**Class 20**

**Key Ideas**

* Most of NumPy is based on arrays
* Arrays are data structures that store values (elements) that are all the same type
* Arrays have dimensions, which are also called axes
* An array with one dimension is either a row or column, sometimes called a vector
* Arrays can be indexed; array indices begin with 0
* Two dimensional arrays look like a table, with both rows and columns
* All of the rows in a 2D array must store the same number of elements
* Arrays with two or more dimensions are frequently called matrices
* A scalar is a single value, which has dimension of 0
* Arrays can be indexed and sliced
* NumPy has logical indexing, in which Boolean expressions can be used to index into an array
* There are methods that can change the shape of arrays
* There are methods that combine (concatenate) arrays

**Built-ins**

**Functions**

**array**: creates an array

**arange**: creates an array using a range

**linspace**: creates an array in which the elements are linearly spaced within a specified range

**zeros**: creates an array of all 0’s

**ones**: creates an array of all 1’s

**full**: creates an array of all n’s, where n can be specified, or an array in which each row is specified

**vstack**: vertically stacks, or concatenates, arrays

**hstack**: horizontally stacks arrays

**Methods**

**dtype**: returns the type of the elements in an array

**ndim**: returns the number of dimensions

**shape**: returns the lengths of the axes as a tuple

**size**: returns the number of elements in an array

**random.default\_rng**: creates a random number generator

**random**: creates random floats

**integers**: creates random integers

**reshape**: reshapes an array into an array with different dimensions, but the same number of elements as the original; does not modify the original

**resize**: reshapes an array into an array with different dimensions, but the same number of elements as the original; does modify the original

**ravel**: flattens an n-dimensional array into a 1D array, one row at a time

**T**: transposes an array (interchanges rows and columns)

**Assessment Questions**

(T/**F**) Array indices begin at 1, not 0

(T/**F**) Rows in two dimensional arrays can have varying number of elements