National Taiwan University
Department of Electrical Engineering
Algorithms, Fall 2009

Handout #7
October 15, 2009
Yao-Wen Chang

Homework #2 (due in class October 29, 2009)

1. Work on (a) Exercise 6.4-1 (page 136), (b) Exercise 7.1-1 (page 148), and (c) Exercise 8.2-1 (page 170) based on the string (array of characters): "*NTUSTUDENTS*". Please mark the three E's as E_1, E_2, and E_3 and the two U's as U_1, and U_2 according to their order in the input, and show their positions during the processing. For (c), assume you have only the 26 characters, $A, B, \ldots, Z$ and thus you may work on the array of the 26 characters.
2. Problem 6-3 (page 143).
3. Problem 7-3 (page 161).
4. Problem 8-4 (page 179).
5. Exercise 9.3-1 (page 192).
6. Exercise 9.3-8 (page 193).
7. Exercise 12.2-1 (b), (d), and (e) (pages 259–260).
8. Problem 12-2 (page 269).
9. Search trees.
   (a) Give the binary search tree that results from successively inserting the keys 9, 10, 2, 1, 7, 6, 8 into an initially empty tree.
   (b) Label each node in the tree with R or B denoting the respective colors RED and BLACK so that the tree is a legal red-block tree.
   (c) Give the red-black tree that results from inserting the key 3 into the tree of (b).
10. Exercise 15.2-1 (page 338).
11. Given a log of wood of length k, Woody the woodcutter will cut it once, in any place you choose, for the price of k dollars. Suppose you have a log of length L, marked to be cut in n different locations labeled $1, 2, \ldots, n$. For simplicity, let indices 0 and $n + 1$ denote the left and right endpoints of the original log of length L. Let the distance of mark i from the left end of the log be d_i, and assume that $0 = d_0 < d_1 < d_2 < \ldots < d_n < d_{n+1} = L$. The wood-cutting problem is the problem of determining the sequence of cuts to the log that will (1) cut the log at all the marked places, and (2) minimize your total payment to Woody.
    (a) Give an example illustrating that two different sequences of cuts to the same marked log can result in two different costs.
    (b) Let $c(i, j)$ be the minimum cost of cutting a log with left endpoint i and right endpoint j at all its marked locations. Suppose the log is cut at position m, somewhere between i and j. Define the recurrence of $c(i, j)$ in terms of i, m, j, d_i, and d_j. Briefly justify your answer.
    (c) Using part (b), give an efficient algorithm to solve the wood-cutting problem. Use a table C of size $(n + 1) \times (n + 1)$ to hold the values $C[i][j] = c(i, j)$. What is the running time of your algorithm?
12. (DIY Problem) For this problem, you are asked to design a problem *set* related to Chapter(s) 6–9, 12, 13, and/or 15 and give a sample solution to your problem set. Grading on this problem will be based upon the *quality* of the designed problem as well as the *correctness* of your sample solution.