Data Structures and Algorithms

Laboratory 3: Sorting a Vector

Distributed: Wednesday, Feb. 22, 2006
Due: At the start of class, Monday, March 6, 2006.

Goals: To practice extending a class, to learn Java's Comparator interface, and to compare radix sorting with another sort of your choice.

Before you begin: You have read Chapter 5 of your text and reviewed sorting from CSC 182.

Objectives:

• Write a class MyVector as described in Section 5.11. You must use an O(n lg n) sort, any one you wish.

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Remember that the Java code for the structure package is available at Q:\InstructorFiles\Chase_Gene\ds\structure\ Remember also that the Shell sort is not O(n lg n).

• Write a driver program TestMyVector.java that tests MyVector by filling it with random data and then timing how long a sort takes. If any student wishes to contribute his or her sort from CSC 182, that would be nice. If you send me one, I will put it at q:\InstructorFiles\Chase_Gene\ds\sortSample. You may use it if you give proper credit to the author of any code authors found there. Note that the solutions from CSC 182 may not use the Comparator interface as you must here, and maybe not java.util.Random as I'd prefer, so some modifications will be necessary. I may make some corrections and clarifications to the TestSorts.java file, and some additions to accommodate a radix sort, and add a static method radixSort() to the Sorts.java class for you. [Your textbook has an icon in the margin on page 123 that suggests there is a class RadixSort in the package structure. There is not.]

• Gather data on at least three sizes of MyVector that are large enough to generate non-zero sort times using your O(n lg n) sort. Remember that Java's timer is only good to ±10 ms.

• Replace the O(n lg n) sort with a radix sort. Repeat the data gathering for three sizes of MyVector.

• Submit a printed laboratory report using the usual format. Include graphs and tables of your results in the two experiments. Your report should address the following three discussion questions.

1. (Thought Question 1, page 135)

2. (Thought Question 2, page 136)

3. Analysis. In the light of your experiments, does it appear that the time needed to sort with a radix sort agrees with the theoretical discussion given in class? Why do you think it does or does not? Does the time needed to sort with the O(n lg n) sort that you chose agree with theory? Why do you think it does or does not? Be as specific as you can in both cases.

Extra credit: Although you need only present two graphs with three data points on each, one for each of two sorts, if you do additional analysis with other sorts or other kinds of data than random, you are welcome to include your results in your discussion. No extra credit for extra sorts will be given unless you analyze the extra data.

Notes: This is a team assignment. Please put your machine-readable results in your shared team folder.

Hints: You will have to modify the sorts that you use to sort Vectors. As they are set up now, they sort arrays. Get an early start.