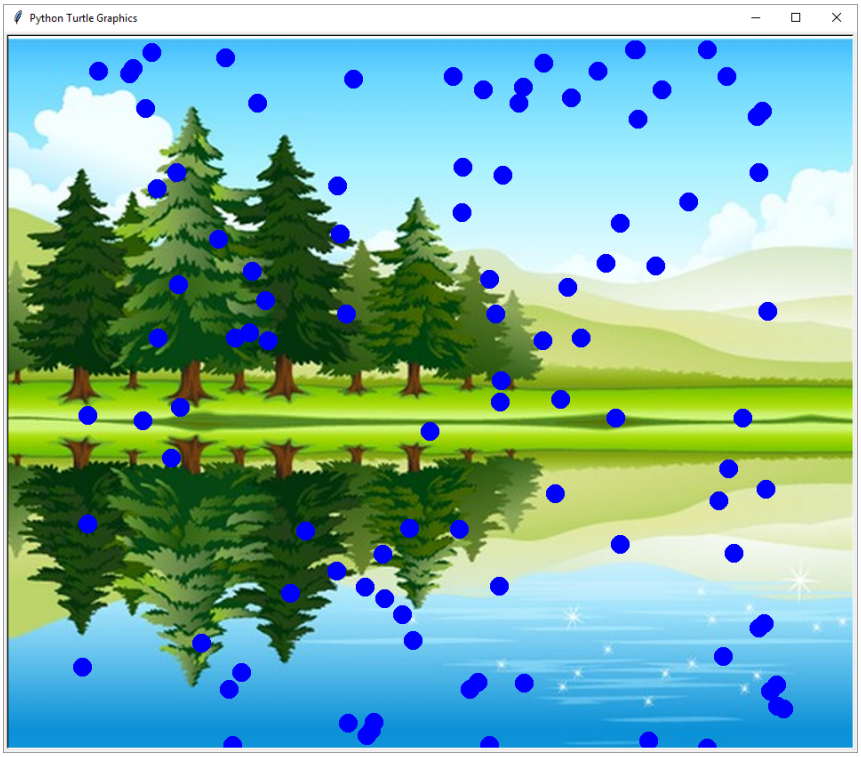
Python Turtle Raindrops

Level: Intermediate	Language: Python	Requires: Laptop with Python



We'll use python and turtle to make it rain. Once you've got it raining, have a go at making other things move around on the screen.

The drops could be snow, stars, faces or footballs.

We'll use some elements you've seen - variables, random numbers and functions.

We'll be introducing one new element - lists.

And you'll get to do some simple animation! Stuff that moves!

This sheet recommends using Mu in Python 3 mode.

Drawing a raindrop

Lets start by setting up turtle to draw fast with `speed(0)`, hide the turtle with `hideturtle`, and pull up the pen with `penup`.

```
import turtle

t = turtle.Turtle()

t.speed(0)
t.hideturtle()
t.penup()
```

To draw a simple drop we can use a blue circle.

```
t.shape("circle")
t.color("blue")

t.goto(0, 0)
t.stamp()
```

`t.shape` changes the turtles shape, `t.goto` jumps to a set of coordinates. By using `t.stamp`, we can leave behind a stamp, an image of the turtles current shape on the canvas where it stands.

Try running this.

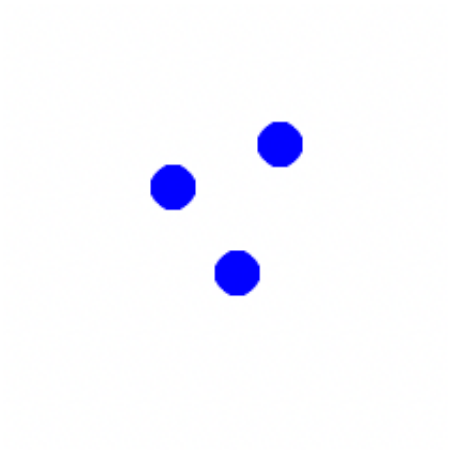
Drawing multiple drops

We are going to want to stamp a blue circle many times - so let's move the drawing code into a function:

```
~~t.goto(0, 0)~~
~~t.stamp()~~
```

```
def draw_drop(x, y):
    t.goto(x, y)
    t.stamp()

draw_drop(0, 0)
draw_drop(30, -40)
draw_drop(50, 20)
```

`x` is how far across the screen from the left, `y` is how far up the screen from the bottom. There is a negative number there. This is because `0, 0` is the middle of screen - so to go further down, or left, we need to subtract from `0` to get there. When you run this, it should draw 3 raindrops.



