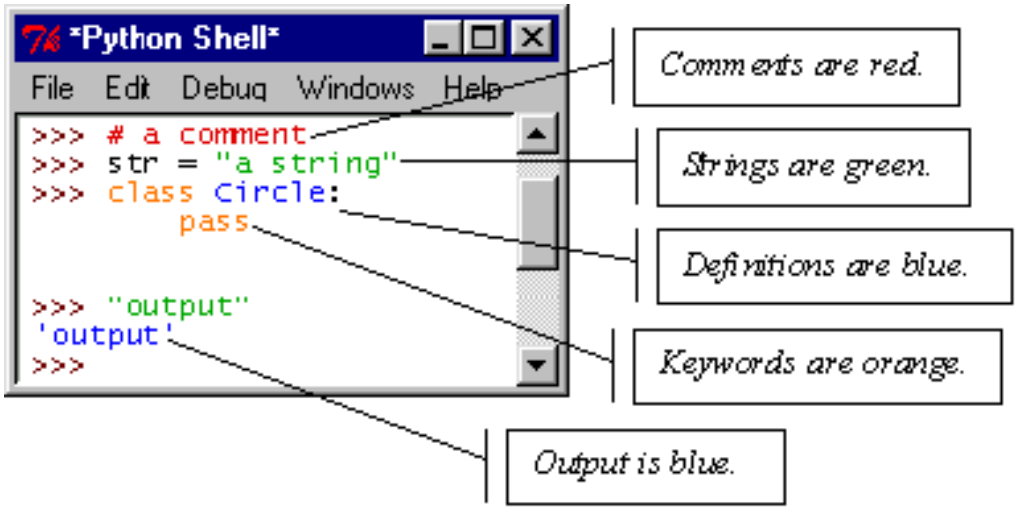
Python Interfaces

- IDLE – a cross-platform Python development environment
- PythonWin – a Windows only interface to Python
- Python Shell – running 'python' from the Command Line opens this interactive shell
- For the exercises, we'll use IDLE, but you can try them all and pick a favorite

IDLE – Development Environment

- IDLE helps you program in Python by:
  - color-coding your program code
  - debugging
  - auto-indent
  - interactive shell

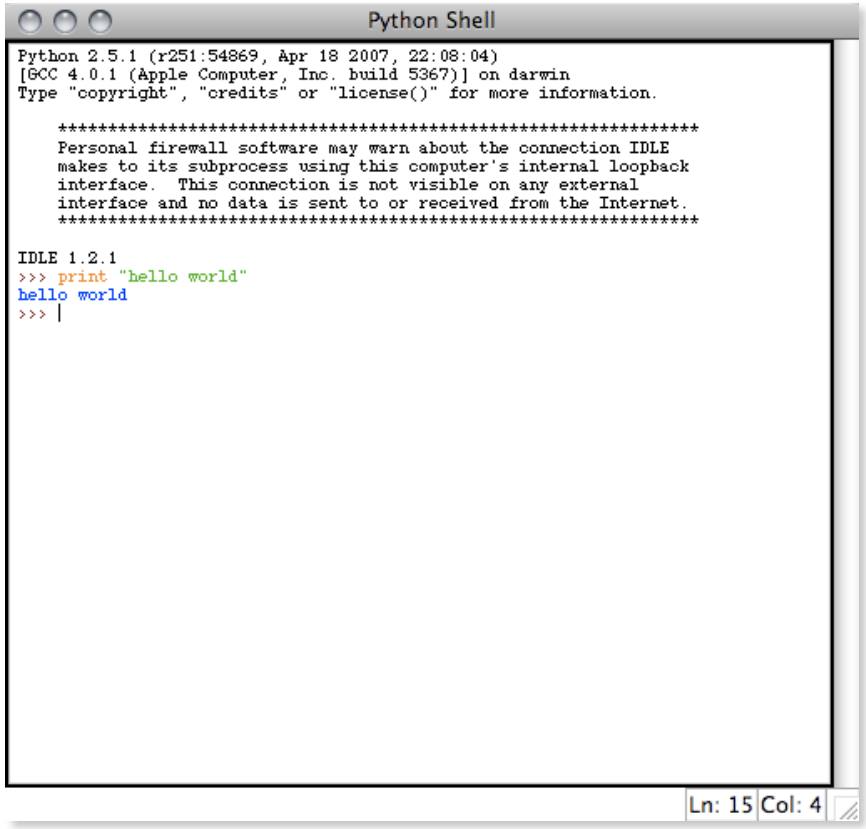


Example Python

- Hello World

```
print "hello world"
```

- Prints hello world to standard out
- Open IDLE and try it out yourself
- Follow along using IDLE

