CIS 122

Now you're thinking with turtles!

Logistics

- Most homework received
  - Try to get them in on time
  - Only 3 late credits
  - Solutions will be posted when they're all in
- Not going to review homework
  - If you have questions, come ask me

Logistics

- Midterm next Monday
  - Recap on Thursday
  - Review session on Friday
  - Study guide is coming
- There will be a homework due this week
  - Shorter than usual
  - Only 2 real problems (and a bit of extra credit)
- Due Date
  - Scheduled for Sunday night
  - Would you prefer earlier?

Dueling Paradigms

- Different philosophies towards programming
  - Functional Programming
  - Imperative Programming
  - Object Oriented Programming

Dueling Paradigms

- Functional Programming
  - Functions exist to return values
  - Calling a function should not change the world
- No side effects
  - Reassigning variables
  - Printing information
- Idempotent
  - Calling function multiple times does not change result

Dueling Paradigms

```
def foo(x):
    x = x+1
    return x

a = foo(1)
a = foo(1)
a = foo(1)

print a
```

Dueling Paradigms

- Imperative Programming
  - Functions exist to do work
  - May or may not return useful information
- Functions can change the world
  - Variables may hold different values afterwards
  - May have printed out messages
- Non-idempotent
  - Calling function multiple times may yield different results

Dueling Paradigms

```
x = 0

def foo():
    x = x+1
    return x

a = foo()
a = foo()
a = foo()

print a
```

Turtle Graphics

- Graphical Output
  - Turtle Drawing
  - Imperative
- The turtle module contains line drawing functions
  - You control a "turtle"
  - Tell it to go forwards, backwards, left, right
  - Kind of like an etch-a-sketch
- Turtle functions don't return values
  - (well, technically, they return None)
  - They issue commands to the turtle

Turtle Graphics

- IDLE doesn't cooperate with turtle graphics
  - Need to open IDLE in a special mode
- Open the command prompt
  - Terminal for macs
- Enter the IDLE path followed by "-n"
  - C:\Python27\Lib\idlelib\idle.pyw -n (lab computers)
  - <somewhere else> -n (pc laptops)
  - idle -n (mac laptops)
- IDLE should start up with a special message
  - ==== No Subprocesses ====

Turtle Graphics

- First, import the turtle module
  - import turtle
- Now, you're ready to draw!
  - turtle.forward(dist)
  - turtle.backward(dist)
  - turtle.left(angle)
  - turtle.right(angle)
- And one more really useful function
  - turtle.reset()

Turtle Graphics

- What does this code do?

```
turtle.forward(100)
turtle.left(120)
turtle.forward(100)
turtle.left(120)
turtle.forward(100)
```

Turtle Graphics

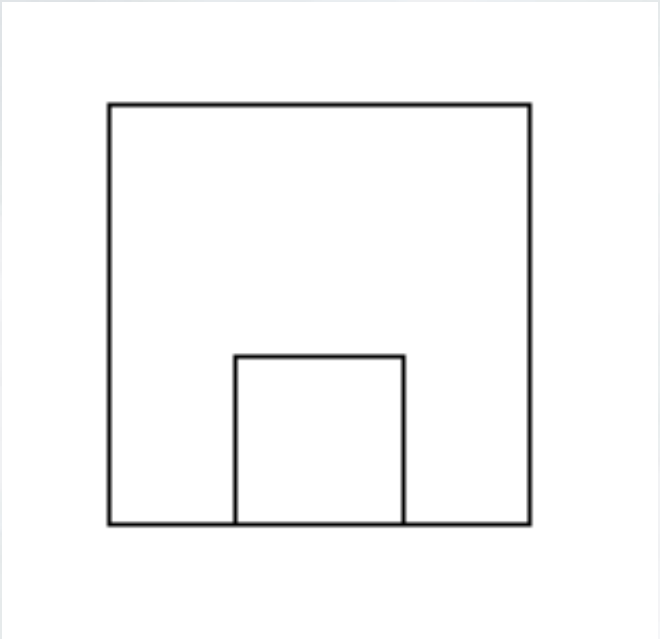
- What does this code do?

```
turtle.forward(100)
turtle.left(120)
turtle.forward(100)
turtle.left(120)
turtle.forward(100)
```

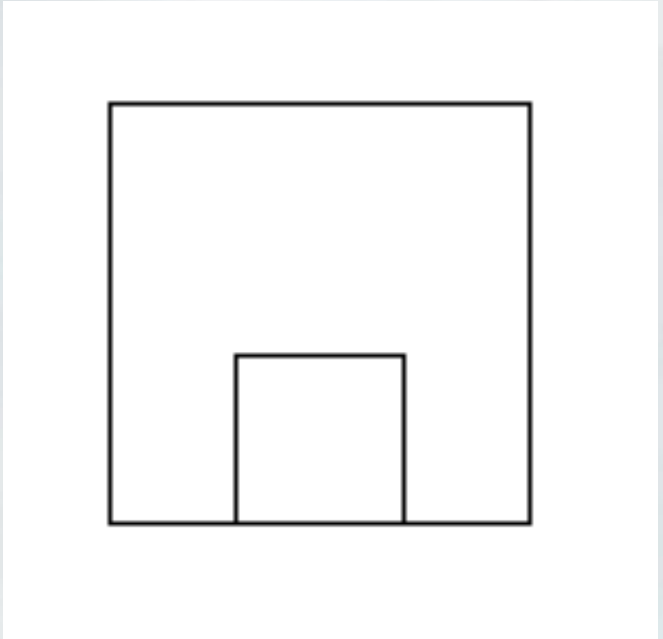
- Draws an equilateral triangle
  - Equilateral triangle has 60° angles
  - Why did we turn left 120°?

Turtle Graphics Practice

- Write code to draw this shape
  - Write it in a file
  - Start with turtle.reset()



Turtle Graphics Practice



- Writing out the same code is a pain
  - Programmers are lazy
  - Never do the same work twice
- Write a square function
  - square(length)
  - Draws a square with sides of the given length
- Use your square function to draw our shape again