# FUNCTIONS, PARAMETERS, AND SUBVERSION

CSSE 120 – Rose-Hulman Institute of Technology

## Outline

- Review of topics for Exam #1
- Tools: Version Control
- Functions :
  - Math, Maple, Python
  - Function definition and invocation mechanics
  - Exercise: writing `distance()`
  - Nested function calls and execution order
  - Code-reading exercise
- Homework: function versions of pizza, poly, and star (solutions to HW4 are posted for your reference)

# Exam 1

- When? Where?: See schedule page
  - Please get in the habit of checking the schedule regularly.  Time management is a problem solving process too!
- Format:
  - Paper part: Zelle book, 1 double-sided page of notes, *closed computer*
  - Programming part: Zelle book, any written notes, and your computer
    - Any resources you can reach from Angel by clicking only.

Q1

## Possible Topics for Exam 1

- Zelle chapters 1-5
- algorithm
- comment
- variable, assignment
- identifier, expression
- loop
  - definite (for)
  - counted (range function)
- phases of software development
- input, print
- import, math functions
- using functions
- int, float, long, conversion
- strings (basic operations)
- character codes (chr, ord)
- lists (concatenation, slices)
  - list methods
  - indexing
- reading, writing files
- formatted output using %
- using objects, graphics
- method vs. function
- event-driven program

# Review: += and related operators (-=, *=, ...)

- `a += b` is equivalent to `a = a + b`

```
IDLE 1.2.1
>>> x = 5
>>> x += 6; print x
11
>>> x *= 2; print x
22
>>> x -= 3; print x
19
>>> x %= 7; print x
5
>>> s = "abc"
>>> s += "d"; print s
abcd
```

```
>>>nums = [1,2,3]
>>>nums += [4,5]
>>>print nums
[1,2,3,4,5]
```

Q2

## Tidbit: random numbers

from random import randrange, random

randrange(start, end, step) returns a random **integer** from the list generated by the corresponding range statement

random() returns a random **float** in the range [0,1) Includes 0, but not 1.

# Software Engineering Tools

- The computer is a powerful tool
- We can use it to make software development easier and less error prone!
- Some software engineering tools:
  - IDEs, like Eclipse
  - Version Control Systems—like Subversion
  - Diagramming applications—like Violet or Visio
  - Modeling languages—like Alloy, Z, or JML

# Version Control Systems

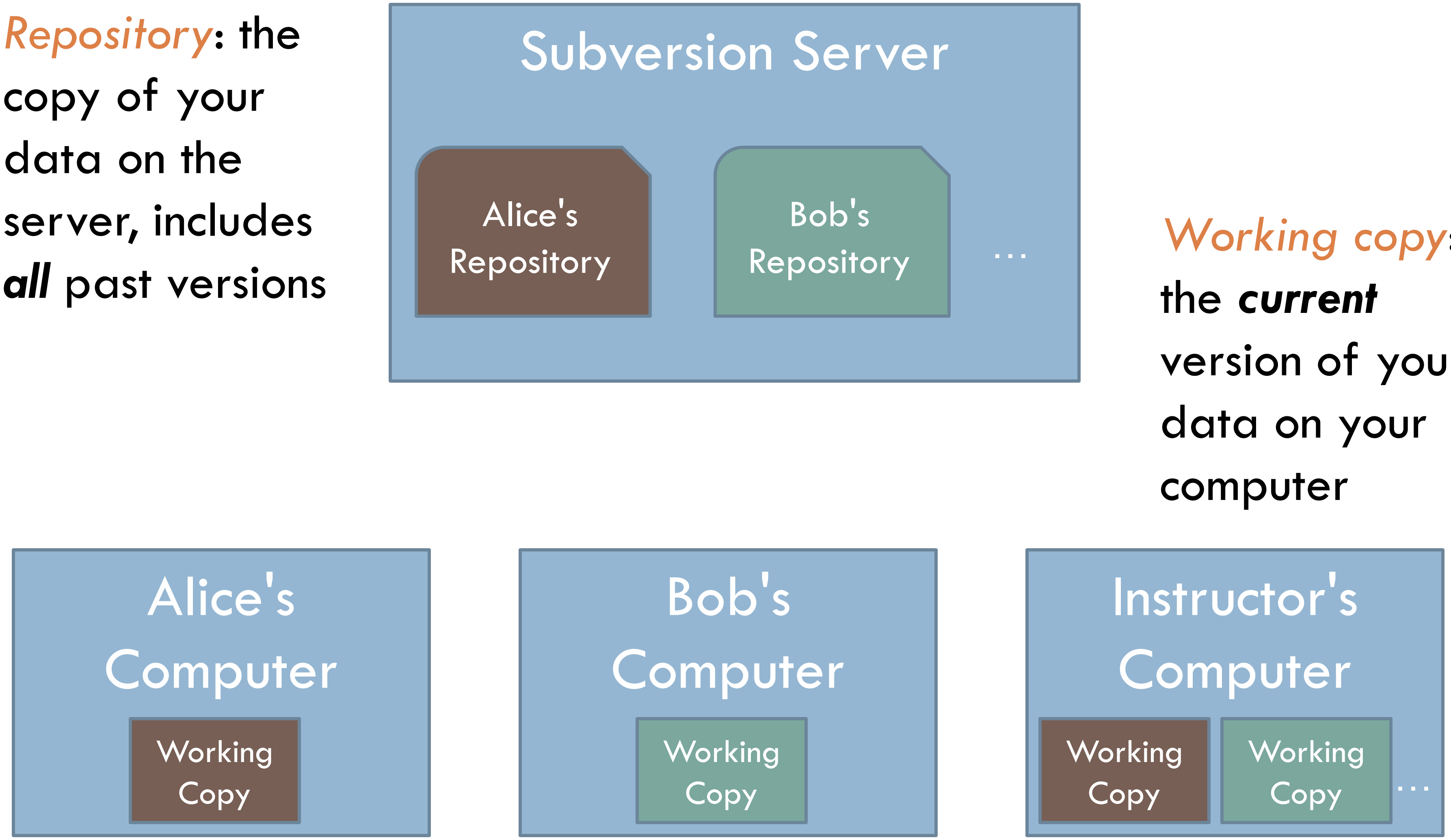
- Store "snapshots" of all the changes to a project over time
- Benefits:
  - Allow multiple users to share work on a project
  - Act as a "global undo"
  - Record who made what changes to a project
  - Maintain a log of the changes made
  - Can simplify debugging
  - Allow engineers to maintain multiple different versions of a project simultaneously

