Homework #4

Due on Thursday, March 3 before class starts.

1. Apply mergesort to sort a list of numbers 21, 78, 33, 17, 15, 89, 51, 13 in a nondecreasing order. Show the mergesort operation following the example in Figure 5.2 in the textbook. How many comparisons you need for sorting this list? (30 pts)

2. Apply quicksort to sort a list of numbers 21, 78, 33, 17, 15, 89, 51, 13 in a nondecreasing order. You must show the step-by-step quicksort operations following the example in Figure 5.3 in the textbook. A tree of recursive calls with l, r, and pivot positions is required. How many comparisons you need for sorting this list? (35 pts)

3. a. Write a pseudocode for a divide-and-conquer algorithm for the exponentiation problem of computing a^n where $a > 0$ and n is a positive integer. (15 pts)

   b. Set up and solve a recurrence relation for the number of multiplications made by this algorithm. (10 pts)

   c. How does this algorithm compare with the brute-force algorithm for this problem? (5 pts)

   d. How does this algorithm compare with the decrease-and-conquer algorithm for this problem? (5 pts)

Hints: How would you compute a^8 by solving two exponentiation problems of size 4? How about a^9?