INFO 450 Fall 2020

Week 6

Agenda

- None
- json - remix
- function deep dive
  - Really deep dive
- Errors and Exceptions

- hackerrank

None

The sole value of the type NoneType. None is frequently used to represent the absence of a value, as when default arguments are not passed to a function. Assignments to None are illegal and raise a SyntaxError.

https://docs.python.org/3/library/constants.html

```
$ python3
Python 3.8.5 (default, Jul 21 2020, 10:48:26)
[Clang 11.0.3 (clang-1103.0.32.62)] on darwin
Type "help", "copyright", "credits"    "license"     more information.
>>>       = 3
  File "<stdin>", line 1
SyntaxError: cannot assign to
>>> x =
>>> x
>>>    x ==      :
...     print("Hi")
...
Hi
>>>    x: print("Hi")
...
>>>
>>>        x:  print("Hello")
...
Hello
```

Load and Dump JSON

Reiteration of last week:

```
>>> my_data = {"key1": "value1", "key2": "value2"}
>>> my_data
{'key1': 'value1', 'key2': 'value2'}
>>>        json
>>> my_string = json.dumps(my_data)
>>> my_string
'{"key1": "value1", "key2": "value2"}'
>>> my_new_data = json.loads(my_string)
>>> my_new_data
{'key1': 'value1', 'key2': 'value2'}
```

Functions

Let's deep dive into functions so we can understand the homework assignments and online practices.

- A function is an executable statement.
- Its execution binds the function name in the current local namespace to a function object
- The function definition does not execute the function body; this gets executed only when the function is called.
- Functions can have required and optional parameters with default values.
- Function names must be unique within a given scope

https://docs.python.org/3/tutorial/controlflow.html#defining-functions

Defining a function

- The keyword `def` introduces a function definition.
- It must be followed by the function name and the parenthesized list of formal parameters. The statements that form the body of the function start at the next line, and must be indented.

The first statement of the function body can optionally be a string literal; this string literal is the function's documentation string, or docstring. (More about docstrings can be found in the section Documentation Strings.)

- There are tools which use docstrings to automatically produce online or printed documentation, or to let the user interactively browse through code; it's good practice to include docstrings in code that you write, so make a habit of it.

Function to print a help menu

help.py

```
        ():
    print("To use this program, execute it with a python3.7+ interpreter")

   __name__ == "__main__":
    help()
    h = help
    h()
```

```
$ python3 help.py
To use this program, execute it with a python3.7+ interpreter
To use this program, execute it with a python3.7+ interpreter
```

Yes! You can assign a function 'name' to a variable if you want.

Function with a parameter

- Required parameters are listed in the paranthesis.
- Multiple parameters must be comma separated.

```
       logging
# create logger
logging.basicConfig(format='%(levelname)s: %(message)s', level=logging.DEBUG)

       (n):
    first = 0
    second = 1
        x    range(n):
        print(first)
        first, second = second, first+second

   __name__ == "__main__":
    logging.debug("Calling fib(3)")
    fib(3)
    logging.debug("Calling fib(8)")
    fib(8)
```

Output of fib

```
$ python3 fib.py
DEBUG: Calling fib(3)
0
1
1
DEBUG: Calling fib(8)
0
1
1
2
3
5
8
13
```

Multiple parameters

Comma separated to allow multiple values to be passed into a function

add_them.py

```
       logging
# create logger
logging.basicConfig(format='%(levelname)s: %(message)s', level=logging.DEBUG)

            (first, second):
           first + second

  __name__ == "__main__":
    logging.debug("add_them(1, 2)")
    logging.debug(add_them(1, 2))
    logging.debug("add_them(3, 4)")
    logging.debug(add_them(3, 4))
    logging.debug("add_them(\"dog\", \"type\")")
    logging.debug(add_them("dog", "type"))
```

```
$ python3 add_them.py
DEBUG: add_them(1, 2)
DEBUG: 3
DEBUG: add_them(3, 4)
DEBUG: 7
DEBUG: add_them("dog", "type")
DEBUG: dogtype
```

Optional Parameters

hello_world.py

```
       logging
# create logger
logging.basicConfig(format='%(levelname)s: %(message)s', level=logging.DEBUG)

              (name=None):
          name:
        print("Hello, World!")
       :
        print(f"Hello, {name}!")

  __name__ == "__main__":
    logging.debug("No parameters.")
    hello_world()
    logging.debug("Explicit None")
    hello_world(    )
    logging.debug("Chris")
    hello_world('Chris')
    logging.debug("name=\"Mom\"")
    hello_world(name='Mom')
```

```
$ python3 hello_world.py
DEBUG: No parameters.
Hello, World!
DEBUG: Explicit None
Hello, World!
DEBUG: Chris
Hello, Chris!
DEBUG: name="Mom"
Hello, Mom!
```

