The CS 5 Black Post

Penguins Invade Zoom Call

Read Section 2.8 (easy peasy!)

Claremont (AP)—A wild group of penguins took over a Zoom-based lab session yesterday, sharing screenshots of icebergs and dead fish. Taking advantage of Zoom's "remote control" feature, they managed to interfere with students who were diligently attempting to complete their CS 5 homework. "I had just gotten my program to work," sobbed one student, they activated my 'delete' key and wiped it all out! Now I have to start all over. It took me hours to get my program to say 'Hello, world'

`return` vs `print`..


```
def dbl(x):
    return 2 * x

def trbl(x):
    print(2 * x)

def happy(yay):
    y = dbl(yay)
    return y + 42

def sad(boo):
    y = trbl(boo)
    return y + 42
```

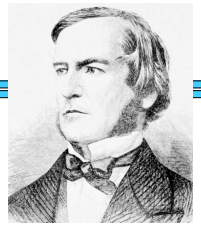
```
def friendly(pal):
    y = dbl(pal)
    print(y, "is very nice!")
    return y + 42
```

Strings are in single or double quotes

Booleans

```
>>> 3 == 1+2
True
>>> 42 == "ham"
False
>>> "spam" > "ham"
True
>>> 42 > "spam"
Barf!
```

Strings!

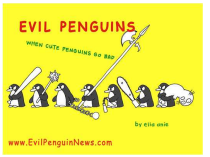


George Boole
1815-1864

The "Truth" about Python's Booleans

```
>>> True + 41
42
>>> 2**False == True
True
```

Demonstrating the True "power" of Falsity!



Lists!

```
>>> L = [1, 42, 3, 4]
>>> L
[1, 42, 3, 4]
```

```
>>> L + 10
Traceback (most recent call last):
  File "<stdin>", line 1, in ?
TypeError: can only concatenate list (not "int") to list
```

```
>>> L + [50]
[1, 42, 3, 4, 50]
>>> L
[1, 42, 3, 4]
```

L doesn't change!

```
>>> L*2
[1, 42, 3, 4, 1, 42, 3, 4]
>>> M = [42, "hello", 3+2j, 3.141, [1, 2, 3, 4, 5, 6]]
```

Lists are "polymorphic"

List Indexing and Slicing!

```
          0   1   2    3
>>> M = [42, 3, 98, 37]

>>> M[0]

>>> M[2]

>>> M[0:2]

>>> M[0:3:2]

>>> M[1:]

>>> M[:-1]

>>> M[1:-2]

>>>
```

Python slices just like slapchop!

"What kind of thing does this return?

Try to reverse the list!

Strings Revisited

```
          0 1 2 3 4 5 6 7 8 9 1 1
                              0 1
>>> S = "I love Spam!"

>>> S[0]

>>> S[11]

>>> S[2:6]

>>> S[11:6:-1]

>>> S*2
```

Hey penguins, get off my slides!

if, else…

```
def special(x):
    """This function demonstrates the use
       of if and else"""
    if x == 42:
        return "Very special number!"
    else:
        return "Stupid, boring number."
```

```
def special(x):
    if x == 42:
        return "Very special number!"
    return "Stupid, boring number."
```

Alternatively??

Notice how lines with the same level of indentation are in the same code block!

if, elif, else…

```
def superSpecial(x):
    """This function demonstrates the use
       of if, elif, and else"""
    if x < 41:
        ans = "Small number"
    elif x == 42 or x % 42 == 0:
        ans = "Nice!"
    elif 41 <= x <= 43:
        ans = "So close!"
    else:
        # We might do more stuff here...
        ans = "Yuck!"
    return ans
```

Would swapping the order of these elif's give the same behavior?

Notice how lines with the same level of indentation are in the same code block!

Avoiding elif

```
def unwise(x):
    """This function avoids using elif"""
    if x == 42 or x % 42 == 0:
        ans = "Nice!"
    if 41 <= x <= 43  or  x != 42:
        ans = "So close!"
    if x != 42  or  x % 42 != 0:
        ans = "Yuck!"
    return ans
```

I'm getting quite confused here…

Is Recursion Magic?

```
factorial(3):
   return 3 * factorial(2)
                  return 2 * factorial(1)
                                 return 1 * factorial(0)
```

6 2 1

"To understand recursion, you must first understand recursion"—anonymous Mudd alum

```
# recursive factorial
def factorial(n):
  '''This computes n!'''
  if n == 0:
    return 1
  else:
    return n*factorial(n-1)
```

A Tower of Fun!

Math

$tower(3) = 2^{2^2}$

$tower(4) = 2^{2^{2^2}}$

$tower(5) =$

The tower function is taking recursion to new heights!

Python (Functional)

recursive function

```
# recursive tower
def tower(n):
```

Computing the Length of a List

```
>>> len([1, 42, "spam"])
3
>>> len([1, [2, [3, 4]]])
```


```
def len(List):
  '''Returns the length of List'''
```

Reversing a List

```
>>> reverse([1, 2, 3, 4])
[4, 3, 2, 1]

def reverse(L):
  '''Returns a new list that is the
     reverse of the input list'''
```

Reversing a List

```
>>> reverse([1, [2, [4, 5], 6], 7])
```

Deep-Reversing a List


```
>>> reverse([1, [2, [4, 5], 6], 7])
[7, [2, [4, 5], 6], 1]

>>> deepReverse([1, [2, [4, 5], 6], 7])
[7, [6, [5, 4], 2], 1])
```

Recursion = :^)

Recursion, conditional statements, and lists suffice to give us a Turing-complete programming language!

Variables, assignment (=), for, while, etc. are all unnecessary!