Sorting

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Abstract

As we have learned, sorting algorithms perform two operations: comparisons, to check to see if two pieces of data are in so kind of order, and exchanges, which swap to pieces of data. In this lab you will implement various sorting algorithms and compare the amount of time it takes for them to run. You can use any programming language you want for this assignment.

1 Premise

Implement Insertion Sort, Quicksort, and one other sorting algorithm from the list below.[1]

- Shellsort
- Mergesort
- Heapsort
- Timsort (+7 points EC)

Modify the sorting algorithms to keep track of the number of comparisons performed, the number of exchanges performed, and the total runtime of the algorithm. Click here to see how you can measure the elapsed time in nanoseconds using `System.nanoTime()`.)

2 Testing and Collecting Data

Test your algorithms on differently sized lists or arrays of integers. A good test will have many data points of varying magnitudes. For example, a decent test might test lists that have sizes that are powers of 2s (64, 128, 256, 512, 1024 ...), but don't be afraid to add more data points.

Output your data to a file. It may be useful for you to output your data into a `.csv` file if you plan on using Excel in the next portion.

[1] Remember to cite if you use code from the book or class.

3 Presenting Your Data

Your objective is to present your data in such a way that a non-programmer can tell which algorithms perform better. We will give you a fair amount of freedom here, but my expectation is that if you are collecting a lot of data on big sample sizes, you should output your results to a file so you don't have to run your program for hours in front of us. That will be something you need to look up, but you can find it in Appendix A. Some options include:

- A well formatted table.
- Graphing your data (using a program such as Excel).

4 Grading

20 points Insertion Sort

30 points Quicksort

20 points Third sorting algorithm of student's choice.

15 points Data is collected.

15 points Data is presented in a meaningful way.

7 points Extra Implement Timsort as the third algorithm.