San José State University
Department of Computer Science
Sami Khuri

Spring 2014
CS 255
Due: April 3, 2014

Assignment FOUR

Problem 1

Recall the Manhattan Tourist Problem (MTP) we covered in the beginning of the semester.
Describe and analyze an algorithm to solve MTP. Use your algorithm to solve the problem instance of the MTP (Problem 1) of the Interesting Problems handout.

Problem 2

Given keys a, b, c, d, e, f (in this order) having frequencies $10, 3, 4, 7, 15, 4$, respectively, use dynamic programming to find the optimal binary search tree. Draw the resulting tree. What is the average access time for this tree?

Problem 3

Solve the following instance of the $0-1$ knapsack problem using dynamic programming. Also, find the contents of the optimal knapsack from the table. The weights are 1, 2, 3, 5, 6, and 8, the profits are 3, 6, 7, 9, 11, and 18 respectively, and the knapsack capacity is 15.

Problem 4

Use Floyd's algorithm to solve the all-pairs shortest path problem for the instance given by the following matrix of edge costs:

$$\begin{bmatrix} 0 & 3 & 5 & 7 & 4 \\ 3 & 0 & 1 & 6 & 8 \\ 5 & 1 & 0 & 6 & 3 \\ 7 & 6 & 6 & 0 & 2 \\ 4 & 8 & 3 & 2 & 0 \end{bmatrix}$$

Also, write out all 10 shortest paths.

Problem 5

Solve the following instance of the TSP using backtracking with branch-and-bound:

$$\begin{bmatrix} \infty & 4 & 6 & 8 & 7 & 3 \\ 4 & \infty & 5 & 3 & 6 & 5 \\ 6 & 5 & \infty & 1 & 5 & 4 \\ 8 & 3 & 1 & \infty & 2 & 7 \\ 7 & 6 & 5 & 2 & \infty & 3 \\ 3 & 5 & 4 & 7 & 3 & \infty \end{bmatrix}$$

Problem 6

For two given sequences $A = (a_1, a_2, \ldots, a_n)$ and $B = (b_1, b_2, \ldots, b_m)$ of characters from some alphabet, a sequence $C = (c_1, \ldots, c_k)$ is a *common supersequence* if A and B are both subsequences of C. For example, MODULARITY is a common supersequence of OLATY and MULRY. Give a dynamic programming algorithm that finds a shortest common supersequence of two given sequences A and B. Analyze the running-time of your algorithm. Use the algorithm to compute a shortest common supersequence of OLATY and MULRY.

Problem 7

Read Section 15.4 Longest Common Subsequnce, pages 390 to 397. Use the algorithms explained in the section to find the longest common subsequence of ALGORITHM and PARACHUTE. Show all your work.