**Sorting Algorithms**

**What is a sorting algorithm?**

* **Data:** a collection of information stored in a similar location such as an array or some other Data Structure
* **Data** will always be in the form of **numerical** or **alphanumeric** values

A List can be in two different states:

* **Sorted** (data is sorted by some order)
* **Unsorted** (data is not in any particular order)

**Sorting Algorithm:**

* A function used to rearrange a given array or list of elements **according to a comparison operator** (<, >, =, etc.) on the elements

**Why Sort?**

* Having a **sorted list** allows you to gain a lot more from that data than you would be able to otherwise
  + **Binary Search** (much faster than linear search)
* This is used in password databases, checking in and out of hotels, hospitals, etc.
* Having a sorted list allows you to gain a lot more information from the data than you would be able to otherwise (**median, mode, get the Kth largest element in O(1) time** [accessing a list], **conduct a frequency distribution**)

**How to Use/Create a Sorting Algorithm:**

* **Comparison Sorts:**
  + Sort a set of data by continually comparing the elements near each other in the list, and **swapping** if necessary
  + listA = [4,19,10]……sort…..[19,4,10]……final sort…..[19,10,4]
  + **Types of Comparison Sorts:**
    - **Selection Sort**
    - **Odd-Even Sort**
    - **Bubble Sort**
    - **Cocktail-Shaker Sort**
    - **Quicksort**
    - **Bitonic Sort**
    - **Heap Sort**
    - **Cycle Sort**
* **Insertion Sorts:**
  + Insertion Sorts go through the list of elements and slowly build the sorted list **one element at a time**
  + **Types of Insertion Sorts:**
    - **Insertion Sort**
    - **Shell Sort**
* **Other Sorting Algorithms:**
  + **Types:**
    - **Merge Sort**
    - **Bucket Sort**
    - **Comb Sort**
* Merge Sort is a recursive sorting algorithm that breaks the list down into smaller and smaller parts, then builds it back up to be sorted
* Bucket Sort is a **Counting Sort** which takes advantage of lists with similar deviations between them, to presort lists into “buckets”
* Comb Sort is an **Exchange Sort** which repeatedly swaps pairs of items in a set of data

**Each algorithm differs in how fast they can sort a list, and how much memory they require to do so.**

* **This is called “Space and Time Efficiency”, or Big O() notation.**