Advertising Strategy

A firm is planning its advertising strategy for a period of four weeks. In each week the sales level will be either *High* or Low and the firm will receive profits on sales of $800 or $600, respectively.

If the sales were High in the previous week then there is a 60% chance that sales will be High again in the current week if they do not advertise in the current week or 80% if they do advertise. If the sales were Low in the previous week then there is a 20% chance that sales will be High in the current week if they do not advertise in the current week or 60% if they do advertise.

The cost of advertising in one week is $70. An extra cost of $80 is incurred if the level of sales (and thus production) is changed from one week to the next.

What advertising strategy should the firm pursue?

Data p_{sa} prob of high sales if sales were s and we take action a.

r_s revenue if sales are s ($)

c cost of changing production ($)

d cost of advertising ($)

Stages weeks $t \in \{1,2,3,4\}$

State Sales level in previous week $s_t \in \{H, L\}$

Actions Advertise or not, $a_t \in \{Y, N\}$

Value Function

$V_t(s_t)$ = maximum expected profit from weeks $t, \ldots, 4$ if we had sales s_t in previous week.

we want $V_1(s_1)$ for $s_1 \in \{H, L\}$.

$$V_5(s_5) = 0$$

$$V_t(H) = \max \begin{cases} p_{HY}(r_H - d + V_{t+1}(H)) + (1-p_{HY})(r_L - d - c + V_{t+1}(L)), & \text{if } Y \\ p_{HN}(r_H + V_{t+1}(H)) + (1-p_{HN})(r_L - c + V_{t+1}(L)), & \text{if } N \end{cases}$$

$$V_t(L) = \max \begin{cases} p_{LY}(r_H - d - c + V_{t+1}(H)) + (1-p_{LY})(r_L - d + V_{t+1}(L)), & \text{if} \\ p_{LN}(r_H - c + V_{t+1}(H)) + (1-p_{LY})(r_L + V_{t+1}(L)), & \text{if } N \end{cases}$$