Lesson 15. Multiperiod Models, Revisited

Example 1. Priceler manufactures sedans and wagons. The demand for each type of vehicle in the next three months is:

	Month 1	Month 2	Month 3
Sedans	1100	1500	1200
Wagons	600	700	500

Assume that the demand for both vehicles must be met exactly each month. Each sedan costs $2000 to produce, and each wagon costs $1500 to produce. Vehicles not sold in a given month can be held in inventory. To hold a vehicle in inventory from one month to the next costs $150 per sedan and $200 per wagon. During each month, at most 1500 vehicles can be produced. At the beginning of month 1, 200 sedans and 100 wagons are available. Formulate a linear program using symbolic input parameters that can be used to minimize Priceler's costs during the next three months.

Input parameters.

V = set of vehicle types

T = set of months

d_{it} = demand for type i vehicles in month t for $i \in V$ and $t \in T$

c_i = cost of producing 1 type i vehicle for $i \in V$

h_i = cost of holding 1 type i vehicle from one month to the next for $i \in V$

I_{i0} = initial inventory for type i vehicle for $i \in V$

For example:

Decision variables.

x_{it} = number of type i vehicles produced in month t for $i \in V$ and $t \in T$

I_{it} = number of type i vehicles held in inventory at the end of month t for $i \in V$ and $t \in T$

Objective function and constraints.

Example 2. During the next three months, the Bellman Company must meet the following demands for their line of advanced GPS navigation systems:

Month 1	Month 2	Month 3
1200	1400	2200

It takes 1 hour of labor to produce 1 GPS system. During each of the next three months, the following number of regular-time labor hours are available:

Month 1	Month 2	Month 3
1200	1300	1000

Each month, the company can require workers to put in up to 500 hours of overtime. Workers are only paid for the hours they work. A worker receives \$10 per hour for regular-time work and \$15 per hour for overtime work. GPS systems produced in a given month can be used to meet demand in that month, or put into a warehouse. Holding a GPS system in the warehouse from one month to the next costs \$2 per GPS system. Formulate a linear program that minimizes the total labor and inventory cost incurred in meeting the demands of the next three months.

Input parameters.

T = set of months

d_t = demand for GPS systems in month t for $t \in T$

r_t = regular-time labor hours available in month t for $t \in T$

o = overtime labor hours available in each month

h = cost of holding 1 GPS system in inventory from one month to the next

c_r = cost of 1 hour of regular-time labor

c_o = cost of 1 hour of overtime labor

Decision variables.

x_{rt} = number of GPS systems produced in month t with regular-time labor for $t \in T$

x_{ot} = number of GPS systems produced in month t with overtime labor for $t \in T$

I_t = number of GPS systems held in inventory at the end of month t for $t \in T$

Objective function and constraints.