## Our Version Control System

- Subversion, sometimes called SVN
- A free, open-source application
- Lots of tool support available
  - Works on all major computing platforms
  - **TortoiseSVN** for version control in Windows Explorer
  - **Subclipse** for version control inside Eclipse

# Version Control Terms

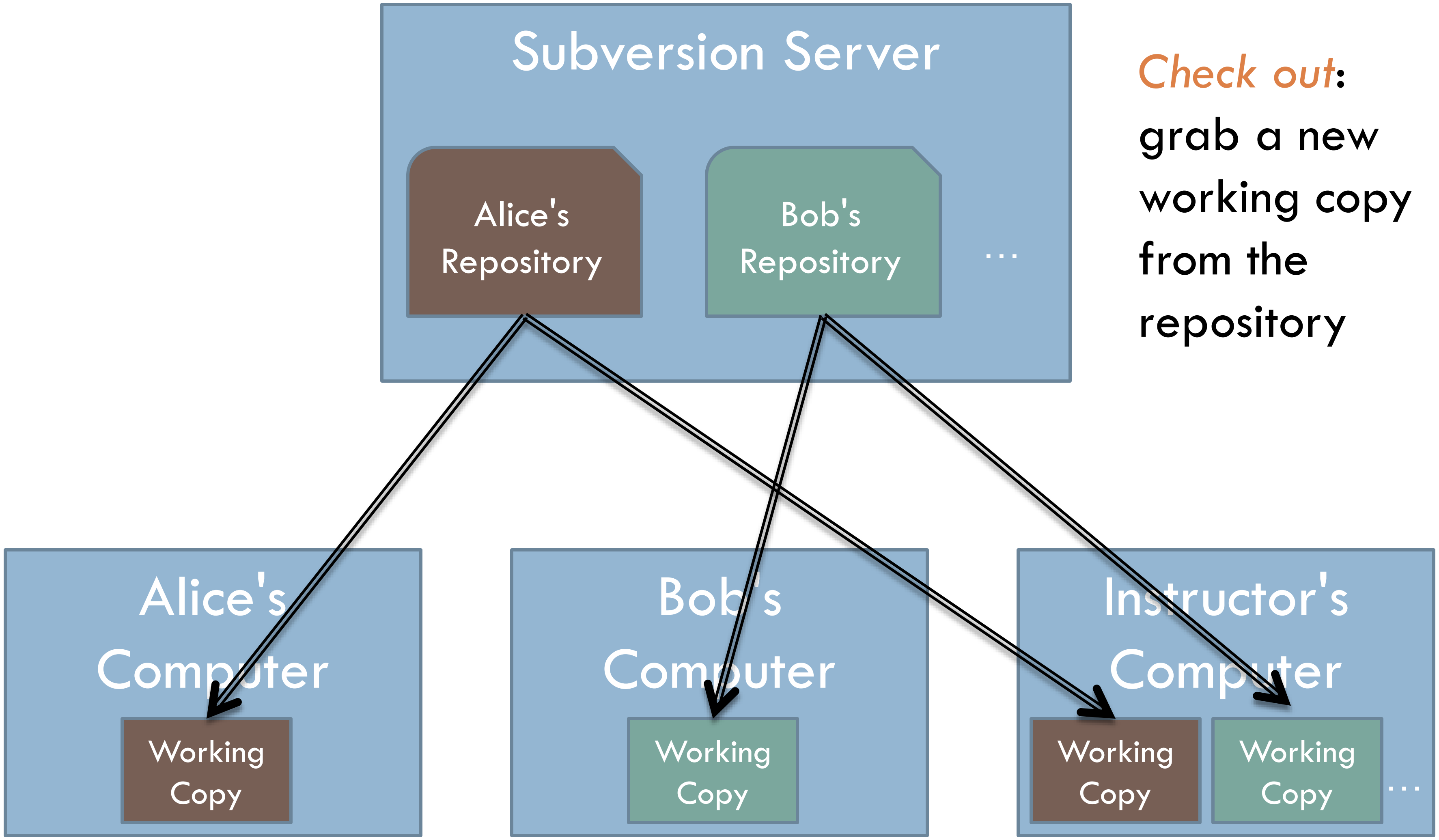
*Repository*: the copy of your data on the server, includes ***all*** past versions



