

Homework 4

Introductory Programming
Fall 2004

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The reading for this assignment is Chapter 4 of *How to think...*

4.1 Recurtle the Turtle

1. On paper, sketch what you think this program will draw:

```
def draw(t, dist, n):
    if n==0:
        return
    fd(t, dist)
    lt(t)
    draw(t, dist, n-1)
```

```
bob = Turtle(world)
draw(bob, 50, 4)
```

2. Now type the code into `turtle_code.py` and run it using `World.py`. Did you get what you expected?
3. Draw a stack diagram that shows the state of the program when `n == 0`.
4. Now change `draw` so that if `n` is even, the turtle turns left, and if `n` is odd, it turns right. What do you expect to see? Run the code and check.
5. From the department of deliberate errors, remove the lines that say

```
    if n==0:
        return
```

Now the recursion has no base case, so it will keep going, calling `draw` over and over. If you wait long enough, eventually the stack grows too big and you'll get a `RuntimeError: maximum recursion depth exceeded`.

4.2 Mating Amoebas

In this section, we will investigate the mating behavior of amoebas. But remember, this isn't exactly biology¹.

1. Download <http://wb/ip/code/Amoebas.py>. Read over the code and then run it. You should see two amoebas moving around the slide at random.

¹Google "Sex and the single amoeba" for more information (than you wanted).

2. Inside the `move` function, add code that keeps the amoebas from moving off the slide. Notice that `move` takes an optional parameter named `limit` that is meant to be the boundary. That is, the coordinates of the amoeba should always be between `-limit` and `+limit`.
3. You might notice that the amoebas sometimes have trouble finding each other. It's like a microscopic version of a Jane Austen novel. But from our omniscient point of view, we can help them by changing the code that controls their behavior.

Write a function called `nudge` that takes two amoebas as parameters and that tries to move the first amoeba toward the second amoeba by some small amount. Inside `main`, you can nudge each amoeba toward the other.

Keep it simple: `nudge` doesn't have to do very much to get the amoebas together.

4. Inside `main` and after both amoebas have moved, add code that computes the distance between the amoebas and, if it is less than 1.0, changes the behavior of the amoebas in a way that you think is appropriate.