Mix and Match

parrot.py

```
       logging
# create logger

          (voltage, state='a stiff', action='voom', type='Norwegian Blue'):
    print("-- This parrot wouldn't", action, end=' ')
    print("if you put", voltage, "volts through it.")
    print("-- Lovely plumage, the", type)
    print("-- It's", state, "!")

   __name__ == "__main__":
    parrot(1000)                                          # 1 positional argument
    parrot(voltage=1000)                                  # 1 keyword argument
    parrot(voltage=1000000, action='VOOOOOM')             # 2 keyword arguments
    parrot(action='VOOOOOM', voltage=1000000)             # 2 keyword arguments
    parrot('a million', 'bereft of life', 'jump')         # 3 positional arguments
    parrot('a thousand', state='pushing up the daisies')  # 1 positional, 1 keyword

    #The following fail
    # parrot()                     # required argument missing
    # parrot(voltage=5.0, 'dead')  # non-keyword argument after a keyword argument
    # parrot(110, voltage=220)     # duplicate value for the same argument
    # parrot(actor='John Cleese')  # unknown keyword argument
```

Execute parrot.py

```
$ python3 parrot.py
-- This parrot wouldn't voom if you put 1000 volts through it.
-- Lovely plumage, the Norwegian Blue
-- It's a stiff !
-- This parrot wouldn't voom if you put 1000 volts through it.
-- Lovely plumage, the Norwegian Blue
-- It's a stiff !
-- This parrot wouldn't VOOOOOM if you put 1000000 volts through it.
-- Lovely plumage, the Norwegian Blue
-- It's a stiff !
-- This parrot wouldn't VOOOOOM if you put 1000000 volts through it.
-- Lovely plumage, the Norwegian Blue
-- It's a stiff !
-- This parrot wouldn't jump if you put a million volts through it.
-- Lovely plumage, the Norwegian Blue
-- It's bereft of life !
-- This parrot wouldn't voom if you put a thousand volts through it.
-- Lovely plumage, the Norwegian Blue
-- It's pushing up the daisies !
```

Returning values from a function

add_them.py

```
       logging
# create logger
logging.basicConfig(format='%(levelname)s: %(message)s', level=logging.DEBUG)

            (first, second):
           first + second

   __name__ == "__main__":
    logging.debug("add_them(1, 2)")
    logging.debug(add_them(1, 2))
    logging.debug("add_them(3, 4)")
    logging.debug(add_them(3, 4))
    logging.debug("add_them(\"dog\", \"type\")")
    logging.debug(add_them("dog", "type"))
```

```
$ python3 add_them.py
DEBUG: add_them(1, 2)
DEBUG: 3
DEBUG: add_them(3, 4)
DEBUG: 7
DEBUG: add_them("dog", "type")
DEBUG: dogtype
```

- Return values can be of any type
- Return values can be None

Empty return statements are essentially None

return_none.py

```
       logging
# create logger
logging.basicConfig(format='%(levelname)s: %(message)s', level=logging.DEBUG)

               ():



                ():



   __name__ == "__main__":
    a = return_none()
    logging.debug(a)
    b = empty_return()
    logging.debug(b)
```

```
$ python3 return_none.py
DEBUG: None
DEBUG: None
```

Returning multiple values

multiple_return.py

```
       logging
# create logger
logging.basicConfig(format='%(levelname)s: %(message)s', level=logging.DEBUG)

                 ():
          1, 2, 3

  __name__ == "__main__":
    logging.debug("All: ")
    a, b, c = return_multiple()
    logging.debug(a)
    logging.debug(b)
    logging.debug(c)

    logging.debug("only first")
    x, _, _ = return_multiple()
    logging.debug(x)

    logging.debug("what it does")
    d = return_multiple()
    logging.debug(d)
```

```
$ python3 multiple_return.py
DEBUG: All:
DEBUG: 1
DEBUG: 2
DEBUG: 3
DEBUG: only first
DEBUG: 1
DEBUG: what it does
DEBUG: (1, 2, 3)
```

Errors and Exceptions

- Syntax Errors
- Exceptions

Syntax Errors

Syntax errors, also known as parsing errors, are perhaps the most common kind of complaint you get while you are still learning Python:

```
>>>
>>>      True print('Hello world')
  File "<stdin>", line 1
         True print('Hello world')
                  ^
SyntaxError: invalid syntax
```

The parser repeats the offending line and displays a little ‘arrow’ pointing at the earliest point in the line where the error was detected.

The error is caused by (or at least detected at) the token preceding the arrow: in the example, the error is detected at the function print(), since a colon (':') is missing before it.

File name and line number are printed so you know where to look in case the input came from a script.

