Data Types

In computer programming, a data type is a classification identifying one of various types that data can have. In this simple, short introduction I will mainly be using Python as an example, but the general idea is the same in all computer languages.

The most common data type we will see in this class are:

- **integers** : *int*
- **booleans** : *bool*
- **floating point** : *float*
- **strings** : *str*

Integers are the classic cardinal numbers: ... `-3, -2, -1, 0, 1, 2, 3, 4,` ...

Booleans types can only have one of two values: `True` or `False`. In many languages 0 is considered `False`, and any other value is considered `True`.

Floating Point are numbers with a decimal point: `1.2, 34.98, -67,23354435,` ...

Strings can be composed of one or more characters: `'a', 'spam', 'spam spam eggs and spam'`. Usually quotes (') are used to specify a string. For example `'12'` would refer to the string, not the integer.

Collections of Data Types

Scalar: A single value of any data type.

List: A collection of values. May be mixed data types. `(1, 2.34, 'Spam', True)` including lists of lists: `(1, (1,2,3), (3,4))`

Array: A collection of values. **Must** be same data type. `[1,2,3,4]` `or` `[1.2, 4.5, 2.6]` `or` `[True, False, False]` `or` `['Spam', 'Eggs', 'Spam']`

Matrix: A multi-dimensional array: `[[1,2], [3,4]]` (an array of arrays).

Indexing

Indexing is a way to refer to a specific piece of a list or array. This piece may be one *element* or a range of *elements*.

In nearly all computer languages, indexing is *zero-based*. This means that the first element of a list or array is the 0th element.

In `python` the last element of a list or array is the -1 element. This is not as common in other languages, but is *very* useful.

```
X = (1, 2.3, True, 'Spam')

X[0] = 1
X[1] = 2.3
X[2] = True
X[3] = 'Spam'

X[0:2] = (1, 2.3)
X[2:] = (True, 'Spam')

  Python ONLY:

    X[-1] = 'Spam'
    X[-2] = True
    X[-3] = 2.3
    X[-4] = 1


Y = [ [1,2] , [3,4] ]

Y[0] = [1,2]

Y[0][0] = 1
Y[0][1] = 2

Y[1] = [3,4]

Y[1][0] = 3
Y[1][1] = 4
```