

CS35L – Winter 2019

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| Slide set: | 3.2 |
| Slide topics: | Python |
| Assignment: | 3 |

What is Python?

- Not just a scripting language
- Object-Oriented language
 - Classes
 - Member functions
- Compiled and interpreted
 - Python code is compiled to bytecode
 - Bytecode interpreted by Python interpreter
- Not as fast as C but easy to learn, read and use
- Very popular at Google and other big companies

Why is it popular?

- Uses English keywords frequently where other use different punctuation symbols
- Fewer Syntactical Constructions
- Automatic Garbage Collection
- Easy integration with other programming languages

Different Modes

- Interactive:
 - Run commands on the python shell without actually writing a script/program.
- Script Mode:
 - Type a set of commands into a script
 - Execute all the commands at once by running the script

Python Variables

Case sensitive

Start with `_` (underscore) or letters followed by other letters, underscores or digits

Other special characters are not allowed as part of the variable name

Certain reserved words may not be used as variable names on their own unless concatenated with other words

Example: Python Variables

Python Script:

```
#!/usr/bin/python
```

```
counter = 100    # An integer assignment
```

```
miles = 1000.0   # A floating point
```

```
name = "John"    # A string
```

```
print(counter)
```

```
print(miles)
```

```
print(name)
```

Output:

100

1000.0

John

Python Lines and Indentation

No braces to indicate blocks of code for class and function definitions or flow control

Blocks of code are denoted by line indentation, which is why it is strictly enforced

Number of spaces for indentation may be variable but all the statements within the same block must be equally indented

Hence, a single space has the ability to change the meaning of the code

Python Decision Making

```
#!/usr/bin/python  
var = 100  
if ( var == 100 ) :  
    print("Correct")  
print("Good bye!")
```

Python List

- Common data structure in Python
- A python list is like a C array but much more:
 - **Dynamic (mutable)**: expands as new items are added
 - **Heterogeneous**: can hold objects of different types
- How to access elements?
 - `List_name[index]`

Example

- `>>> t = [123, 3.0, 'hello!']`
- `>>> print t[0]`
 - 123
- `>>> print t[1]`
 - 3.0
- `>>> print t[2]`
 - hello!

Example – Merging Lists

- `>>> list1 = [1, 2, 3, 4]`
- `>>> list2 = [5, 6, 7, 8]`
- `>>> merged_list = list1 + list2`
- `>>> print(merged_list)`
 - Output: `[1, 2, 3, 4, 5, 6, 7, 8]`

Python Dictionary

- Essentially a hash table
 - Provides key-value (pair) storage capability
- Instantiation:
 - `d = {}`
 - This creates an EMPTY dictionary
- Keys are unique, values are not!
 - Keys must be immutable (strings, numbers, tuples)

Example

```
d = {}  
d['france'] = "paris"  
d['japan'] = "tokyo"  
print(d['france'])  
  
d['germany'] = "berlin"  
if (d['france'] == "paris"):  
    print("Correct!")  
else:  
    print("Wrong!")  
del d['france']  
del d
```

for loops

```
list1 = ['Mary', 'had', 'a', 'little', 'lamb']
```

```
for i in list1:  
    print i
```

Result:

Mary
had
a
little
lamb

```
for i in range(len(list1)):  
    print i
```

Result:

0
1
2
3
4

I/O Basics

The *raw_input([prompt])* function reads one line from standard input and returns it as a string (removing the trailing newline)

- *s = raw_input("Enter your input: ");*
- *print("Received input is : ", s)*

The *input([prompt])* function is equivalent to *raw_input*, except that it assumes the input is a valid Python expression and returns the evaluated result to you.

- *str = input("Enter your input: ");*
- *print("Received input is : ", str)*

Functions

A function is a block of organized, reusable code that is used to perform a single, related action. They provide better modularity for your application and a high degree of code reusing.

Syntax:

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

```
    #code inside the function
```

Functions examples

Example 1:

```
def printme(new_string): #string is a parameter
    #This prints a passed string into this function
    print new_string
    return
```

Example 2: To print sum of numbers in a list

```
def find_sum(new_list):
    sum=0 #initialize variable*
    for element in new_list:
        sum = sum + element
    return sum #returns the computed sum

answer_variable=find_sum([2,3,4,5]) #function call
print answer_variable
```

* # are used for putting comments

Task 1

Take a list `a = [1,1,2,3,5,8,13,21,34,55,89]` and write a program that prints out all the elements of the list that are less than 5

Instead of printing the elements one by one, make a new list that has all the elements less than 5 from this list in it and print out this new list.

Ask the user for a number and return a list that contains only elements from the original list `a` that are smaller than that number given by the user

Task 2

Write a program that accepts sequence of newlines from the user as input till the user gets bored. (The user gets bored when he/she presses Enter twice)

Hint: to detect if Enter is pressed twice (in other terms - the user input is void)

Suppose your input string name is 's' just type:

if s:

**#write code to capitalize (s.upper()) this input string 's' and append it
#to a 'new_list'**

Now, print all the elements of this 'new_list'

Suppose the following input is supplied to the program:

Hello world

Practice makes perfect

Task 3

Write a Python program to get a string made of the first 2 and the last 2 chars from a given a string.

