Business Decision Analytics under Uncertainty  
Spring 2019, Professor Eckstein  
Homework 4  
Due Wednesday, March 6

For each problem below, first 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.”

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: Airline Schedule Planning**

Using dynamic programming, problem 4 on page 270 of the textbook (with data table on page 271). Note that there is a misprint in the data table heading in the textbook: it should read “profit”, not “profit per flight” – for example, the profit from having 3 flights to New York is simply 210, *not* $3 \times 210 = 630$. Assume that the contribution to profit from having zero flights to any given destination (say, New York) is $0$. Also assume that Indianapolis airport has a “use it or lose it” policy with respect to the flight slots it grants to carriers, so the airline has a policy of using all the flight slots assigned to it (otherwise it will lose them to another carrier). When there are six flight slots, you should find two equally good alternative optimal solutions; state them both, along with the optimal profit. As requested at the end of the problem, also find the optimal solution and profit if there are only four available flight slots.