COMP 555 Bioalgorithms

Fall 2012

Problem Set 2

Assigned: Tue Oct 2
Due: Thu Oct 11 (in class)

1. Consider the change problem from Chapter 2. The parameters to this problem are the number of different coins d, the denomination of the coins $c = (c_1, \ldots, c_d)$ with integers $c_1 > c_2 > \cdots > c_d$, and the integer amount $M \geq 0$ to be rendered in coins. **(a)** Give a necessary and sufficient condition on c so that the change problem always has a solution. **(b)** Determine the approximation ratio of the greedy BetterChange algorithm when $c = (25, 20, 10, 5, 1)$ and $0 \leq M \leq 100$. **(c)** Determine the approximation ratio with the same c and arbitrary $M \geq 0$. **(d)** Can you determine an upper bound on the approximation ratio of BetterChange for arbitrary c and $M \geq 0$?

2. Problem 5.4 (pg 143) in the text.

3. Study problem 6.10 (pg 212) in the text. Given a rook on position (i, j) on a chessboard where $1 \leq i, j \leq 8$, define $s(i, j)$ = W if the next player to move can force a win and L if the next player to move cannot force a win. **(a)** Give a recurrence relation to determine $s(i, j)$. **(b)** Show pseudocode to fill in $s(i, j)$ for all i, j. **(c)** Who will win, given the initial condition of the problem? **(d)** Describe the winning strategy.

4. Problem 6.20 (pg 214) in the text.

5. Suppose we are given two strings v, w each of length n. **(a)** Design an algorithm to determine whether the *edit distance* between v and w is less than or equal to a given value $s \ll n$. Your algorithm should have time complexity $O(sn)$. **(b)** Suppose $|v| = n$ and $|w| = m$. Explain how your algorithm can be adapted for this case and give the asymptotic complexity of your algorithm. HINT: use dynamic programming!