

PROBLEM SET 1
Due: Friday, September 13

Reading: Read CLR Chapters 1 & 2 and Sections 4.1 & 4.2. Skim Chapter 3 and Sections 5.1--5.3.

Suggested Problems: 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 22 functions (not the 30 given in the text):

$(\sqrt{2})^{\lg n}$	n^2	$n!$	n^3	$\lg^2 n$	2^{2^n}
$\ln(\ln n)n \cdot 2^n$	$\ln n$	1	$2^{\lg n}$	$4^{\lg n}$	
$(n+1)!$	$\sqrt{\ln n}$	n	2^n	$n \lg n$	$2^{2^{n+1}}$
$\frac{1}{n}$	2^{n+1}	\sqrt{n}	3^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 (n) and (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. Assume $T(n) = 1$ for $n < 2$. Express your solutions in Θ notation. Show your work. (Note that parts **d** through **g** generalize examples discussed in class.)

- a. $T(n) = 2T(n/2) + 1$
- b. $T(n) = 2T(n/2) + n$
- 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. $T(n) = T(an) + 1, 0 < a < 1$
- g. $T(n) = T(an) + n, 0 < a < 1$
- h. $T(n) = T(an) + T(bn) + n, 0 < (a + b) < 1$

Extra Credit [20] CLR Exercise 1.3-7

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

CS231 Problem Set 1
Due Friday, September 13, 1996

Name:

Date & Time Submitted (*only if late*):

Collaborators (*anyone you collaborated with in the process of doing the problem set*):

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

Part	Time	Score
General Reading		
Problem 1		
Problem 2		
Problem 3		
Problem 4		
Problem 5		
Extra Credit		
Total		