Python - Lists

Lists can have different types of elements, e.g. all integers or a mix of floats, strings, etc.

```
>>> r = [ 1,  2.5, 3+9j, “hello”]
```

Alternatively, you can first define a number of variables and then create the list:

```
>>> x = 1
>>> y=2.5
>>> z=3+9j
>>> a=”hello”
>>> r = [x, y, z, a]
```

If you now change the values of x, y, z, or a, the list r will NOT change.

Take a few minutes to try the above situation.

Each element in a list is indexed from 0 to the number of elements minus 1:
r[0] r[1] r[2] …..

To use them in the code, you could write:

```
>>> from math import sqrt
>>> length = sqrt(r[0]**2 + r[1]**2)
>>> print(length)
```

You can re change the individual values of each element:

```
>>> r[1]=3.0
>>> print r
```

```
>>> total = sum(r)
>>>  print(total)
```

The number of list elements can be determined with:

```
>>>print len(r)
```

The function map takes the elements in the list and creates a different list:

```
>>> rsqrt = map(sqrt,r)
```

In older Python versions, use:

```
>>> rsqrt = list(map(sqrt,r))
```

Adding new elements to a list is done with:

```
>>> r.append(5.5)
```

We can usually start with an empty list:

```
>>> r = []
```

Then start adding elements:

```
>>> r.append(1.0)
>>> r.append(1.5)
>>> r.append(-2.2)
>>> print r
```

If you want to delete elements in the list, use pop. To remove the last element:

```
>>> r.pop()
```

To remove the third element in the list use:

```
>>> r.pop(2)
```

Python - Arrays

Arrays in python are very similar to the ones encountered in other programming languages. The number of elements is fixed and they are all of the same type (e.g. integer or float). Arrays can be two-dimensional and the usual matrix operations will work with arrays.

To create an array:

1D

```
>>> from numpy import zeros
>>> a = zeros(4,float)
print(a)
```

2D – m x n

```
>>> from numpy import zeros
>>> a = zeros([m,n],float)
print(a)
```

Note instead of zeros use ones and empty from numpy.

Changing values of array elements:

```
>>> a[0,0] = 4
>>> a[0,1] = 1
```

Reading an array from a file:
Suppose you have a file in your computer named values.txt which contain the following lines:
1.0
1.5
-2.2
2.6

To read them into python:
>>> from numpy import loadtxt
>>> a = loadtxt("values.txt",float)
>>> print a

Repeat the above but now passing a file with a 3 x 4 list of numbers.

Use the function array in number to generate a new matrix:

M = array([[1,1,4],[2,2,3]],int)

Explore the following concepts:

- dot
- copy (in numpy)
- size (M.size)
- shape (M.shape)
- slicing an array or list: slice = list[2:5] or subM = M[3:6]; OR slice = list[2:] or subM = M[3:]