**Class 21**

**Key Ideas**

* NumPy has functions, known as ufuncs, to which entire arrays can be passed
* Aggregation functions perform operations either on entire arrays or by axis (rows or columns)
* Scalar operations involve an array and a scalar
* Array operations are operations that are performed element by element on two arrays that have the same dimensions
* Matrix multiplication has a very specific meaning, and can only be performed if the dimensions are correct
* To multiply a matrix A by a matrix B, the number of columns of A must be the same as the number of rows of B
* Square matrices have the same number of rows and columns
* The diagonal of a square matrix is the set of elements whose row and column indices are the same
* In a diagonal matrix, all of the numbers that are not on the diagonal are 0’s
* An Identity matrix is a diagonal matrix in which all of the numbers on the diagonal are 1’s
* A square matrix is symmetric if the numbers opposite the diagonal are the same
* Assigning one array variable to another creates a reference, not a new array
* A deep copy creates a new array

**Built-ins**

**NumPy Functions**

Trig Functions: **sin**, **cos**, **tan**, etc.

**sqrt**: square root

**abs**: absolute value

Aggregation functions: **min**, **max**, **mean**, **median**, **std**, **var**, **sum**, **prod**

**diag**: creates a diagonal matrix from a 1D array or list, or returns the diagonal of a diagonal matrix

**eye**: creates an Identity matrix

**Operators**

+, -, \*. /, //, \*\*, etc. for scalar operations and for array operations

@ Matrix multiplication

**Assessment Questions**

**(T**/F): In order to perform array operations, the two arrays must have the same dimensions

(T/**F**): In order to perform matrix multiplication, the two arrays must have the same dimensions