Business Decision Analytics under Uncertainty
Spring 2017, Professor Eckstein
Homework 5

Due Wednesday, March 8

Q1: Trading Strategies

You have a sideline business buying and selling vintage jukeboxes. You have room to store up to two jukeboxes and feel certain that the following prices will prevail over the next four months:

Month	1	2	3	4
Sell (Ask) Price	$2500	$2800	$2000	$2700
Buy (Bid) Price	$2600	$2900	$2100	$2800

Each month, you have a choice of one of the following three actions:

- Buy: buy one jukebox at the bid price (unless you already have two in storage)
- Hold: do nothing (allowable with any number of jukeboxes in storage, including zero)
- Sell: sell one jukebox at the ask price (unless you do not have any left in storage).

You have a direct holding cost of $100 for each jukebox in storage at the end of each month (for maintenance and cleaning), and want to maximize your profit from trading jukeboxes over the next four months. Assume that you do not have any jukeboxes currently in storage, and that you ascribe a "salvage" value of $2000 to each jukebox left over after the end of the four months (holding cost at the end of month four still applies to any such jukeboxes).

(a) What are the stages, states, and decisions in this problem? What is the definition of the value function $f_t(i)$ for this problem?

(b) Manually solve this problem by dynamic programming, showing your work. What is the optimal trading strategy, and what is the resulting profit?

Q2: An Integer Knapsack Problem

You have four different kinds of items you can place in a knapsack that can hold up to 7 pounds, as follows:

Kind of Item	1	2	3	4
Weight per Item	4	3	5	1
Value per item	$22	$20	$33	$5

You can put in as many copies of each type of item into the knapsack as you like, so long as the total weight of the knapsack does not exceed 7 pounds. What loading of the knapsack maximizes its total value?

Manually solve this problem by dynamic programming, showing your work. State the optimal loading plan and the total value of the knapsack under this plan. ***Hint:*** you can greatly reduce the amount of work by performing a "reachability analysis" to see which states are actually reachable.