Exceptions

Even if a statement or expression is syntactically correct, it may cause an error when an attempt is made to execute it.

Errors detected during execution are called exceptions and are not unconditionally fatal: you will soon learn how to handle them in Python programs.

Most exceptions are not handled by programs, however, and result in error messages as shown here:

```
>>> 10 * (1/0)
Traceback (most recent call last):
  File "<stdin>", line 1,    <module>
ZeroDivisionError: division by zero
>>> 4 + spam*3
Traceback (most recent call last):
  File "<stdin>", line 1,    <module>
NameError: name 'spam'       defined
>>> '2' + 2
Traceback (most recent call last):
  File "<stdin>", line 1,    <module>
TypeError: Can't convert 'int' object to str implicitly
```

Handling Exceptions

It is possible to write programs that handle selected exceptions.

Look at the following example, which asks the user for input until a valid integer has been entered.

```
>>>           :
...        :
...         x = int(input("Please enter a number: "))
...
...           ValueError:
...         print("Oops!  That was no valid number.  Try again...")
...
```

fake_number.py

```
          :
       :
        x = int(input("Please enter a number: "))

          ValueError:
        print("Oops!  That was no valid number.  Try again...")
```

```
$ python fake_number.py
Please enter a number: asdf
Oops!  That was no valid number.  Try again...
Please enter a number: 333
```

```
$ python fake_number.py
Please enter a number: alskdjf
Oops!  That was no valid number.  Try again...
Please enter a number: fdslakj
Oops!  That was no valid number.  Try again...
Please enter a number: ^CTraceback (most recent call last):
  File "fake_number.py", line 3,    <module>
    x = int(input("Please enter a number: "))
KeyboardInterrupt
```

- The user to interrupt the program (using Control-C or whatever the operating system supports); note that a user-generated interruption is signalled by raising the KeyboardInterrupt exception.

Can handle multiple Exception types

```
...       (RuntimeError, TypeError, NameError):
...
```

Handle 'other' Exceptions

```
       sys

   :
    f = open('myfile.txt')
    s = f.readline()
    i = int(s.strip())
      OSError    err:
    print("OS error: {0}".format(err))
      ValueError:
    print("Could not convert data to an integer.")
      :
    print("Unexpected error:", sys.exc_info()[0])
```

Exception information

```
>>>    :
...           Exception('spam', 'eggs')
...        Exception    inst:
...     print(type(inst))    # the exception instance
...     print(inst.args)     # arguments stored in .args
...     print(inst)          # __str__ allows args to be printed directly,
...                          # but may be overridden in exception subclasses
...     x, y = inst.args     # unpack args
...     print('x =', x)
...     print('y =', y)
...
<      '         '>
('spam', 'eggs')
('spam', 'eggs')
  =
  =
```

Clean up actions

The try statement has another optional clause which is intended to define clean-up actions that must be executed under all circumstances.

```
>>>    :
...          KeyboardInterrupt
...       :
...     print('Goodbye, world!')
...
Goodbye, world!
KeyboardInterrupt
Traceback (most recent call last):
  File "<stdin>", line 2,    <module>
```

Command Line Arguments

Common utility scripts often need to process command line arguments.

These arguments are stored in the sys module’s argv attribute as a list.

For instance the following output results from running

```
$ python3 command_line.py one two three
```

command_line.py

```
       sys
print(sys.argv)
```

at the command line:

```
$ python3 command_line.py one two three
['command_line.py', 'one', 'two', 'three']
```

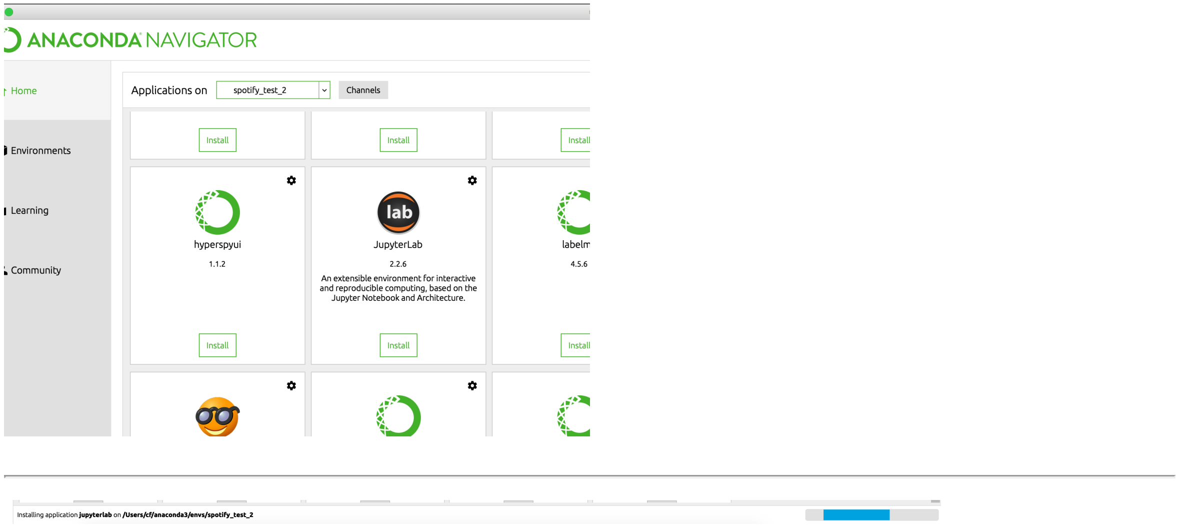
`sys.argv` is a `list` representing the command line.