*Working copy*: the ***current*** version of your data on your computer

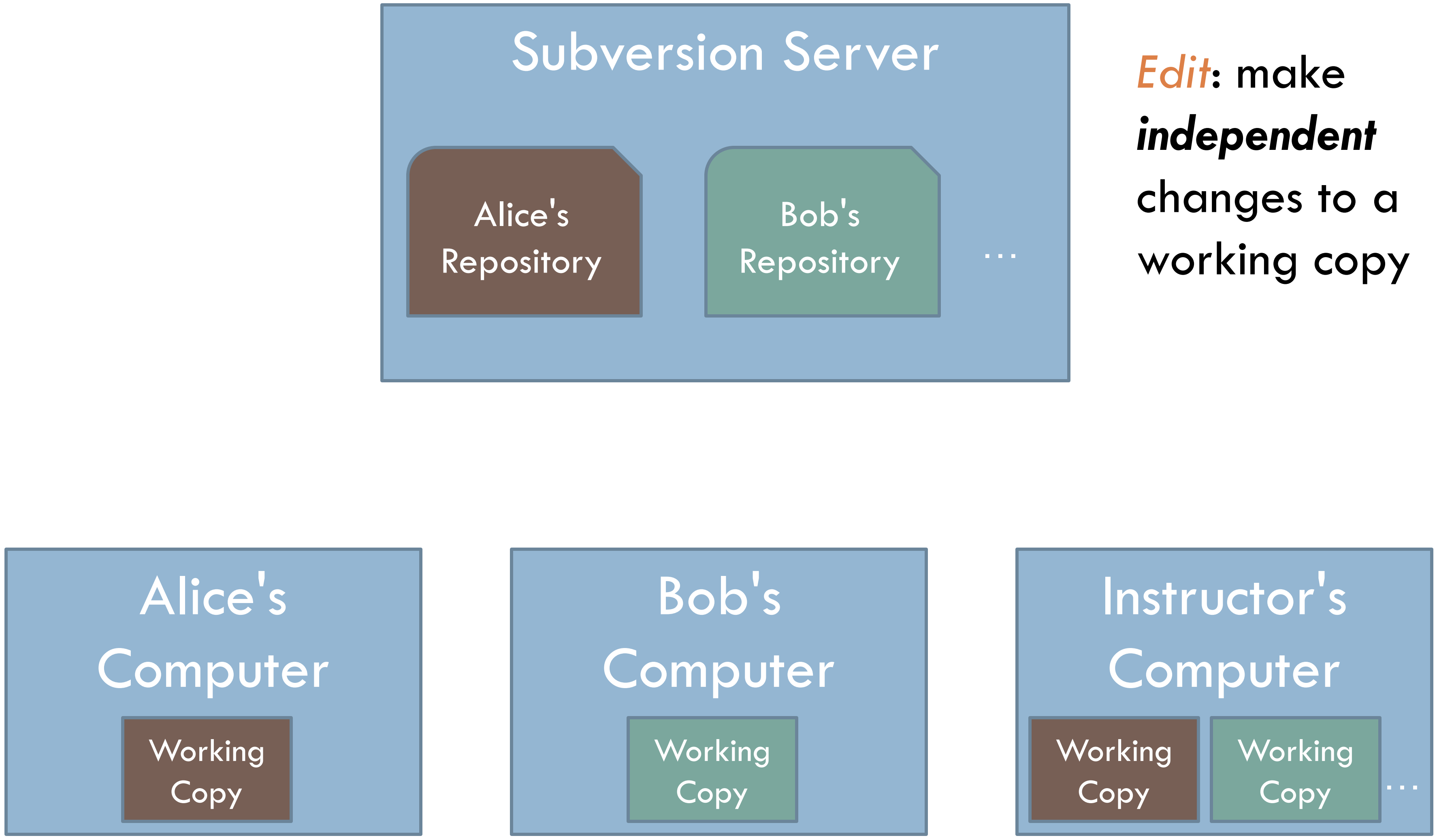
Q3b

