CPS 231 Homework 1

Insertion sort, Mergesort and Growth of Functions

CLRS Chapter 1, 2 and 3

Write and justify your answers on this sheet in the space provided.[1]

Exercises (suggested)

1. (CLRS 2.1-2) How do you modify the $INSERTION - SORT$ procedure to sort into non-increasing instead of non-decreasing order?

2. (CLRS 2.2-4) How can we modify almost any algorithm to have a good best-case running time?

Problems (mandatory)

1. (CLRS 1.2-2) Suppose we are comparing implementations of insertion sort and merge sort on the same machine. For inputs of size n, insertion sort runs in $8n^2$ steps, while merge sort runs in $64n \log n$ steps. For which values of n does insertion sort beat merge sort?

2. (CLRS 1-1) For each function $f(n)$ and time t in the following table, determine the largest size n of a problem that can be solved in time t, assuming that the algorithms to solve the problem takes $f(n)$ microseconds.

	1 second	1 minute	1 day	1 month
n				
n^2				
2^n				

[1] Collaboration is allowed, even encouraged, provided that the names of the collaborators are listed along with the solutions. Write up the solutions on your own.

3. (CLRS 3.1-3) Explain why the statement 'The running time of algorithm A is at least $O(n^2)$' is content free.

4. CLRS 2-4 (The inversion problem).

5. (part of CLRS 3-3) Order the following expressions by their asymptotic growth and **justify your answer.**

$$2^n, n!, (\log n)!, n^3, e^n, 2^{\log_2 n}, n \log n, 2^{2^n}, n^{\log \log n}$$