

WEEK 03

1. PREPARATION FOR ASSIGNMENT

If, and *only if* you can truthfully assert the truthfulness of each statement below are you ready to start the assignment.

1.1. Reading Comprehension Self-Check.

- I know that *decrease-and-conquer* is a general algorithm design technique based on exploiting a relationship between a solution to a given instance of a problem and a solution to a smaller instance of the same problem.
- I can give a common example of each of the three major variations of the *decrease-and-conquer* technique.
- I know that *insertion-sort*'s notable advantage is good performance on almost-sorted arrays.
- I know that the *topological sorting problem* for a directed graph has a solution if and only if the graph has no directed cycles.
- I know that an application of topological sorting is resolving symbol dependencies in linkers.
- I know that a *dag* is a directed acyclic graph.
- I know that the *decrease-by-one* technique is a natural approach to developing algorithms for generating elementary combinatorial objects.
- I know that *binary search* is the most important and well-known example of a *decrease-by-a-constant-factor* algorithm.
- I know why the Euclidean GCD algorithm is an excellent example of a *decrease-by-a-variable-size* algorithm.
- I know how to order and have ordered the seven Big- \mathcal{O} efficiency classes shown below from *fastest growing* reference function (first) to *slowest growing* reference function (last):
 - (1) $\mathcal{O}(\log n)$
 - (2) $\mathcal{O}(n!)$
 - (3) $\mathcal{O}(n)$
 - (4) $\mathcal{O}(1)$
 - (5) $\mathcal{O}(2^n)$
 - (6) $\mathcal{O}(n \log n)$
 - (7) $\mathcal{O}(n^2)$

- I know given a $\mathcal{O}(n^3)$ algorithm whose running time for a problem of size 100,000 is 10 seconds what its running time would be for a problem of size 150,000.
- I know given a $\mathcal{O}(1)$ algorithm whose running time for a problem of size 100,000 is 10 seconds what its running time would be for a problem of size 200,000.

1.2. Memory Self-Check.

1.2.1. Algorithm Efficiency Calculation.

- (1) Code and understand a *reduce-by-variable-size* algorithm, without looking at pseudocode, that is an implementation of Euclid's GCD algorithm.
- (2) Write a non-brute-force algorithm to generate all subsets of a set (A power set).
- (3) Write a non-brute-force algorithm that solves the Josephus problem.

2. WEEK 04 EXERCISES

- 2.1. Exercise 7 on page 137.
- 2.2. Exercise 1 on page 142.
- 2.3. Exercise 2 on page 148.
- 2.4. Exercise 1 on page 156.
- 2.5. Exercise 1 on page 166.
- 2.6. Exercise 12 on page 167.

3. WEEK 04 PROBLEMS

- 3.1. Exercise 6 on page 137.
- 3.2. Exercise 10 on page 143. Make sure you write out all the mathematical steps to get the result.
- 3.3. Exercise 12 on page 149.
- 3.4. Exercise 8 on page 156.