Final - Due Tuesday 12/12/2000

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1 Asymptotic Notation

1. Is $n = O(0.2831n)$? (5 pts.)

2. What is the asymptotic relationship between $n^2$ and $n \log^5 n$? (5 pts.)

2 Divide and Conquer


3 Greedy

1. Consider the problem of making change for $n$ cents using the least number of coins.
   
   (a) Describe a greedy procedure to make change consisting of quarters, dimes, nickels and pennies. Prove that your algorithm is correct. (15 pts.)
   
   (b) Give a set of coin denominations for which the greedy strategy fails (10 pts.)

4 Dynamic Programming

1. Assume that $n$ programs are to be stored on two tapes $T_1$ and $T_2$. Let $l_i$ be the length of tape needed to store the $i^{th}$ program. Assume that $\sum_{i=1}^{n} l_i \leq L$, where $L$ is the length of each tape. A program may be stored on on either $T_1$ or $T_2$. If $S_i$ is the set of programs on $T_1$, then the worst-case access time for a program is proportional to $\max\{\sum_{i \in S_i} l_i, \sum_{i \not\in S_i} l_i\}$. Formulate a dynamic programming algorithm to determine the worst case access time of an optimal assignment. Analyze the running time of your algorithm. (25 pts.)

5 Graph Algorithms

1. In class, we studied two algorithms for the All-Pairs shortest path problem. In both cases, we assumed that a negative weight cycle did not exist in the graph. Modify either algorithm to provide a test to detect negative weight cycles. (Note: Do not use Bellman-Ford; it works only for single-source shortest paths.) (20 pts.)