Due at the start of class Thurs, Mar 11, 2004.

Problem 1. Design a sorting algorithm for n elements, where the running time is $O(n+k)$ and k is the number of inversions. An inversion is defined as a pair of elements such that $a_i > a_j$ with $i < j$.

Problem 2. Prove that the sum of the degrees of all the vertices is $2|E|$ where E is the edge set of a graph.

Problem 3. Run the following 3 sorting algorithms on the following set of numbers to show the different ways they sort. Give an exact count of the number of element comparisons that were done.

Bubble Sort
Insertion sort
Quick sort

Set to be sorted: $[17, 3, 15, 4, 7, 9, 5]$.

Problem 4. What is the running time of Heapsort on a heap of length n that is already sorted in increasing order? What about decreasing order?

Problem 5.

1. Is an array in sorted increasing order a Min-Heap? Prove or disprove.
2. Show how the element 8 is inserted in the following table that stores a Max-Heap. $[10, 7, 6, 5, 2, 4, 3]$. Show how this table can be interpreted as a heap and what the table will be after 8 has been inserted.