More rain

There are many raindrops in rain. Let's use a list to hold them:

```
draw_drop(0, 0)
draw_drop(30, -40)
draw_drop(50, 20)
```

```
drops = [[0, 0], [30, -40], [50, 20]]

for drop in drops:
    draw_drop(drop[0], drop[1])
```

Drops is a list of (x,y) pairs - each a small list too. When we draw this - x is drop[0] and y is drop[1]. This should show the same 3 drops as before, but you can change the list to add more drops.

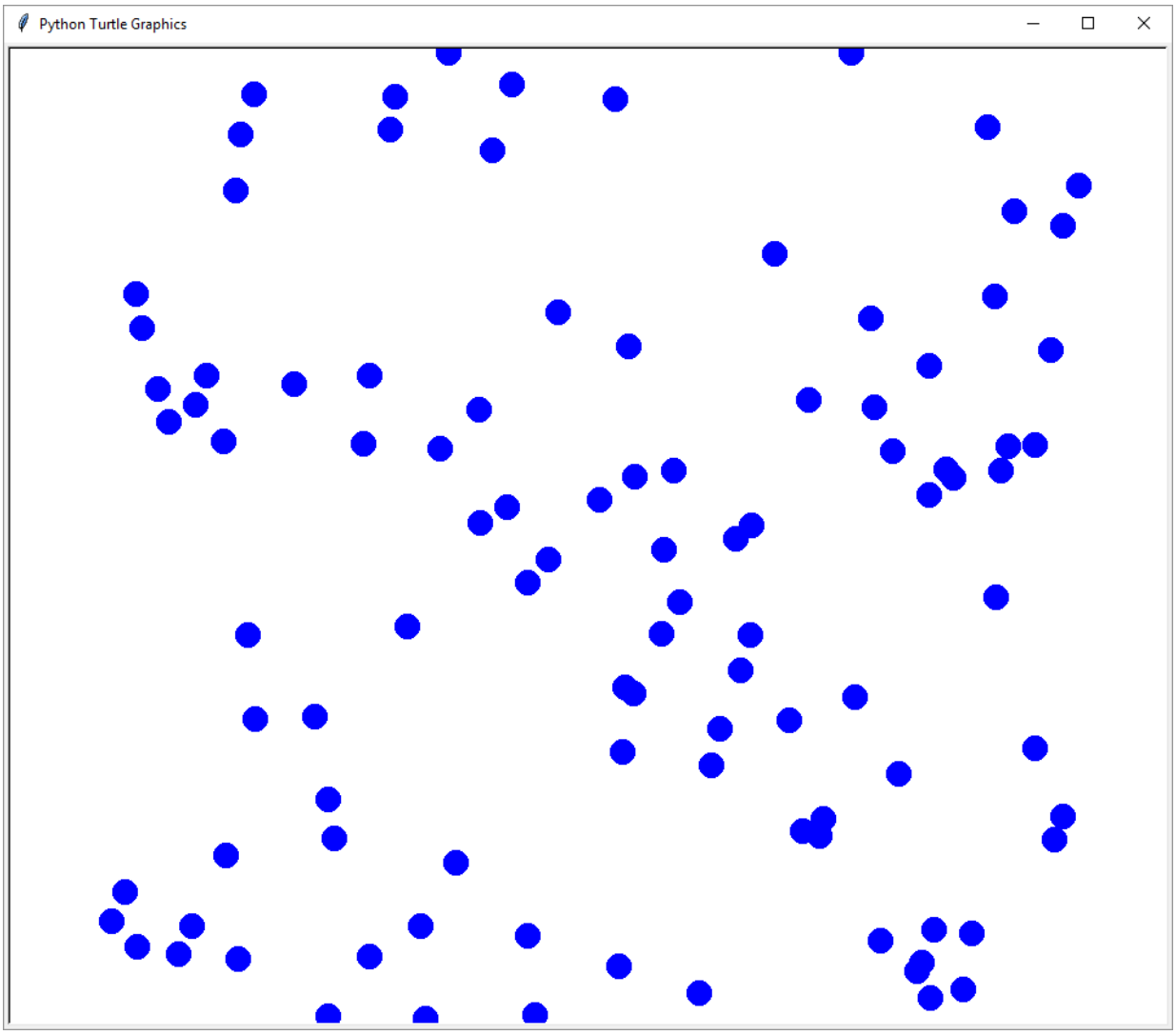
Now we can make the list bigger. Let's add 100 raindrops using `random` to scatter them around the screen. First we need to import random at the top of our code:

```
    import turtle
    import random
```

Then we replace our fixed list with an empty list, and fill it with random drop positions:

```
drops = [[0, 0], [30, 40], [50, 20]]
```

```
drops = []
for n in range(100):
    drop = [random.randint(-400, 400), random.randint(-400, 400) ]
    drops.append( drop )
```



Each time you run it - you'll get different drops!

