Functions

Functions

- A set of statements (lines of code) that can be run repeatedly
- Goals: Learning Python by Lutz and Ascher
  - Code reuse
  - Procedural decomposition

Top-Down Design

- Break problem into subproblems
- Print HIHO in block letters

1. print H
2. print I
3. print H
4. print O

- Write a *function* to solve each subproblem

```
def printH():
        print "* *"
        print "***"
        print "* *"
        print

def printI():
        print "***"
        print " * "
        print "***"
        print

def printO():
        print " * "
        print "* *"
        print " * "
        print

printH()
printI()
printH()
printO()
```

Function Calls

- We've seen a few:
  - my_num = input("Enter number: ")
  - my_string = raw_input("Enter string: ")
- Syntax: *function_name(parameters)*
- Other examples:
  - *int("7")* - converts the string "7" to an integer
  - *str(9)* - converts the integer 9 to a string
  - *float(2)* - converts the integer 2 to a float(2.0)
    - can be used to force floating point division: float(5)/2 = 2.5!

Modules

- A module groups together several functions
- math is a common module
- *import math* allows you to use the math functions
- dot operator allows you to call math functions
  - syntax: *module_name.function(parameters)*

```
import math
math.floor(9.5)
math.ceil(9.5)
str(math.floor(9.4)) #function call as parameter
```

Function Definition

- **Step 1**: Think about what your function will do, the input it requires, the result it will produce, and the side-effects it might have
  - printH
    - the function will display the letter H in star characters
    - it does not require input
    - it will not produce a result
    - the side-effect will be output displayed on the screen

Function Definition

- Syntax:

```
def function_name(parameters):
    statements
```

- function_name can be anything - follow the rules for variable names
- parameters are the input
- statements are the code that gets executed
- statements ***MUST*** be indented (all by the same number of spaces/tabs)

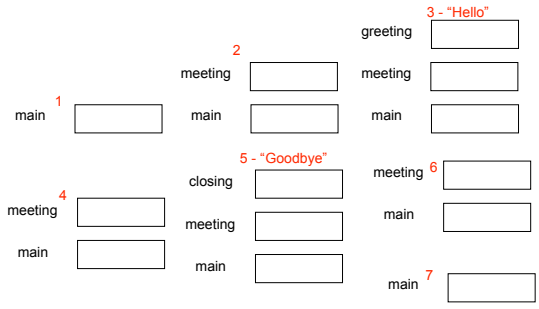
Example - no input

```
#definition of function to print a greeting
#no input, no output, side-effect: greeting is displayed
def greeting():
        print "Hello"
greeting() #call to function greeting

#definition of function to print a closing
#no input, no output, side-effect: closing is displayed
def closing():
        print "Goodbye"
closing() #call to function closing

#definition of function to print a greeting and closing
#no input, no output, side-effect: greeting and closing displayed
def meeting():
        greeting() #example of a function call from within
        closing()  #a function
meeting() #call to function meeting
```

Call to function meeting()



Exercises

1. Copy and paste or save hiho.py into a new file
2. Modify the program so that it prints "FIFO"
3. Write a program with the following three functions:
   1. printFirstName - a function that prints your first name
   2. printLastName - a function that prints your last name
   3. printFullName - a function that prints your full name

   Make sure to test each function by calling it. Verify that it produces the correct result/side-effect

Parameters/Arguments

- Input for functions
- Specify variable names in parameter list

```
def add(number1, number2):
    sum = number1 + number2
    print "Sum: ", sum
```

- When function *add* is called, two numbers must be passed as input

```
add(3, 4)
```

- Variable number1 gets the value 3 and variable number2 gets the value 4

Parameters/Arguments

- Values are assigned in order
  - the first value passed in the function call is assigned to the first parameter in the function definition

```
>>> def taketwo(mynum, mystring):
...     print "mynum ", mynum
...     print "mystring ", mystring
...
>>> taketwo("hello", 7)
mynum  hello
mystring  7
```

Parameters/Arguments

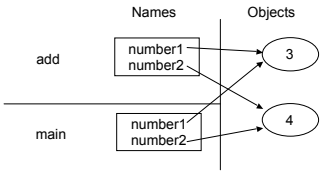
- Variables can be passed as parameters

```
number1 = input("Enter first number: ")
number2 = input("Enter second number: ")
add(number1, number2)
bob = input("Enter first number: ")
alice = input("Enter second number: ")
add(bob, alice)
```

Parameters/Arguments

- Pass by assignment

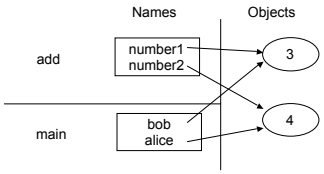
```
number1 = input("Enter first number: ")
number2 = input("Enter second number: ")
add(number1, number2)
```



Parameters/Arguments

- Pass by assignment

```
bob = input("Enter first number: ")
alice = input("Enter second number: ")
add(bob, alice)
```



Scope

- Parameters and variables defined inside a function can only be accessed in that function

```
def greeting(word):
        sentence = "The greeting is " + word + "."

print sentence

Traceback (most recent call last):
  File "test.py", line 4, in ?
    print sentence
NameError: name 'sentence' is not defined
```

Scope

- Parameters and variables defined inside a function can only be accessed in that function

```
def greeting(word):
        sentence = "The greeting is " + word + "."

print word

Traceback (most recent call last):
  File "test.py", line 4, in ?
    print sentence
NameError: name 'word' is not defined
```

Another Example

```
def greeting(word):
        sentence = "The greeting is " + word + "."
        print sentence

sentence = "This is not the greeting."
print sentence
greeting("hello")
print sentence


This is not the greeting.
The greeting is hello.
This is not the greeting.
```

Exercises

1. Write a program with the following functions:
   1. add - this function takes as input two numbers, adds them, and displays the result
   2. subtract - this function takes as input two numbers, subtracts the second from the first, and displays the result
   3. multiply - this function takes as input two numbers, multiplies them, and displays the result
   4. quotient - this function takes as input two numbers, divides the first by the second, and displays the result

Make sure to test each function by calling it. Verify that it produces the correct result/side-effect.

Return Values

- Functions may return a value to the caller
- Results should be saved in a variable
  - *the function call should appear on the right side of an =*

```
#a function to get input
def getprice():
        price = input("Enter purchase price: ")
        return price
price = getprice()
```

```
TAX_RATE = .0825

def getcost():
        cost = input("Enter item cost: ")
        return cost

def calctax(cost):
        tax = cost*TAX_RATE
        return tax

def calctotal(cost, tax):
        total = cost+tax
        return total

def printresult(cost, tax, total):
        print "Cost: ", cost
        print "Tax : ", tax
        print "Total: ", total

cost = getcost()
tax = calctax(cost)
total = calctotal(cost, tax)
printresult(cost, tax, total)
```

Exercises

1. Modify your add/subtract/multiply/quotient program as follows:
   1. Modify your functions such that they return the result calculated
   2. Create two new functions, the first function should prompt the user for a number. You will have to call this function twice, once to get the first number and once to get the second number. The second function will take as input the results calculated by the functions add/subtract/multiply/quotient and will display all four results for the user