Sample String : 'w3resource'

Expected Result : 'w3ce'

Sample String : 'w3'

Expected Result : 'w3w3'

Task 4

Create a python dictionary with the following keys and values:

“Names” : [“Mickey”, “Minnie”]

“Mickey” : [“UCLA”, “Bachelor Degree”]

“Minnie” : [“UCB”, “Bachelor Degree”]

The values in the dictionary are in the form of a list.

Now traverse the list whose key is ‘Names’ and for every element in this list, find the corresponding key (eg. ‘Mickey’). Append the word “Computer Science” to the value (eg. the list of ‘Mickey’) of that particular key.

Now create a new key-value pair for “DonaldDuck” - [“Stanford”, “PhD”, “Computer Science”]. Add the name ‘DonaldDuck’ to the ‘Names’ list as well.

Optparse Library

- Powerful library for parsing command-line options
 - **Argument:**
 - String entered on the command line and passed in to the script
 - Elements of `sys.argv[1:]` (`sys.argv[0]` is the name of the program being executed)
 - **Option:**
 - An argument that supplies extra information to customize the execution of a program
 - **Option Argument:**
 - An argument that follows an option and is closely associated with it. It is consumed from the argument list when the option is

Homework 3

- randline.py script
 - Input: a file and a number n
 - Output: n random lines from *file*
 - Get familiar with language + understand what code does
 - Answer some questions about script (Q3, Q4)
- Implement shuf utility in python

Running randline.py

- Run it
 - `./randline.py -n 3 filename` (need execute permission)
 - `python randline.py -n 3 filename` (no execute permission)
- randline.py has 3 command-line arguments:
 - filename: file to choose lines from
 - **argument** to script
 - n: specifies the number of lines to write
 - **option**
 - 3: number of lines
 - **option argument** to n
- Output: 3 random lines from the input file

shuf.py

Support the options for shuf

- --echo (-e)
- --head-count (-n)
- --repeat (-r)
- --help

Support all type of arguments

- File names and – for stdin
- Any number of non-option arguments

Error handling

Homework 3

- shuf.py – this should end up working almost exactly like the utility ‘shuf’
 - Check `$ man shuf` for extensive documentation
- Use randline.py as a starting point!
 - Modify to accomplish logical task of shuf
- shuf C source code :
 - Present in coreutils
 - This will give you an idea of the logic behind the operation that shuf executes
- Python argparse module instead of optparse:
 - How to add your own options to the parser
 - `-e -n --repeat --echo` etc

Homework 3 Hints

- If you are unsure of how something should be output, run a test using existing shuf utility!
 - Create your own test inputs
- The shuf option --repeat is Boolean
 - Which action should you use?
- Q4: Python 3 vs. Python 2
 - Look up “automatic tuple unpacking”
- Python 3 is installed in /usr/local/cs/bin
 - `export PATH=/usr/local/cs/bin:$PATH`

Python Walk-Through

```
#!/usr/bin/python
```

Tells the shell which interpreter to use

```
import random, sys
```

```
from optparse import OptionParser
```

Import statements, similar to include statements

```
class randline:
```

Import OptionParser class from optparse module

```
    def __init__(self, filename):
```

```
        f = open (filename, 'r')
```

```
        self.lines = f.readlines()
```

```
        f.close ()
```

The beginning of the class statement: randline

The constructor

Creates a file handle

Reads the file into a list of strings called lines

Close the file

```
    def chooseline(self):
```

```
        return random.choice(self.lines)
```

The beginning of a function belonging to randline

```
def main():
```

```
    version_msg = "%prog 2.0"
```

Randomly select a number between 0 and the size of lines and returns the line corresponding to the randomly selected number

```
    usage_msg = """%prog [OPTION]...
```

```
FILE Output randomly selected lines
from FILE."""
```

The beginning of main function

version message

usage message

Python Walk-Through

```
parser = OptionParser(version=version_msg,
                      usage=usage_msg)
parser.add_option("-n", "--numlines",
                  action="store", dest="numlines",
                  default=1, help="output NUMLINES
                  lines (default 1)")

options, args = parser.parse_args(sys.argv[1:])

try:
    numlines = int(options.numlines)
except:
    parser.error("invalid NUMLINES: {0}".
                format(options.numlines))

if numlines < 0:
    parser.error("negative count: {0}".
                format(numlines))

if len(args) != 1:
    parser.error("wrong number of operands")

input_file = args[0]
try:
    generator = randline(input_file)
    for index in range(numlines):
        sys.stdout.write(generator.chooseline())
except IOError as (errno, strerror):
    parser.error("I/O error({0}): {1}".
                format(errno, strerror))

if __name__ == "__main__":
    main()
```

Creates OptionParser instance

Start defining options, action “store” tells optparse to take next argument and store to the right destination which is “numlines”. **Set the default value of “numlines” to 1 and help message.**

options: an object containing all option args

args: list of positional args leftover after parsing options

Try block

get numline from options and convert to integer

Exception handling

error message if numlines is not integer type, replace {0} w/ input

If numlines is negative

error message

If length of args is not 1 (no file name or more than one file name)

error message

Assign the first and only argument to variable input_file

Try block

instantiate randline object with parameter input_file

for loop, iterate from 0 to numlines – 1

print the randomly chosen line

Exception handling

error message in the format of “I/O error (errno):strerror

In order to make the Python file a standalone program