

Homework 8 – Sorting

C++ //

Description

For this assignment we analyze the running time of some sorting algorithms.

Specifications

You will need to complete the following:

1. You will need to implement a few different versions of the quick_sort using the following methods to choose a pivot –
 - a. First element
 - b. Middle element
 - c. Random element
 - d. Median of five
 - e. Media of three (we wrote in class)
2. You will test the running times of the sorting algorithms on different size vectors of random integers. Fill each list with random integers – use the rand() method, but DO NOT compress the size (set each element equal to rand()).
3. You will sort the data using the following algorithms –
 - a. Insertion Sort
 - b. Shell Sort
 - c. Quick Sort (all 5 versions)
 - d. Merge Sort
 - e. Radix Sort
4. You want to test the running time of these algorithms on sorting the data – use the chrono library to get the current timestamp so you can log the running times.
 - a. std::chrono::system_clock::now().time_since_epoch().count()
5. Start with a list of 50K, then 100K, 150K, etc until you reach a limit. Once you reach 1M, then increment the size by 100K. Try to get at least 2M or more elements.
6. For each sorting algorithm, record the running time in an excel table – with rows the sort algorithm and columns the vector size.
7. DO NOT include filling the vector with random data in the running times.
8. After 600K, drop the shell sort, and after 300K drop the insertion sort.
9. After you have all the data, graph the data and write an analysis of your results.
 - a. Graph by vector size, by algorithm, then all together.
10. DO NOT wait to start this assignment, it will take time for the algorithms to run and sort.
11. Choose another student in class and compare your running times, make sure your analysis compares your data with the other data.
12. **BONUS – Reimplement the quick sorting algorithms using the shell sort with a cut off of 5K element – include the running time in your data and analysis.**

Documentation

You will create a document (.docx, .rtf, .pdf) which contains the following:

- Your name and assignment.
- Your written analysis of the running times. Be detailed and explain what your data shows.
- You will need to include your Excel file which should contain all the data and the graphs.

What to Submit

You need to submit your C++ code files along with your document. Make sure your document is in the correct format and all your files include your name and assignment. **ZIP** your C++ code, but **DO NOT** zip your document file.