Preparing to animate

You may have noticed that drawing the drops was a bit slow - one drop at a time. If we are going to animate this, we need to be able to draw a lot faster. Add the bold line near the top of the file. Note that this should be `turtle` and not `t`.

```
import turtle
import random
turtle.tracer(0, 0)
```

This tells the turtle not to animate itself, so we can animate instead. This will be very quick, but it's actually drawn on a background/hidden screen. To actually see it you'll need to add this at the end of the code:

```
turtle.update()
```

This will now make the random raindrops draw much faster.

Moving the raindrops

We can start to make these raindrops move now.

```
import turtle
import random

turtle.tracer(0, 0)
t = turtle.Turtle()
t.speed(0)
t.hideturtle()
t.penup()
t.shape("circle")
t.color("blue")

def draw_drop(x, y):
    t.goto(x, y)
    t.stamp()

drops = []
for n in range(100):
    drop = [random.randint(-400, 400), random.randint(-400, 400) ]
    drops.append( drop )

while True:
    t.clear()
    for drop in drops:
        drop[1] -= 3
        draw_drop(drop[0], drop[1])
    turtle.update()
```

Our animation is in the while loop. It clears the drawings, then moves them down by 3 (subtracting 3 from Y), and draws the drop.

After drawing all drops, we update the screen. This makes a different picture every time, which will look like the drops are moving.

You'll note all the drops fall off the screen here. You may see an "invalid command name" and a large number when you close the window, don't worry - this can be ignored for now.

Rain from the top again

We can stop them falling off. The bottom of the screen here is -400. So if we are below that, we can put them back at the top. Add the following in the loop after we subtract 3 from the drop y:

```
    if drop[1] < -400:
      drop[1] = 400
```

Ideas to try

Try changing the draw_drop function

You can put the pen down and do standard turtle drawing commands. Or you could use a GIF image.

```
- t.shape("circle")
- t.color("blue")

+ screen = turtle.Screen()
+ image = "myimage.gif"
+ screen.addshape(image)
+ t.shape(image)
```

Now when you stamp - it will be your image instead of the circles. Happy faces? Spaceships? Stars? You could just use the turtle command `t.dot()` to do a single dot instead of stamping with the pen down.

Try adding a 3rd parameter

You can try using a 3rd item in the lists - for speed, or raindrop size (t.shapesize, or as a parameter for dot).

When creating the drop, we can try a number between 2 and 4:

```
 for n in range(100):
+    drop = [random.randint(-400, 400), random.randint(-400, 400), rando
     drops.append( drop )
```

You can then use this 3rd parameter for speed instead of -3:

```
     for drop in drops:
+        drop[1] -= drop[2]
         if drop[1] < -400:
             drop[1] = 400
```

This now moves different drops at different speeds, giving a feeling of depth.