# Version Control Steps—Check Out



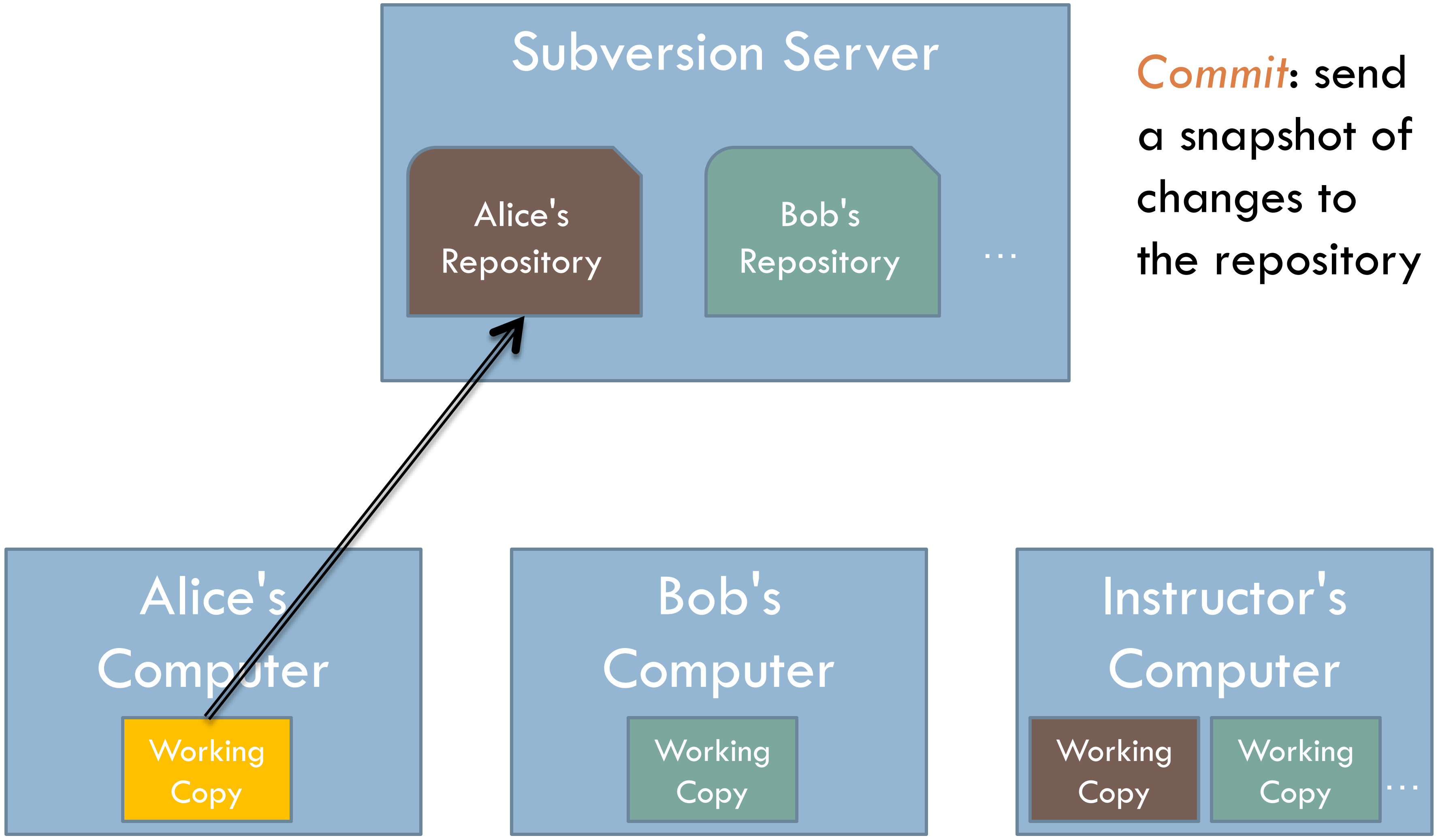
*Check out*: grab a new working copy from the repository

