Functions Re-visited

June 2, 2015
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\[ f(x) \]
1. Two Types

- The \( f(x) \) analogy is misleading because Python functions may or may not return a value.
- \texttt{display} prints a value and then returns
- \texttt{double} computes a new value and returns the newly computed result

```python
def display(x):
    print "x is ", x

def double(x):
    return 2*x
```
1.1. Call two types differently

- **display** doesn’t return a value, so we simply call the function on line #7
- **double** returns a value, we can use the returned value, see line #8

```python
1 def display(x):
2     print "x is ", x
3
4 def double(x):
5     return 2*x
6
7 display(12)
8 print double(12)
```
1.2. If we call it wrong: None

- On line #4, we first call `display`,
- and then try to print the returned value.
- But no value is returned!
- So Python returns special value: None

```python
1 def display(x):
2   print "x is ", x
3
4 print display(12)
```

```
x is  12
None
```
1.3. Missing return statement: None

- Must supply a return value for every \( x \)
- \texttt{badAbs} doesn’t have return if \( x \) is zero

```python
1 def badAbs(x):
2    if x > 0:
3        return x
4    elif x < 0:
5        return -x
6
7 print badAbs(12)
8 print badAbs(-12)
9 print badAbs(0)
```

12
12
None
1.4. Easy to Fix

- `fixedAbs` has a return for every value of `x`
2. Composition

- *Composition* is when one function calls another function
- *Compose* means to “combine things”
- In the next example, `display` calls `fixedAbs`
- It’s as if `display` is composed of `fixedAbs`
```
1 def fixedAbs(x):
2     if x < 0:
3         return -x
4     else:
5         return x

6 def display(x):
7     print fixedAbs(x), "is positive"
8
display(12)
display(-12)
display(0)
```
3. Boolean Functions

- Functions can return True or False

```python
1 def isEven(x):
2     if x % 2 == 0:
3         return True
4     else:
5         return False
6
7 print isEven(12)
8 print isEven(17)
9 print isEven(0)
```

True
False
True
3.1. Better Version of isEven

- if $x \% 2 == 0$ then $x$ is even!
- Recall, $==$ is relational operator: it returns a boolean value

```python
1 def isEven(x):
2    return x % 2 == 0
3
4 print isEven(12)
5 print isEven(17)
6 print isEven(0)
```

True
False
True
4. Math Library

- Many functions available; consult:
  
  https://docs.python.org/2/library/math.html

```python
1 import math
2
3 def areaCircle(radius):
4    return math.pi * (radius**2)
5
6 print math.factorial(5)
7 print math.fabs(-5.3)
8 print math.pi
9 print areaCircle(5)
10 print math.sqrt( math.fabs(-3.0) )
```
120
5.3
3.14159265359
78.5398163397
1.73205080757