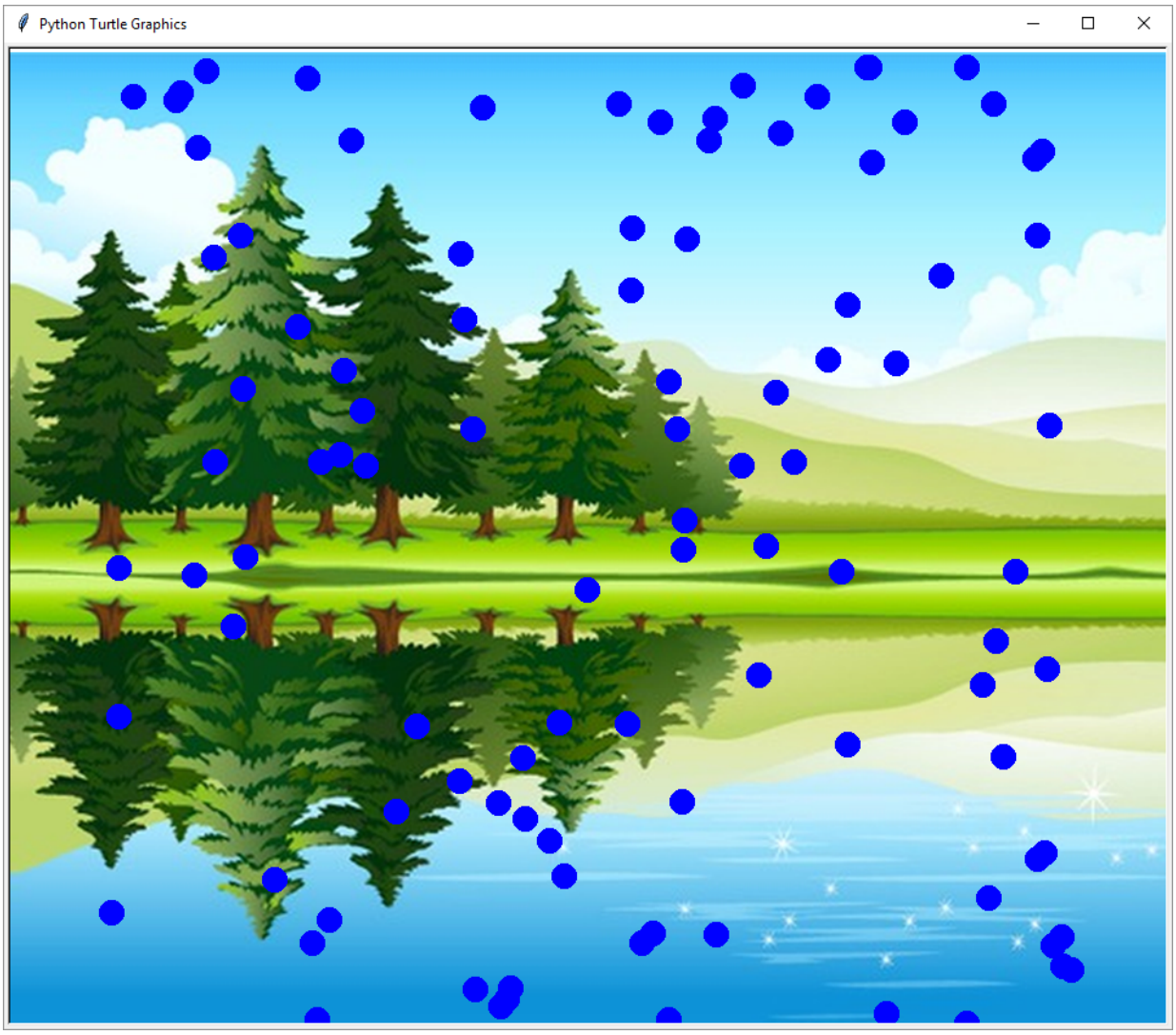
Background images

You can use a GIF as a background image:

```
    screen = turtle.Screen()
    screen.bgpic("mybackground.gif")
```

Inspiration

```
import turtle
import random

screen = turtle.Screen()
screen.bgpic("lake-background.gif")

turtle.tracer(0, 0)
t = turtle.Turtle()
t.speed(0)
t.hideturtle()
t.penup()
t.shape("circle")
t.color("blue")

def draw_drop(x, y):
    t.goto(x, y)
    t.stamp()

drops = []
for n in range(100):
    drop = [random.randint(-400, 400), random.randint(-400, 400) ]
    drops.append( drop )

while True:
    t.clear()
    for drop in drops:
        drop[1] -= 3
        if drop[1] < -400:
            drop[1] = 400
        draw_drop(drop[0], drop[1])
    turtle.update()
```


Python Turtle Graphics

Turtle Colours

This is a limited list. Look up "TK colours" for more names. You can also use three numbers for red, green and blue to mix your own colours: `t.color((172, 38, 53))` Sample.

Colour Name	Sample
red	
blue	
green	
yellow	
salmon	
orange	
black	
white	

Its worth trying other colour names and seeing what works.

Turtle reference

Command	Effect
`t = turtle.Turtle()`	Make a turtle called t
`turtle.tracer(0,0)`	Turn off tracer animation - makes it very fast
`turtle.update()`	Make a screen update - handy when fast
`turtle.done()`	Program finished, wait for window to close
`t.clear()`	Clear everything drawn by this turtle
`t.speed(0)`	Make this turtle fast
`t.penup()`	Pull the pen up - don't draw lines
`t.pendown()`	Put the pen down - draw a line
`t.hideturtle()`	Hide the turtle - don't draw it
`t.goto(x, y)`	Jump to position x, y. 0, 0 is the middle
`t.stamp()`	Stamp the current turtle shape
`t.shape("shape")`	Change shape. Try "turtle", "circle", "square"
`t.color("color")`	Change color. Try "red", "green", "blue"
`t.forward(100)`	go forward 100 pixels
`t.left(90)`	turn left 90 degrees
`t.right(45)`	turn right 45 degrees