Sorting Algorithms

Fundamentals

- **Sorting** is the process of arranging data in a specific order.
- The most common sorting algorithms are as follows:
  - **Bubble Sort** – Every pair of adjacent items is compared and items are swapped until they are in order.

31	**12**	25	8	→	12	31	25	8
12	**31**	**25**	8	→	12	25	31	8
12	25	**31**	**8**	→	12	25	8	31
12	**25**	8	31	→	12	25	8	31
12	**25**	**8**	31	→	12	8	25	31
12	8	**25**	**31**	→	12	8	25	31
12	**8**	25	31	→	8	12	25	31

  - **Selection Sort** – The smallest unsorted item is chosen and then swapped with the item in the next position to be filled.

31	12	25	**8**	33	17	→	8	12	25	31	33	17
8	**12**	25	31	33	17	→	8	12	25	31	33	17
8	12	**25**	31	33	**17**	→	8	12	17	31	33	25
8	12	17	**31**	33	**25**	→	8	12	17	25	33	31
8	12	17	25	**33**	**31**	→	8	12	17	25	31	33

  - **Insertion Sort** – The comparison applies to adjacent items and previously scanned items.

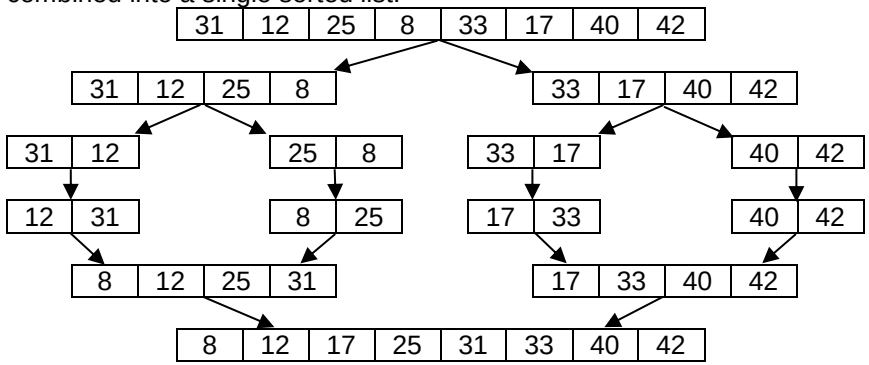
31	**12**	25	8	17	→	12	31	25	8	17
12	**31**	**25**	8	17	→	12	25	31	8	17
12	25	**31**	**8**	17	→	12	25	8	31	17
						12	**25**	**8**	31	17
						12	**8**	25	31	17
						8	12	25	31	17
8	12	25	**31**	**17**	→	8	12	25	17	31
						8	12	**25**	**17**	31
						8	12	17	25	31

  - **Shell Sort** – Items at a specific interval are sorted. The interval between the items is gradually decreasing based on a sequence. The most common sequence is the original sequence by Donald Shell, the inventor of this algorithm, which is N/2, N/4, …, 1, where N is the number of items. Insertion sort is applied when the interval reaches 1.

Intervals: N/2 = 6/2 = 3
N/4 = 6/4 = 1

31	12	25	8	33	17	→	8			31		
31			8			→		12			33	
	12			33		→			17			25
		25			17	→	8	12	17	31	33	25
8	**12**	17	31	33	25	→	8	12	17	31	33	25
8	**12**	**17**	31	33	25	→	8	12	17	31	33	25
8	12	**17**	**31**	33	25	→	8	12	17	31	33	25
8	12	17	**31**	**33**	25	→	8	12	17	31	33	25
8	12	17	31	**33**	**25**	→	8	12	17	31	25	33
							8	12	17	**31**	**25**	33
							8	12	17	25	31	33

  - **Merge Sort** – The list is divided into sorted sub-lists then combined into a single sorted list.



- Easiest way to sort in Java and Python:

Java:
```
ArrayList values = new ArrayList();
Collections.addAll(values, 1, 3, 2);
Collections.sort(values);
```

Python:
```
values = [1, 3, 2]
values.sort()
```

Reference:
Koffman, E. & Wolfgang, P. (2016). *Data structures: Abstraction and design using Java.* Hoboken: John Wiley & Sons, Inc.
Oracle Docs (n.d.). *Citing sources.* Retrieved from https://docs.oracle.com/javase/8/docs/api/java/util/package-summary.html