CS577 Assignment 5

Due on Tuesday 7/10

1. Chapter 6, Q4 in the textbook (Pages 315-316). For part (c), note that you also need to write the algorithm to retrieve the optimal plan.

2. A complex linear structure is to be assembled out of n smaller pieces. We will think of each piece as an interval [a; b]. The joining operation takes [a; b] and [b; c] and produces [a; c]. After joining, each subpart must be tested. Assume that the cost to test [u; v] is given by f(u; v) > 0.
   Different assembly orders potentially have different total testing cost. For example, suppose that we have three pieces corresponding to intervals [1; 2]; [2; 3]; and [3; 4], and the cost of testing is given by: f(1; 3) = 3, f(2; 4) = 1, and f(1; 4) = 5. Then assembling the first and second pieces first and then joining them with the third has a total testing cost of f(1; 3) + f(1; 4) = 8, whereas assembling the second and third pieces first and then joining them with the first has a total testing cost of f(2; 4) + f(1; 4) = 6. Therefore, the second assembly order is preferable.

   Design an $O(n^3)$ algorithm using dynamic programming methodology to find an optimal (least total testing cost) assembly order. Give a brief argument of correctness, and analyze the running time.

3. Chapter 6, Q 12 in the textbook(Pages 323-324).