| CS 278 | **Analysis of Algorithms** | Test 2 |
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| Name: | Summer 2000 | Max Pts: 40 |

**Important**: This is an open book test. You can use any books, notes, or paper. Any calculations and rough work can be done on the back side of the test pages. You will loose five points for not writing your name.

1. [5 pt] Write a recursive function to delete the last element in a linked list.

2. [5 pt] Give upper and lower bounds on the number of leaves in a binary tree with $N$ nodes.

3. [12 pt] What is the maximum number of exchanges involving any particular element during selection sort? What is the average number of exchanges involving an element? Answer the question for insertion sort and bubble sort as well.

4. [8 pt] Show the sorting of the array

$$EASYQUESTION$$

using quicksort with median of three partitioning. Show all the different stages of the array, and clearly illustrate when the partitioning is completed in each recursive step.

5. [5 pt] What are the average and worst case performance characteristics of mergesort? Can the performance be improved by adding a cutoff for small files?

6. [5 pt] The first solution to knapsack that we studied was based on a greedy algorithm, and provided what was claimed to be an optimal solution at that time because of the use of fractional items. Then, we worked with 0/1 knapsack where the fractional quantities were not allowed. For this, we got a solution using dynamic programming algorithm. Now, suppose that we allow fractional quantities in the knapsack. Will the dynamic programming algorithm beat the greedy algorithm in this instance? If yes, why. If not, why not?