Sorting (I): Introduction

CSCD 300 – Data Structures

Eastern Washington University

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Sorting [1]

Goal: Given a sequence of numbers, design a computer algorithm to shuffle around the numbers in the sequence, so that after the shuffling process all the numbers in the resulting sequence become in ascending (or descending) order.

[1] https://en.wikipedia.org/wiki/Sorting_algorithm

Note

- If a sorting algorithm can sort the sequence of data into the ascending order, it can also easily sort the same sequence of data into the descending order (why ?).
- The teaching of sorting algorithms will use a sequence of integers as input, but the same sorting algorithms will also be able to sort an input sequence of other data types, as long as those data types are comparable.
- For most sorting algorithms, the input data are assumed being saved in an array. A particular sorting algorithm may or may not be extended for the case where the input data is saved in a different data structure, for example, a linked list. It needs study case by case.
- We will only discuss comparison-based sorting algorithms, in which the working mechanism essentially is based on comparing the numbers in the sequence in some well-designed way: Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort.
- We will NOT discuss non-comparison based sorting algorithms, such as counting sort, bucket sort, radix sort, ...

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Time complexity of a sorting algorithm

- We will analyze the time complexity of a sorting algorithm in the best case and in the worst case.
- We will NOT analyze the time complexity of a sorting algorithm in the average case, which needs knowlege on statistics and probability theory and is out of the scope of this course.

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Extended study

- Non-comparison based sorting: those sorting algorithms are not based on the comparisons between the numbers in the sequence. For example: count sorting, bucket sorting, radix sort, ...
- External sorting: those sorting algorithms work for the data sets that are too large to fit into the main memory.
- Parallel sorting: those sorting algorithms use multiple machines/processors in parallel to speed up the sorting process.
- ...

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