1. exercise 15.2-1, p 338 [6 points]

2. exercise 15.3-5, p 350 [6 points]

3. You are driving to a job interview a very long ways away. Your budget allows you to stay in hotels at distances $a_1 < a_2 < \cdots < a_n$ from your starting point, and the final hotel is where the interview is to be held. Ideally, you want to drive 400 miles a day - if you drive $x$ miles in a day, your penalty for that day is $(400 - x)^2$. Design an algorithm to decide at which hotels to stop in such a way as to minimize the total penalty. (There is no penalty on the last day if you drive less than 400 miles.)

Be sure to

(a) describe the subproblem
(b) give a recurrence for the subproblem
(c) provide pseudo-code showing how a table for the subproblems is filled
(d) give the time and space requirements of your method

[8 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 $t$. [6 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