LECTURE 24

HIGHER-ORDER FUNCTIONS & LAMBDA

MCS 260 Fall 2021
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REMINDERS

- Homework 8 due tomorrow at 10am
- Midterm letter grades will be posted Wednesday
- Project 3 will be announced this week

SUM

The built-in function `sum(L)` takes an iterable `L` and returns the sum of all its elements.

HIGHER-ORDER FUNCTIONS

Previously (Lec 20): functions are values

Functions can take other functions as arguments

```python
def dotwice(f):
    """Call the function f twice (with no arguments)"""
    f()
    f()
```

A function that accepts function arguments is sometimes called a **higher-order function**.

See dotwice.py.

EXAMPLE

A function `announce_call(f)` that calls a given function `f`, but prints a message before and after.

See announce.py.

EXAMPLE

A function that loops from 0 to 100, but accepts a function to increment the value.

See looper.py.

EXAMPLE

A function `nest(func,val,times)` that applies function `func` a specified number of times to `val` i.e.

- `nest(f,x,3)` should return the value of `f(f(f(x)))`

- `next(h,y,2)` should return the value of `h(h(y))`

See nest.py.

EXAMPLE

A function
`repeat_until_acceptable(getval,testfn)`
that calls `getval` repeatedly until the return value is
one for which `testfn` returns `True`.

LAMBDA

In Python, you can create a function with no name using the syntax:

```python
lambda x: x*x      # param x, return value x*x
lambda x,y: x-y   # params x and y, return value x-y
```

`lambda` gives you the function object, so the value of

```python
lambda x,y: x-y
```

is the same as the value of

```python
diff
```

if you previously defined

```python
def diff(x,y):
    return x-y
```

WHEN TO USE LAMBDA

Functions definitely deserve names if they are used in several places, or if they are complicated.

But `lambda` is good for simple functions used once, so the definition appears in the only place of use.

COMMON USE FOR LAMBDA

The built-in functions `max`, `min`, and `list.sort` accept a keyword argument `key` that is a function which is applied to elements before making comparisons.

e.g. if `L` is a list of words, then `max(L, key=len)` is the longest word.

REFERENCES

- In *Downey*:
  - Higher-order functions are discussed in the exercises of Chapter 3.
  - `lambda` isn't discussed
- Official Python documentation of `lambda`

REVISION HISTORY

- 2021-10-18 Initial publication
- 2021-10-19 Links to sample code