# Version Control Steps—Edit



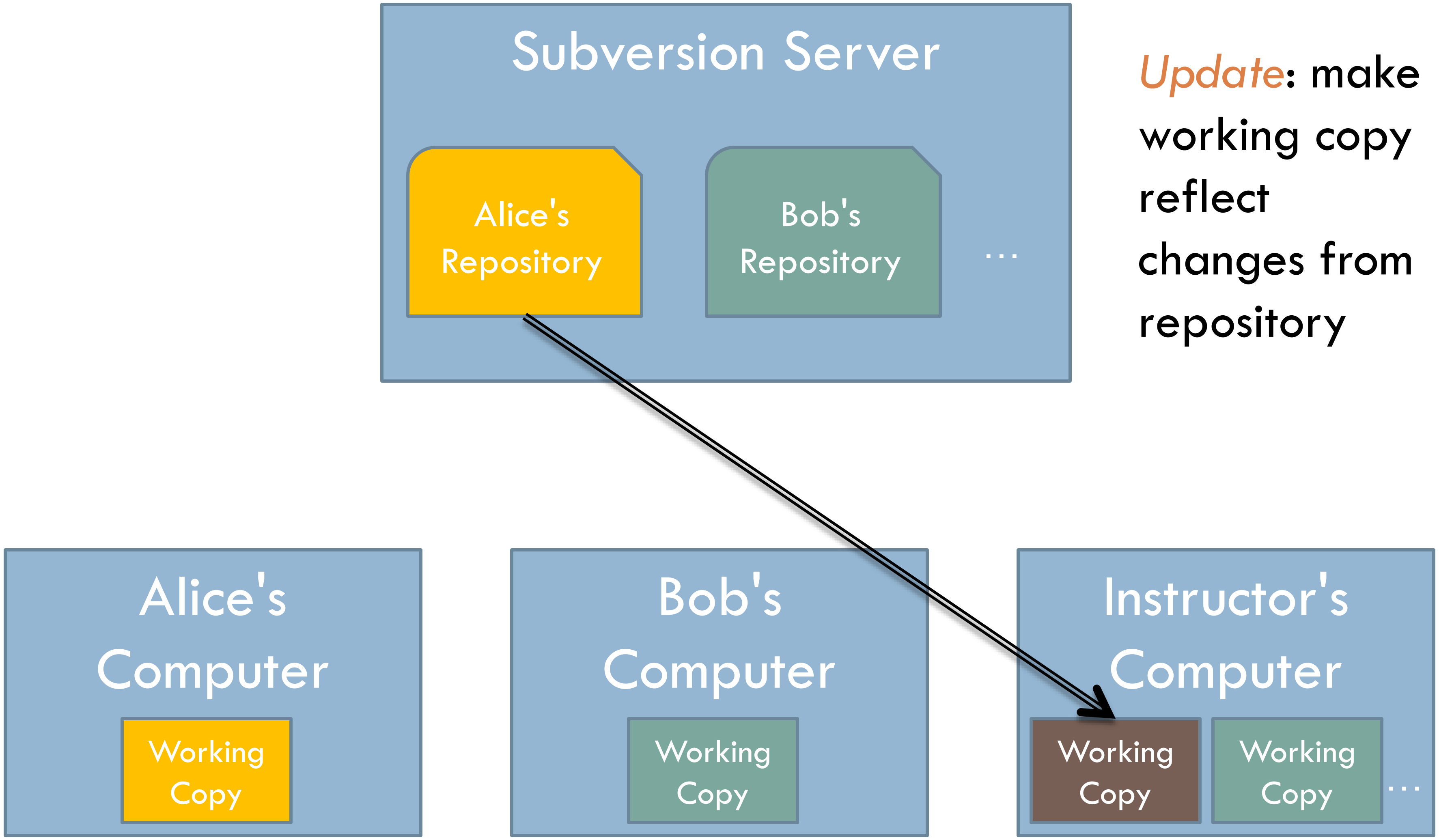
*Edit*: make ***independent*** changes to a working copy