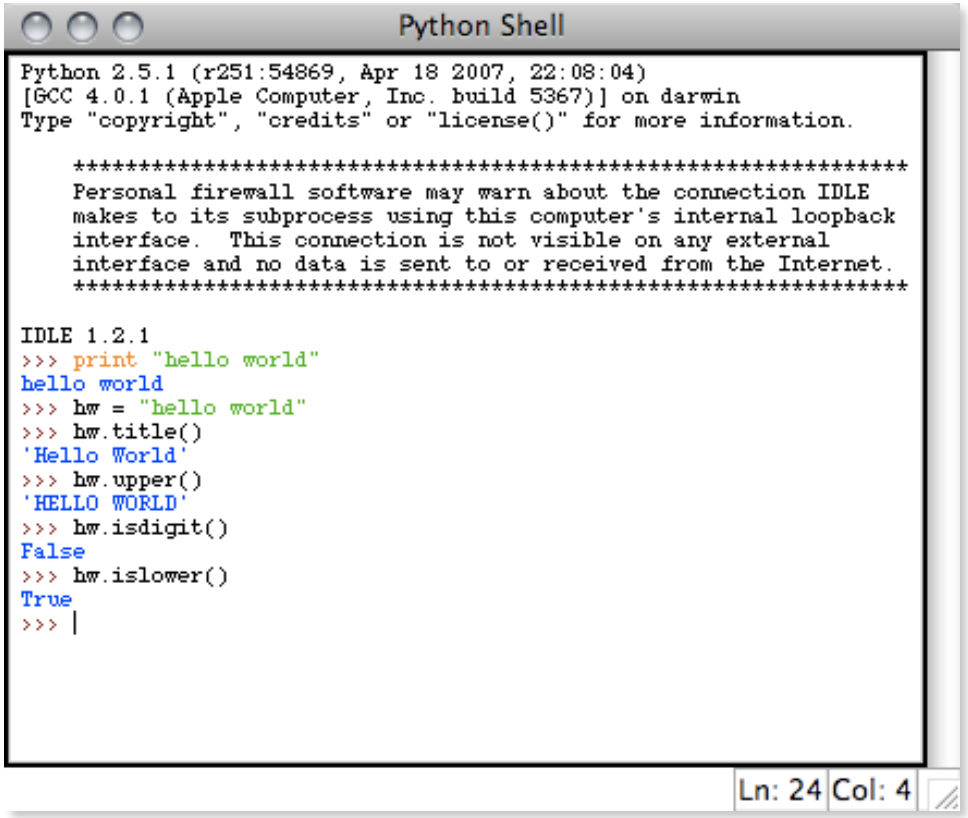


More than just printing

- Python is an object oriented language
- Practically everything can be treated as an object
- “hello world” is a string
- Strings, as objects, have methods that return the result of a function on the string

String Methods

- Assign a string to a variable
- In this case "`hw`"
- `hw.title()`
- `hw.upper()`
- `hw.isdigit()`
- `hw.islower()`



String Methods

- The string held in your variable remains the same
- The method returns an altered string
- Changing the variable requires reassignment
  - `hw = hw.upper()`
  - `hw` now equals “HELLO WORLD”

Other Python Objects

- Lists (mutable sets of strings)
  - `var = [] # create list`
  - `var = [‘one’, 2, ‘three’, ‘banana’]`
- Tuples (immutable sets)
  - `var = (‘one’, 2, ‘three’, ‘banana’)`
- Dictionaries (associative arrays or ‘hashes’)
  - `var = {} # create dictionary`
  - `var = {‘lat’: 40.20547, ‘lon’: -74.76322}`
  - `var[‘lat’] = 40.2054`
- Each has its own set of methods

Lists

- Think of a list as a stack of cards, on which your information is written
- The information stays in the order you place it in until you modify that order
- Methods return a string or subset of the list or modify the list to add or remove components
- Written as var[*index*], index refers to order within set (think card number, starting at 0)
- You can step through lists as part of a loop

List Methods

- Adding to the List
  - var[*n*] = *object*
    - replaces *n* with *object*
  - var.append(*object*)
    - adds *object* to the end of the list
- Removing from the List
  - var[*n*] = []
    - empties contents of card, but preserves order
  - var.remove(*n*)
    - removes card at *n*
  - var.pop(*n*)
    - removes *n* and returns its value

