Indian Institute of Technology Jodhpur

CS121 Data Structures and Algorithms

1. You are given n coins denominations $c_1, c_2, \ldots c_n$ where $c > 1$ is an integer. You would like to represent a nonnegative amount x using the smallest possible amount of coins. Develop a greedy algorithm for such task. Does it work when the denominations are not necessarily powers of the same number?

2. You are given a directed graph $G = V, E$ and a weight function $c : E \rightarrow \mathbb{R}^+$. Your task is to find the cheapest paths from 1 to any other vertex, where the cost of a path is:

   - product of all edges costs
   - maximum of all edges costs

3. Use dynamic programming to solve the following problem: given n strings $s_1, s_2, ..., s_n$, find the shortest string S such that all s_i occur in S. For example, if $n = 3$ and $s_1 = aab$, $s_2 = bb$, and $s_3 = baa$, one of the possible solutions is $S = aabbaa$. Running time of your method can (and, probably, should) be exponential, but try to keep it around $O(2^n n)$.

4. Show how to implement the quicksort algorithm, so that it works in place (uses only $O(1)$ additional memory). You are not allowed to use recursion.

5. A sorting algorithm is stable if it does not change the relative order of equal elements. Which of the known (to you) sorting algorithms are stable?