Advanced Sorts - Sorting Analysis

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1 SUMMARY

The goal of this homework is to produce a report analyzing the strengths and weaknesses of various sorting algorithms. **Note that you are required to have completed the Basic Sorts Module for this homework**

You will perform some experiment(s) by doing the following:

1. Experiment 1: Run an experiment in which you fill an array with random values between 1 and 1,000,000. Time each sorting algorithm (including the basic and advanced sorts). Make sure the list is large enough that comparing the runtimes of the algorithms shows a meaningful difference.

2. Experiment 2: Run each algorithm on a large list of elements that begins in reverse sorted order. How do these results compare with that of experiment 1?

3. Experiment 3: Run each algorithm on a list that is "almost" sorted. Here, by "almost sorted", we mean that each element in the unsorted list is about 5-10 positions away from its correct position, but almost all elements are not in their final position.

4. Experiment 4: Update your code to add a "hybrid sort" that switches algorithms mid-executions. Design this algorithm such that you take advantage of the results obtained

in experiments 1-3. Then, go back and run experiments 1-3 again with your new algorithm. Can you get yoru algorithm to beat all of the others in every experiment?

5. **FILES TO DOWNLOAD:** None

6. **FILES TO SUBMIT:** Sorting Analysis.pdf

For each experiment, make sure that you are sorting large enough lists such that differences in the algorithm speeds begins to show.

1.1 REPORT

Summarize your experiment and your findings in a report. Make sure to adhere to these general guidelines:

- Your submission MUST BE a pdf document. You will receive a zero if it is not.

- Your document MUST be presented as if submitted to a professional publication outlet. You can use the template posted in the course repository or follow Springer's guidelines for conference proceedings.

- You should write your report as if it is original novel research.

- The grammar / spelling / professionalism of this document should be sound.

- When possible, do not use the first person. Instead of "I ran the code 60 times", use "The code was executed 60 times...".

In addition to the general guidelines above, please follow the following rough outline for your paper:

- **Abstract**: Summarize the entire document in a single paragraph

- **Introduction**: Present the problem, and provide details regarding the algorithms you implemented (especially the "hybrid" algorithm).

- **Methods**: Describe your methodology for collecting data. How many method calls, how many executions, how you averaged things, how large were the lists, etc.

- **Results**: Describe your results from your execution runs.

- **Conclusion**: Interpret your results. Which algorithm was fastest in each situation? Did the fastest algorithm change? If so, why? Does the performance you see match the theoretical runtimes of the algorithms? Why or why not?

Lastly, your paper MUST contain the following things:

- A table (methods section) summarizing the experiments and how many execution runs were done in each group.

- At least one table (results section) summarizing the results of all of your experiments.

- Some kind of graph visualizing the results of the table from the previous bullet.