Summer 2002 **CMSC 251: Homework 3** Clyde Kruskal

Due at the start of class Friday, June 14, 2002.

Problem 1. Assume your machine has 32 bit words. Assume you can multiply two n word numbers in time $4n^2$ with a standard algorithm. Assume you can multiply two n word numbers in time $15n^{\lg 3}$ with a "fancy" algorithm.

(a) Approximately, how large does n have to be for the fancy algorithm to be better?

(b) How many bits is that?

(c) How many decimal digits is that?

Problem 2. Use the same assumptions as for problem (1), except assume you can multiply two n word numbers in time only $8n^{\lg 3}$ with a "fancy" algorithm.

(a) Approximately, how large does n have to be for the fancy algorithm to be better?

(b) How many bits is that?

(c) How many decimal digits is that?

Problem 3. Selection Sort can be thought of as a recursive algorithm as follows: Find the largest element and put it at the end of the list (to be sorted). Recursively sort the remaining elements.

(a) Write down the recursive version of Selection Sort in psuedocode.

(b) Derive a recurrence for the exact number of comparisons the algorithm uses.

(c) Use the iteration method to solve the recurrence. Simplify as much as possible.

(d) Use mathematical induction to verify your solution.