## Version Control Steps—Commit



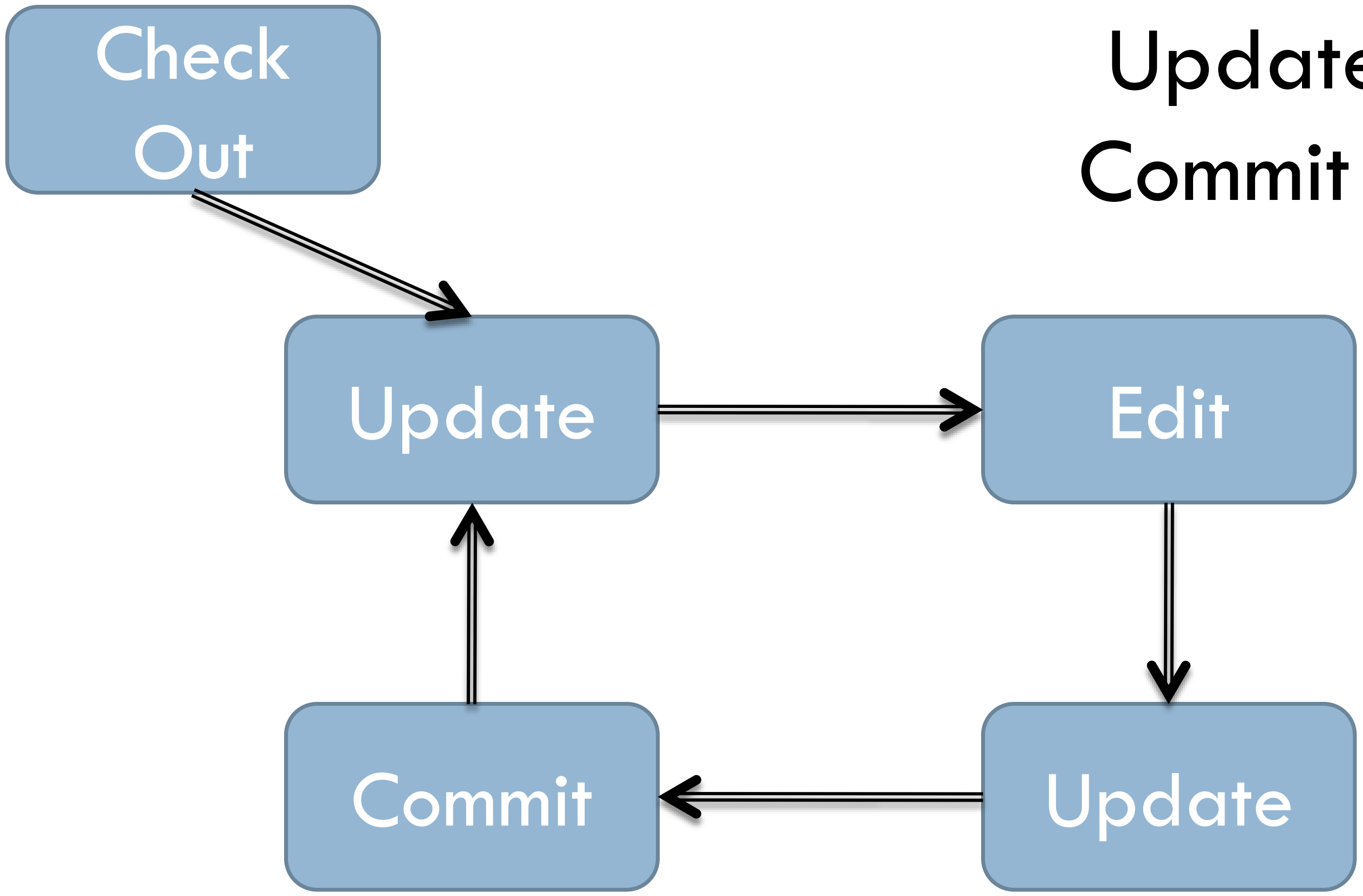
*Commit*: send a snapshot of changes to the repository

# Version Control Steps—Update



*Update*: make working copy reflect changes from repository

# The Version Control Cycle



Update and Commit often!

If you're stuck, get help and see http://www.rose-hulman.edu/class/csse/resources/Subclipse//installation.htm

## Check out today's exercise

- Go to the SVN Repository view at the bottom of the workbench
  - If it is not there, Window→Show View→Other→SVN Repositories→OK
- Browse SVN Repository view for Session07 project
- Right-click it, and choose Check Out
- Confirm all of the options presented
- In Package Explorer, find distance.py inside your Session07 project
- Add your name to comments, and commit your changes

## Why functions?

- A function allows us to group together several statements and give them a name by which they may be invoked.
  - Abstraction (easier to remember the name than the code)
  - Compactness (avoids duplicate code)
  - Flexibility (parameters allow variation)
- Example:

```
def complain(complaint):
    print "Customer:", complaint
```

Q4

## Functions in different realms

We compare the mechanisms for defining and invoking functions in three different settings:

- Standard mathematical notation
- Maple
- Python

# Functions in Mathematics

- Define a function:
  - $f(x) = x^2 - 5$

Formal Parameter. Used so that we have a name to use for the argument in the function's formula.

