Homework #1: Algorithm analysis, asymptotic notation
Due Date: Tuesday, 16 April 2002

Reading: Chapters 1-2, Sections 8.1-2, 31.2 in CLR, Chapters 1-3, Sections 7.1-2, 28.2 in CLRS.

Recall that *exercises* are for you to work out on your own; *problems* are to be handed in.

Exercise 1-1. Do Exercise 1.1–3 on page 5 of CLR, 2.1–3 on page 21 of CLRS.

Exercise 1-2. Do Exercise 1.3–5 on page 15 of CLR, 2.3–5 on page 37 of CLRS.

Exercise 1-3. Do Exercise 1.3–6 on page 15 of CLR, 2.3–6 on page 37 of CLRS.

Exercise 1-4. Do Exercise 2.1–1 on page 31 of CLR, 3.1–1 on page 50 of CLRS.

Exercise 1-5. Do Exercise 2.2–5 on page 37 of CLR, 3.2–4 on page 57 of CLRS.

Exercise 1-6. Describe a $\Theta(n \lg n)$ algorithm which, given a set S of n real numbers and another real number x, determines whether or not there exist two elements in S whose sum is exactly x.

Unless otherwise stated, proofs will be required for all claims made on your homework assignments.

Problem 1-1. Do Exercise 1.4–1 on page 17 of CLR, 1.2–2 on page 13 of CLRS. [10 points]

Problem 1-2. Do Problem 1–2 on page 17 of CLR, 2–1 on page 37 of CLRS. [20 points]

Problem 1-3. Do Exercise 2.1–2 on page 31 of CLR, 3.1–2 on page 50 of CLRS. [10 points]

Problem 1-4. Asymptotic relations among common functions [40 points]

Rank the following functions by order of growth, *i.e.*, find an arrangement $g_1, g_2, \ldots, g_{25}$ of the functions such that each pair satisfies either $g_i = \Omega(g_{i+1})$ or $g_i = \Theta(g_{i+1})$ for $i = 1, 2, \ldots, 24$. Justify the relationship between each pair. *Hint:* Read Section 2.2 from the text.

$(3/2)^n$	$(\sqrt{2})^{\lg n}$	$\lg^* n$	n^2	$(\lg n)!$
n^3	$\lg^2 n$	$\lg(n!)$	2^{2^n}	$n^{1/\lg n}$
$\lg\lg n$	$n \cdot 2^n$	$n^{\lg\lg n}$	$\ln n$	2^n
$2^{\lg n}$	$(\lg n)^{\lg n}$	$4^{\lg n}$	$(n+1)!$	$\sqrt{\lg n}$
$n!$	$2^{\sqrt{2\lg n}}$	n	$n \lg n$	1