Assignment 4

due Wednesday, May 23, 2007

1. exercise 15.2-1, p 338 [6 points]
2. exercise 15.3-5, p 350 [6 points]
3. exercise 15.5-3, p 363 [6 points]

4. Suppose we have coins of denominations \(c_1, c_2, \ldots, c_n\) and want to make change for \(t\) cents. We have an unlimited supply of each coin, and want to know whether it is possible to have a collection of coins that add up to \(t\). For example, if \(c_1 = 5\), \(c_2 = 11\) and \(c_3 = 27\), we can make change for \(t = 59\) (two \(c_3\)'s and one \(c_1\)) but not for \(t = 39\). Write an \(O(n \cdot t)\) algorithm to determine whether it is possible. If it is possible, give the collection of coins that add to \(t\). [8 points]

5. Suppose we have two transmitters, each of which sends out repetitions of some short string. For example, transmitter 1 may repeat string \(x=101\) over and over, so what we will hear from it will be a prefix of \(x^k\) - that is, \(x\) concatenated to itself \(k\) times, possibly with a few bits chopped off the end (as in \(10110110\)). Transmitter 2 repeats another string, \(y\). Our job is to determine if some sequence \(s\) that we have heard is an interleaving of these two transmissions.

For example, suppose transmitter 1 repeats \(x=101\) and transmitter 2 repeats \(y=01\). The sequence \(010111010101\) can be unraveled into \(x\) and \(y\): positions 1, 5, 9, and 12 contain \(0101\), a repetition of \(y\), while the remainder of the string contains \(10110110\), a repetition of \(x\).

Describe an efficient algorithm which takes a sequence \(s\) of length \(n\), and two strings \(x\) and \(y\), and determines if \(s\) is an interleaving of repetitions of \(x\) and \(y\). [8 points]

Total: 34 points