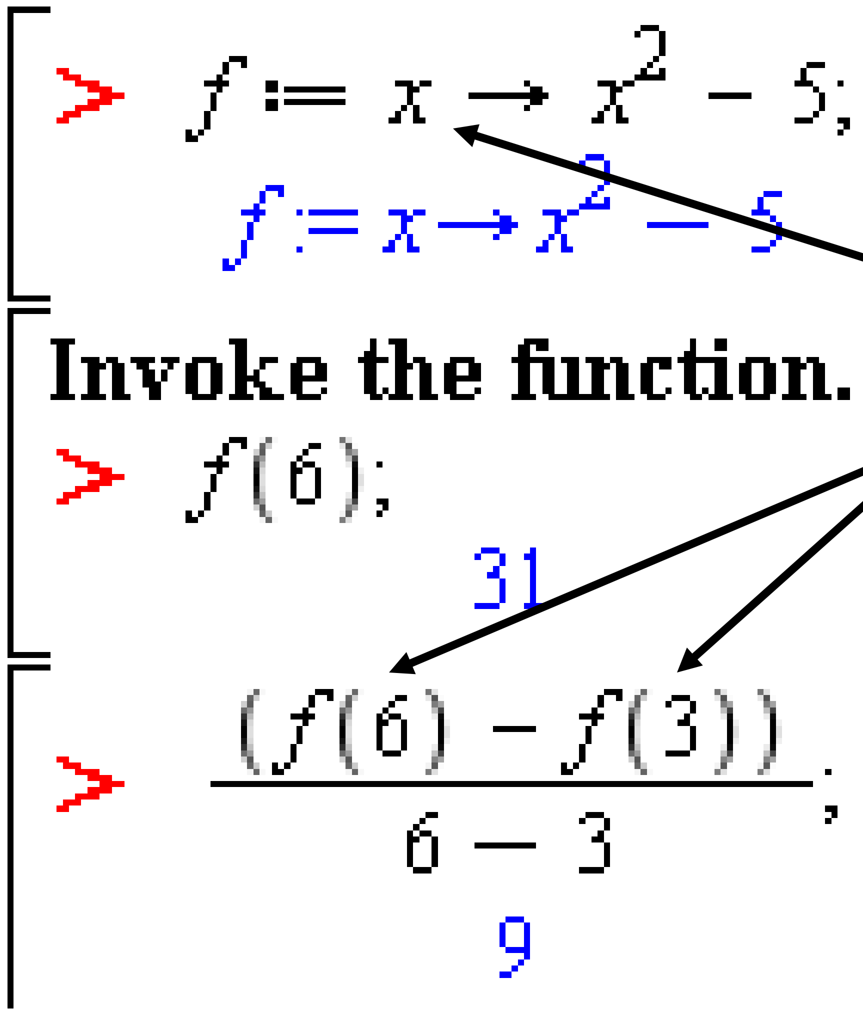
- Invoke (call) the function:
  - $$\frac{f(6) - f(3)}{6 - 3}$$

Two calls to function **f**. The first with actual parameter 6, and the second with 3.

- When the call f(6) is made, the actual parameter 6 is substituted for the formal parameter x, so that the value is $6^2 - 5$.

Q5

## Functions in Maple



> $f := x \rightarrow x^2 - 5;$

$$f := x \rightarrow x^2 - 5$$

**Invoke the function.**

> $f(6);$

$$31$$

> $\dfrac{(f(6) - f(3))}{6 - 3};$

$$9$$

Formal Parameter. Used so that we have a name to use for the argument in the function's formula.

Two calls to function **f**. The first with actual parameter 6, and the second with 3.

# Functions in Python

-
  ```
  >>> def f(x):
          return x*x - 5

  >>> f(6)
  31
  >>> (f(6) - f(3)) / (6 - 3)
  9
  >>>
  ```

  Formal Parameter. Used so that we have a name to use for the argument in the function's formula.

  Two calls to function **f**. The first with actual parameter 6, and the second with 3.

  - How would you evaluate **f(f(2))**?
- In Mathematics, functions calculate a value.
- In Python we can also define functions that instead *do something*, such as print some values.

Q6

## Review: Parts of a Function Definition

```
>>> def hello():
        print "Hello"
        print "I'd like to complain about this parrot"
```

*Defining* a function called "hello"

Indenting tells interpreter that these lines are part of the hello function

Blank line tells interpreter that we're done defining the hello function

## Review: Defining vs. Invoking

- Defining a function says what the function should do
- Invoking a function makes that happen
  - Parentheses tell interpreter to invoke the function

```
>>> hello()
Hello
I'd like to complain about this parrot
```

