Python Crash Course Review (Part II)

1. Lists and other sequences

from math import pi
[]  # empty list
a = [-7, 1., 'you', 3]  # list (mutable)
B = [[1, 2, 3], pi, 2]  # nested list
c = (1,2)  # tuple (immutable)
d = 1,2  # tuple
e = 'numerical differential equations'  # string

Change the first element of a to a[0] = 10 and try to change the first element of c to c[0]=10.

print(a, c, d)
print('a+B: ',a+B)  # concatenating two lists

Write two lists i=[1,2,3], j=[5] and concatenate i and j.

1.a) Basics Indexing/Slicing (in Python list/array indices start with 0, in Matlab with 1)

print(e[0])
print(B, "\n", B[0][2])  # indexing a nested list

v = list(range(10))
print(v,"\n", v[-1],"\n", v[0:2],"\n", v[2:])

Create a new list n = [0,3,6,9] from v by specifying a suitable set of indices n=v[start:stop:step].
https://stackoverflow.com/questions/509211/understanding-slice-notation

1.b) Indexing n dimensional arrays

import numpy as np
A = np.array([[0,1,2],[3,4,5]])
print("A =\n",A)
print(A.shape)
Find 3 (or 5) ways to create the array $A[:,0]=[0,1,2]$ from $A$.

1.c Assemble an nd-array from nested lists of blocks

```python
B = np.array([[6,7,8],
              [9,10,11]])
C = np.block([[A],
              [B]])
print(C)
```

1.c Extract a submatrix using indexing arrays

```python
i = np.array([0,1])
j = np.array([0,1])
C = np.ix_(i, j)
print(C)
```

Find the 'scipy.docs.org' reference describing the 'numpy.ix_' function.

2. Functions

2.a) Defining a function with two arguments which returns $f(x,y)=\sqrt{x}+\exp(y)$.
(Remember code block indentation)

```python
def f(x, y):
    from math import sqrt, exp        # 4 empty spaces
    return sqrt(x)+exp(y)
print(f(0,0), f(1,1))
```
2.b) Always add a docstring to your python program.

```python
def g(x=0, y=None): # initialized parameter
    ''' demo function ''' # docstring
    from math import sqrt, exp
    #z = 2 # local variable z
    return z, sqrt(x)+exp(y)
```

2.c) What is the scope of a variable (local/global)?

```python
z = 4 # global variable z
print(g(0,0)) # global variable z
print(z)
```

Uncomment z=2 in the function g.

```python
help(g)
```

2.d) A python script file that calls its function, main scope

```python
def greet():
    print("Hello World")

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

3. PEPs and more in-depth tutorials

- The [Zen of Python](https://docs.python.org/) and [Style Guide for Python Code](https://docs.python-guide.org/)
- [https://docs.python-guide.org/intro/learning/](https://docs.python-guide.org/intro/learning/)
- [http://www.davekuhlman.org/pythonbook01.html](http://www.davekuhlman.org/pythonbook01.html)