

You will submit your solution to this assignment to the Curator System (as HW3). Your solution must be either a plain text file (e.g., NotePad) or a MS Word document; submissions in other formats will not be graded.

Except as noted, credit will only be given if you show relevant work.

1. [25 points] Many operations can be performed faster on sorted data than on unsorted data. For each of the following operations, explain whether it could be performed faster if the data values were sorted (do not take the cost of the sorting into account).
 - a) Checking whether a data set contains two words that are anagrams of each other (e.g., *plum* and *lump*)
 - b) Finding an item that is at least as large as some specified value.
 - c) Computing the average of a set of integers.
 - d) Finding the median of a set of integers.
 - e) Finding the mode of a set of integers (e.g., find the value that occurs the largest number of times).
2. [25 points] As described in the notes, insertion sort goes sequentially through the array when making comparisons to find the proper place for the element that is currently being processed. Suppose that the sequential search is replaced by a binary search. Will the change decrease the big- Θ cost of insertion sort? Explain.
3. [25 points] Suppose that two arrays of N integer values, A and B , are in sorted order. Implement a Java method that will find the median value of $A \cup B$ in $O(\log N)$ time; your solution should conform to the interface:

```
int unionMedian(int[] A, int[] B);
```

You may assume that neither array contains duplicate values, and that $A \cap B = \emptyset$.

4. [25 points] Consider applying radix sort to a collection of N integers in the range from 1,000,000 to 9,999,999.
 - a) Not counting the space needed to store the integers themselves, how many bytes of memory would be required (as a function of N)? Assume pointers/references occupy 4 bytes. Note: radix sort ALWAYS uses a linked structure to store the elements in a bin.
 - b) How many times would radix sort examine each value in the list?