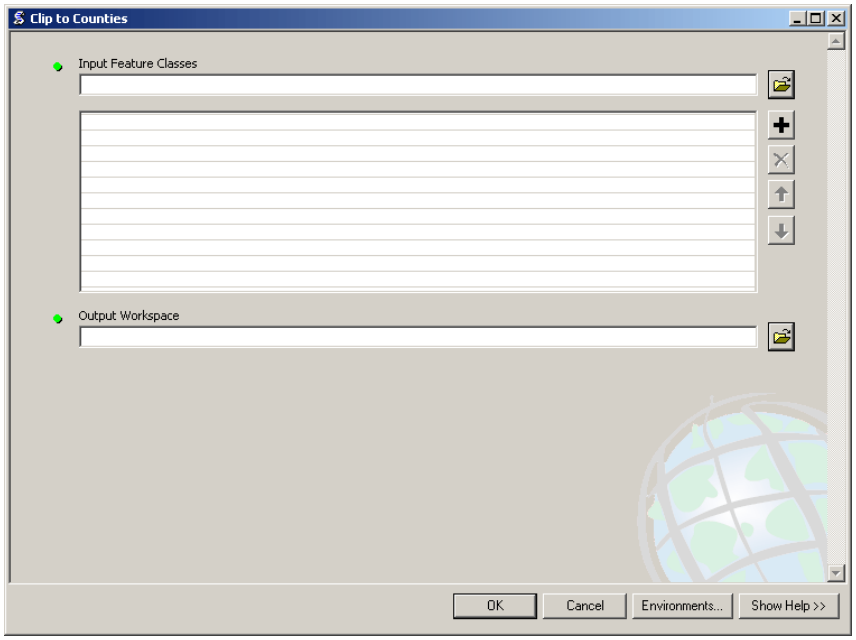
Lists in ArcToolbox

You will create lists:

- Layers as inputs
- Attributes to match
- Arrays of objects

You will work with lists:

- List of field names
- List of selected features



Tuples

- Like a list, tuples are iterable arrays of objects
- Tuples are immutable –
  once created, unchangeable
- To add or remove items, you must redeclare
- Example uses of tuples
  - County Names
  - Land Use Codes
  - Ordered set of functions

Dictionaries

- Dictionaries are sets of key & value pairs
- Allows you to identify values by a descriptive name instead of order in a list
- Keys are unordered unless explicitly sorted
- Keys are unique:
  - var[‘item’] = “apple”
  - var[‘item’] = “banana”
  - print var[‘item’] prints just banana

Conditional Branching

- if and else

```
if variable == condition:
        #do something based on v == c
else:
        #do something based on v != c
```

- elif allows for additional branching

```
if condition:
elif another condition:
…
else: #none of the above
```

Looping with For

- For allows you to loop over a block of code a set number of times
- For is great for manipulating lists:

```
a = ['cat', 'window', 'defenestrate']
for x in a:
    print x, len(x)
```

Results:

```
cat 3
window 6
defenestrate 12
```

Looping with For

- We could use a for loop to perform geoprocessing tasks on each layer in a list
- We could get a list of features in a feature class and loop over each, checking attributes
- Anything in a sequence or list can be used in a For loop
- Just be sure not to modify the list while looping

Modules

- Modules are additional pieces of code that further extend Python's functionality
- A module typically has a specific function
  - additional math functions, databases, network…
- Python comes with many useful modules
- *arcgisscripting* is the module we will use to load ArcGIS toolbox functions into Python

Modules

- Modules are accessed using import
  - import sys, os # imports two modules
- Modules can have subsets of functions
  - os.path is a subset within os
- Modules are then addressed by modulename.function()
  - sys.argv # list of arguments
  - filename = os.path.splitext("points.txt")
  - filename[1] # equals ".txt"

Files

- Files are manipulated by creating a file object
  - f = open("points.txt", "r")
- The file object then has new methods
  - print f.readline() *# prints line from file*
- Files can be accessed to read or write
  - f = open("output.txt", "w")
  - f.write("Important Output!")
- Files are iterable objects, like lists

Error Capture

- Check for type assignment errors, items not in a list, etc.
- Try & Except

```
try:
    a block of code that might have an error
except:
    code to execute if an error occurs in "try"
```

- Allows for graceful failure – important in ArcGIS

Additional Python Resources

- Python Homepage
  http://www.python.org/
- Dive Into Python
  http://www.diveintopython.org/
- Learning Python, 3rd Edition
  http://www.oreilly.com/catalog/9780596513986/
- Getting Started Writing Geoprocessing Scripts
  Available on ESRI's support page