Announcements

- Last project due **THURS** Dec. 3.
- Use functions to draw some graphics.
- Change snowflake code, draw more of them.
- Then add your own picture, also using a function to draw.

Last time

- Variables created inside a function are called its local variables.
- Local variables are invisible outside the function.
- Variables defined outside a function (the usual kind) are global variables.
- A function can see the value of a global variable.
- A function **cannot change** the value of a global variable….unless.....

Example

- Let's look at the usual rules in action again.

Two variables with same name

- Python will let you write a program with a local variable named x and also a global variable named x.

```python
def addTwo(x):
    x = x+2
    return x
x = 10
z = addTwo(x)
```

A perfectly legal Python program, but a very bad idea!
Usually avoid this

- It can be really confusing.
- You need to know that it can be done because you will end up doing it by mistake.
- When you figure it out, fix it by changing the name of one of the variables.
- OK when you consciously re-use variable names, for example when you have lots of for loops using i as the variable:

```python
for i in range(len(s)):
```

Local or global?

```python
def addTwo(y):
    z = x
    y = y+2
    print x,y,z
    return y
x = 5
w = addTwo(x)
```

Local or global?

```python
def addTwo(y):
    x = 3
    y = y+2
    print x,y
    return y
x = 5
w = addTwo(x)
```

The usual rules

- Variables created in a function are local.
- Variables created in the main program are global.
- Functions can see the values of global variables, but they cannot change local variables.

Changing global variables

- Very rarely, it would be nice if a function could change a global variable.
- Use the global command to tell Python you want to be able to change a particular global variable.

```python
global year
```

- Put global commands right after the def.

Change globals rarely

- The function interface (input through parameters, output through return value) is there to help you stay organized.
- Making functions with side effects can lead to confusion.
Some words on snowflakes

- Draws snowflake with six arms.
- Each arm consists of three segments, and their mirror-images across the center of the arm.
- Make a function that draws both a segment, and it's mirror image. Use it to simplify the code under the for.