to catch the mouse!



Cat & Mouse

Let's have a look at this example where we have a game where the cat has to catch the mouse!



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Let's have a look at this example where we have a game where the cat has to catch the mouse!



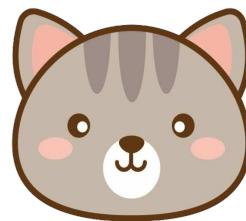
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Cat & Mouse

Let's have a look at this example where we have a game where the cat has to catch the mouse!

I win!



Cat & Mouse



Let's have a look at a little bit of the code from this game. We've left out some of it to keep it short

```
while True:  
    cat = screen.blit(cat_image, (cat_x, cat_y))  
    mouse = screen.blit(mouse_image, (mouse_x, mouse_y))  
    display.update()
```

Cat & Mouse



Let's have a look at a little bit of the code from this game. We've left out some of it to keep it short

```
while True:  
    cat = screen.blit(cat_image, (cat_x, cat_y))  
    mouse = screen.blit(mouse_image, (mouse_x, mouse_y))  
    display.update()
```

What does this code do?

Cat & Mouse



Let's have a look at a little bit of the code from this game. We've left out some of it to keep it short

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while True:  
    cat = screen.blit(cat_image, (cat_x, cat_y))  
    mouse = screen.blit(mouse_image, (mouse_x, mouse_y))  
    display.update()
```

What does this code do?

It blits the cat image and the mouse image to the screen and then updates the display!

Colliderect

We need to be able to tell when our cat collides with our mouse! Let's have a look at the code to do that

```
while True:  
    cat = screen.blit(cat_image, (cat_x, cat_y))  
    mouse = screen.blit(mouse_image, (mouse_x, mouse_y))  
    display.update()  
  
    if cat.colliderect(mouse):  
        print("I win!")
```



Colliderect

Let's take a closer look!

```
while True:  
    cat = screen.blit(cat_image, (cat_x, cat_y))  
    mouse = screen.blit(mouse_image, (mouse_x, mouse_y))  
    display.update()  
  
    if cat.colliderect(mouse):  
        print("I win!")
```

This if statement checks if the cat's rectangle collides (touches) the mouse's rectangle



Not touching!



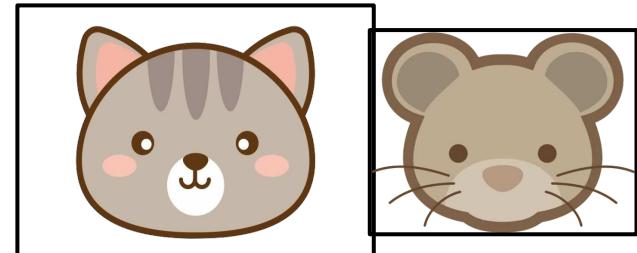
Colliderect

Let's take a closer look!

```
while True:  
    cat = screen.blit(cat_image, (cat_x, cat_y))  
    mouse = screen.blit(mouse_image, (mouse_x, mouse_y))  
    display.update()  
  
    if cat.colliderect(mouse):  
        print("I win!")
```

This if statement checks if the cat's rectangle collides (touches) the mouse's rectangle

Touching!



Project time!

Now we can **collide** our knowledge with the workbook and do the next part!

Try to do the next Part

The tutors will be around to help!

