

COSC 2123/1285 Algorithms and Analysis
Tutorial 4
Decrease and Conquer Algorithmic Paradigm

Objective

Students who complete this tutorial should:

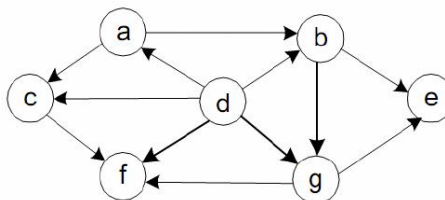
- Be familiar with the three major variations of decrease-and-conquer.
 - Be able to apply decrease-and-conquer strategies to different problem types.
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Questions

4.1.7 Apply insertion sort to sort the list E, X, A, M, P, L, E in alphabetical order.

4.5.12 *Flipping pancakes* There are n pancakes all of different sizes that are stacked on top of each other. You are allowed to slip a flipper under one of the pancakes and flip over the whole stack above the flipper. The purpose is to arrange pancakes according to their size with the biggest at the bottom. Design an algorithm for solving this puzzle.

4.2.5a Apply the source-removal algorithm to solve the topological sorting problem for the following digraph:



4.4.10

- Write a pseudocode for the divide-into-three algorithm for the fake-coin problem. (Make sure that your algorithm handles properly all values of n , not only those that are multiples of 3.)
- Set up a recurrence relation for the number of weighings in the divide-into-three algorithm for the fake-coin problem and solve it for $n = 3^k$
- For large values of n , about how many times faster is this algorithm than the one based on dividing coins into two piles? (Your answer should not depend on n .)

4.1.1 *Ferrying soldiers* A detachment of n soldiers must cross a wide and deep river with no bridge in sight. They notice two 12-year-old boys playing in a rowboat by the shore. The boat is so tiny, however, that it can only hold two boys or one soldier.

- a How can the soldiers get across the river and leave the two boys in joint possession of the boat? Outline the algorithm in plain English.
- b How many times need the boat pass from shore to shore? Give a recurrence relation and solve it.
- c Explain the use of “decrease-and-conquer” in your solution.