`sys.argv[0]` == python file name

`sys.argv[1+]` == optional, and other parameters

Jupyter Notebooks

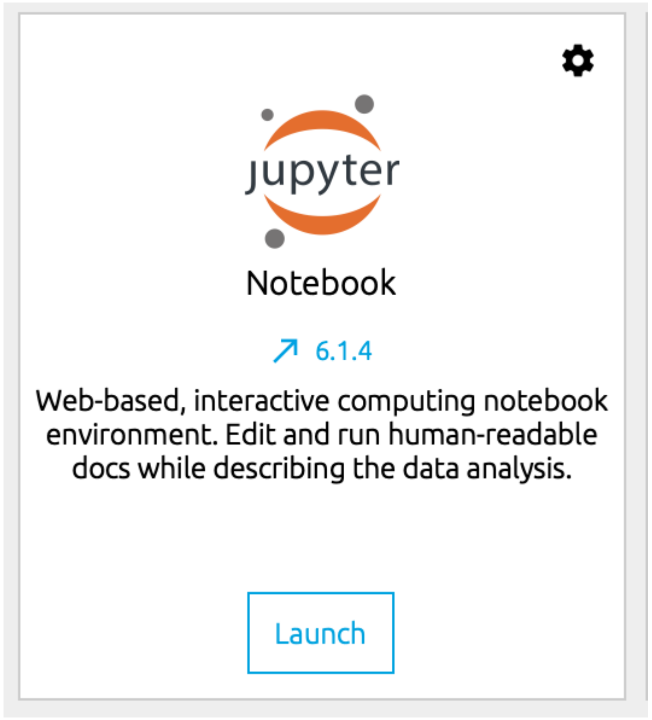
The Jupyter Notebook application allows you to create and edit documents that display the input and output of a Python language script. Once saved, you can share these files with others.



An extensible environment for interactive and reproducible computing, based on the Jupyter Notebook and Architecture.

Installing application **jupyterlab** on **/Users/cf/anaconda3/envs/spotify_test_2**

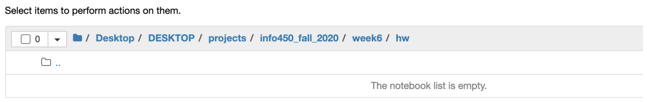
Launch



Web-based, interactive computing notebook environment. Edit and run human-readable docs while describing the data analysis.

- First few times I tried this it didn't work. I updated my Anaconda environment, restarted, and it worked.

Browse



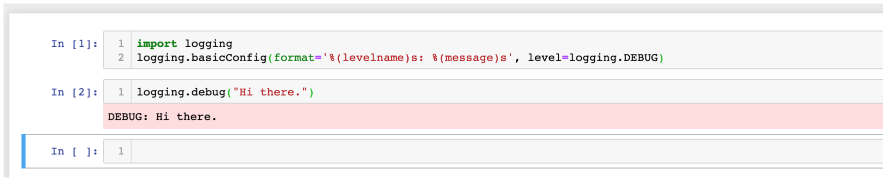
Select items to perform actions on them.

/ Desktop / DESKTOP / projects / info450_fall_2020 / week6 / hw

..

The notebook list is empty.

- New -> Python3



```
In [1]: import logging
        logging.basicConfig(format='%(levelname)s: %(message)s', level=logging.DEBUG)

In [2]: logging.debug("Hi there.")

DEBUG: Hi there.

In [ ]:
```

You can 'rename' your notebook to be something... like `fib` which results in a file called `fib.ipynb`

HOMEWORK

Due Wed, Sept 30, 11:59:59PM Eastern.

In github:

github.com/[yourname]/[yourrepo]/week6/fib.ipynb

Submit in Canvas

Make Three cells

First cell, logging

Second cell, Fibonacci function from before:

`def fib(n)` from slides

Third cell,

```
fib(2)
fib(10)
fib(20)
```

That's it!