Q7

## Review: Function with a Parameter

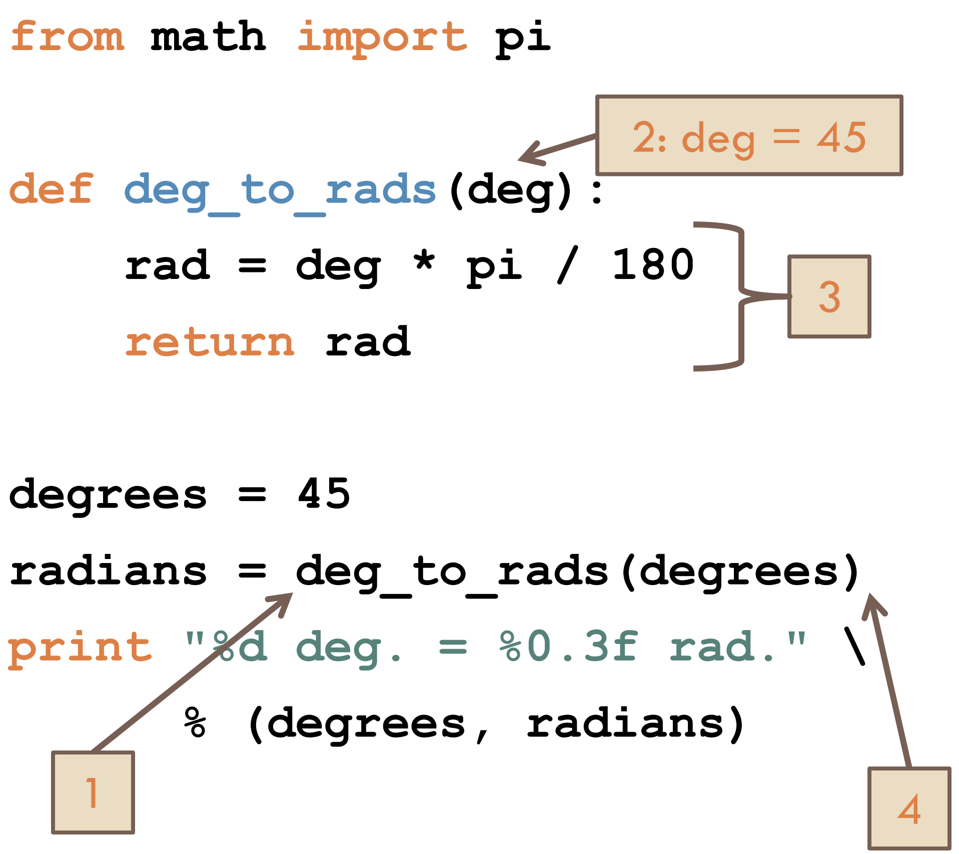
- def complain(complaint):

```
print "Customer: I purchased this parrot not half " +
        "an hour ago from this very boutique"
print "Owner: Oh yes, the Norwegian Blue. " +
       " What's wrong with it?"
print "Customer:", complaint
```

- invocation:
  - complain("It's dead!")

# When a function is invoked (called), Python follows a four-step process:

1. Calling program pauses at the point of the call
2. Formal parameters get assigned the values supplied by the actual parameters
3. Body of the function is executed
4. Control returns to the point in calling program just after where the function was called



```
from math import pi

def deg_to_rads(deg):
    rad = deg * pi / 180
    return rad

degrees = 45
radians = deg_to_rads(degrees)
print "%d deg. = %0.3f rad." \
      % (degrees, radians)
```

## Functions can (and often should) return values

- We've **written** functions that just do things
  - hello()
  - complain(complaint)
- We've **used** functions that *return* values
  - abs(-1)
  - fn_root_1 = math.sqrt(b*b – 4*a*c)
- Define a function that returns a value

```
def square(x):
        return x * x
```

$\leftarrow$ *return statement*

Why might it be better to **return** than **print** when a function performs a calculation?

**Q8**

## Exercise – writing a `distance()` function

- Go to the Session07 project you checked out in Eclipse
- Notice that we gave you test code!
- Add a comment at the top of the file to say what the program does
- Write and test a `distance` function:

  -
    ```
    def distance(p1, p2):
        """Parameters are Points, returns distance between them."""
    ```
- Should the function return anything?
- When you have it working, commit your code back to your repository

# If a Function Calls a Function …

```
def g(a,b):
    print a+b, a-b

def f(x, y):
    g(x, y)
    g(x+1, y-1)

f(10, 6)
```

- Trace what happens when the last line of this code executes
- Now do the **similar** one on the quiz

**Q9**

## An exercise in code reading

- With a partner, read and try to understand the code that is on the handout.
- You can probably guess what the output will be. But how does it work?
- Figure that out, discuss it with your partner and answer quiz question 9.
- Optional Challenge Problem for later: try to write "There's a Hole in the Bottom of the Sea" or "The Green Grass Grew All Around" in a similar style.
- When you are done, turn in your quiz and start HW

Q10-11