CS231 Algorithms
Prof. Lyn Turbak
Wellesley College

Handout # 3
January 29, 2001

Problem Set 1
Due: Thursday, February 8

Reading: Carefully read *CLR* Chapters 1 & 2 and Sections 4.1 & 4.2. Skim Chapter 3 and Sections 5.1–5.3.

Sugggested Problems: *CLR* 1.3-6, 1.4-2, 1-1, 1-3 (These are problems from the book that you should think about, but you should not write them up or turn them in! At least one suggested problem will be on each exam. Some suggested problems will be easy while others will be quite challenging!)

Required Problems: You should write up and turn in the solutions to the problems listed below: The points awarded per problem are given in brackets.

Problem 1 [15] *CLR* Problem 2-2 (p. 38).

Problem 2 [25] Do *CLR* Problem 2-3, part a, (pp. 38–39), but for the following 24 functions (not the 30 given in the text):

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

Problem 3 [10]

a. Suppose algorithm A has worst-case running time $O(n)$ and algorithm B has running time $O(n^2)$. What can you say about the relative performance of the algorithms?

b. Repeat part a for running times $\Theta(n)$ and $\Theta(n^2)$.

Problem 4 [10] Find two integer functions $f(n)$ and $g(n)$ such that $f(n)$ is not $O(g(n))$ and $g(n)$ is not $O(f(n))$. (An integer function is a function that maps integers to integers.)

Problem 5 [40] Use the iteration method to solve the following recurrences. In all cases, you may assume that $T(n) = 0$ for $n < 1$. Express your solutions in Θ notation. Show your work. (Note that parts d through g generalize examples discussed in class.)

a. $T(n) = 3T(n/3) + 1$

b. $T(n) = 3T(n/3) + n$

c. $T(n) = 4T(n/2) + n$

d. $T(n) = T(n-k) + 1, k > 0$

e. $T(n) = T(n-k) + n, k > 0$

f. $T(n) = T(a \cdot n) + 1, 0 < a < 1$

g. $T(n) = T(a \cdot n) + n, 0 < a < 1\text{n}$

h. $T(n) = T(a \cdot n) + T(b \cdot n) + n, 0 < (a+b) < 1$

Extra Credit 1[25]. *CLR* Exercise 1.3-7.

Problem Set Header Page
Please make this the first page of your hardcopy submission.

CS231 Problem Set 1
Due Thursday, February 8

Name:

Date & Time Submitted:

Collaborators (*anyone you worked with on the problem set*):

In the **Time** *column, please estimate the time you spend on the parts of this problem set. Please try to be as accurate as possible; this information will help me design future problem sets. I will fill out the* **Score** *column when grading you problem set.*

Part	**Time**	**Score**
General Reading		
Problem 1 [15]		
Problem 2 [25]		
Problem 3 [10]		
Problem 4 [10]		
Problem 5 [40]		
Extra Credit 1 [25]		
Total		