OR-lecture-11

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1. Problem 1

   (a) Show that $V_2(1) = 10$
   $C_2 = 4, D_2 = 1, H = 1$

x_2	C_2x_2	$y_1 = y + x_2 - D_2$	Hy_1	$V_1(y_1)$	$C_2x_2 + Hy_1 + V_1(y_1)$
0	0	0	0	12	12
1	4	1	1	6	11
2	8	2	2	0	10
3	12	3	3	1	16

   We get the optimal solution which is 10. So the optimal solution is to produce 2 units at day 2.

   (b) Show that $V_3(4) = 8$

x_3	C_3x_3	$y_2 = y + x_3 - D_3$	Hy_3	$V_2(y_2)$	$C_3x_3 + Hy_3 + V_2(y_2)$
4	0	2	2	6	8

   We have 2 unit left , and in the table we can find that $V_2(2) = 6$, so the cost is 8.

   (c) x^* is from $[0-4]$, and y is from $[0-8]$.

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0 0 0 0 0 0 0 0 0
2 1 0 0 0 0 0 0 0
3 2 1 0 0 0 0 0 0
2 1 0 0 0 0 0 0 0
5 4 3 2 1 0 0 0 0
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2. Problem 4

   (a) Formulate a dynamic program

      i. The boundary condition: $V_0(y) = 0$ for all y.
      ii. The demand fulfillment constraint $x_t \geq (D_t y)^+$. Moreover, to incorporate the space limitation, all we need to do is to add a

constraint $y + x_t - D_t \leq K$ for period t to ensure that we do not produce/order too many. And with new fixed cost S we can formulate

$$\begin{aligned} \min_{x_t} \quad & V_t(y) = C_t x_t + H(y + x_t - D_t) + V_{t-1}(y + x_t - D_t) + S z_t \\ s.t. \quad & X_t \geq (D_t - y)^+ \\ & x_t \leq K + D_t - y \\ & z_t \in \{\ 0, 1\} \end{aligned}$$

(b) When there is a positive setup cost, if the setup cost is very high, we tend to produce at the very beginning, but if the setup cost is low , we would calculate all produce method and choose the lowest cost.