Business Decision Analytics under Uncertainty
Spring 2018, Professor Eckstein
Homework 3

Due Wednesday, February 28

Solve each problem by hand using dynamic programming. Before solving each problem, answer the following:

- What are the *stages* in this problem?

- What defines the *states* within each stage?

- For each stage-state combination, what are the *decisions* you are choosing between?

- What is the *interpretation of the value function* $f_t(i)$ for this particular problem? For example, in the knapsack problem we solved in class, $f_t(i)$ was interpreted as "the maximum value that can be derived by packing some subset of items t through 5 into a knapsack capable of holding i pounds."

- Optionally, you may state the recursion that defines the value function f_t in terms of f_{t+1} (except in the last stage). This is not required, but might help your understanding. Stating the recursion compactly might require you to define some notation to encode the data provided with the problem (in the knapsack problem, for example, we defined v_t to be the value of item t and w_t to be the weight of item t).

Next, solve the problem by hand using dynamic programming, showing your work. State the optimal solution and its value.

Q1: The Midwestern Sales Representative

Problem 2 on pages 225-226 of the textbook. For consistency, use the following numbering scheme for days (stages)

Day 1	Sunday, when the sales rep cannot work and has to be in Bloomington
Day 2	Monday
Day 3	Tuesday
Day 4	Wednesday

Assume travel occurs in the evening (after working in the case of days 2 through 4). If the sales representative does not spend Wednesday (day 4) in Indianapolis, he will travel to Indianapolis that evening. In this problem, the objective value is total sales income minus total travel expenses.

Q2: Oil Well Improvements

Problem 1 on page 242 of the textbook. In this problem, the objective is to maximize the total revenue from the three oil wells. Assume that you must invest the entire $4 million in the wells. The problem setup can be somewhat similar to the knapsack problem we solved in class.