

HW Assignment 1 (Due date: September 28, Monday)

1. [Sorting Complexity, 5 points] Exercise 1.2-2, page 13.
2. [Running Time, 10 points] Problem 1-1, page 13.
3. [Correctness Proof, 10 points] Exercise 2.1-3, page 21.
4. [Time Complexity, 10 points] Exercise 2.2-3, page 27.
5. [Binary Search, 5 points] Exercise 2.3-5, page 37.
6. [Asymptotic Notation, 5 points] Exercise 3.1-1, page 50.
7. [Asymptotic Notation, 10 points] Prove or disprove:
 - a) $3^{n+1} = O(3^n)$
 - b) $2^{2n} = O(2^n)$
 - c) $3n^2 \lg n + 4n = O(n^3)$
 - d) $3n^2 \lg n + 4n = O(n^2 \lg n)$
 - e) $3n^2 \lg n + 4n = O(n^2 \sqrt{n})$
8. [Asymptotic Notation, 5 points] Prove $\lg(n!) = \theta(n \lg n)$.
(Hint: use Stirling's approximation (on page 55)).
9. [Substitution Method, 15 points]. Show that the solution to:
$$T(6) = 1$$
$$T(n) = 3T(\lfloor n/3 \rfloor + 4) + n, \text{ for } n > 6$$
is $O(n \lg n)$.
10. [Recurrence, 5 points]. Exercise 4.1-6, page 67.
11. [Master Method, 5 points] Exercise 4-3.1, page 75.
12. [Master Method, 5 points] The recurrence $T(n) = 10T(n/3) + n^2$ describes the running time of an algorithm A . A competing algorithm A' has a running time of $T'(n) = aT'(n/9) + n^2$. What is the largest integer value for a such that A' is asymptotically faster than A ?

13. [Recurrence, 20 points] Problem 4-1, page 85.
14. (*) [Binary Search, 5 points] Exercise 2.3-6, page 37.
15. (*) [Design & Analysis, 10 points] Exercise 2.3-7, page 37.