Homework 3

1. Consider problem of 1 of Homework 2 where a company reviews the state of one of its important products on an annual basis and decides whether it is successful (state 1) or unsuccessful (state 2). The company must then decide whether or not to advertise the product to further promote the sales. The matrices $P_1$ and $P_2$ given below provide the transition probabilities with and without advertisement during any year. The associated returns are given by the matrices $R_1$ and $R_2$. Find the optimal decisions over an infinite horizon with discount factor $\alpha = 0.6$ using policy iteration.

$$P_1 = \begin{bmatrix} 0.9 & 0.1 \\ 0.6 & 0.4 \end{bmatrix} \quad P_2 = \begin{bmatrix} 0.7 & 0.3 \\ 0.2 & 0.8 \end{bmatrix} \quad R_1 = \begin{bmatrix} 2 & -1 \\ 1 & -3 \end{bmatrix} \quad R_2 = \begin{bmatrix} 4 & 1 \\ 2 & -1 \end{bmatrix}$$

2. Now consider the second problem of Homework 2 where a company is introducing a new product into the market. If the sales are high, there is a 0.5 probability that they will remain so next month. If they are not, the probability that they will become high next month is only 0.2. The company has the option of launching an advertisement campaign. If it does and the sales are high, the probability that they will remain high next month will increase to 0.8. On the other hand, an advertising campaign while the sales are low will raise the probability to only 0.4.

If no advertisement is used and the sales are high, the returns are expected to be 10 if the sales remain high next month and 4 if they do not. The corresponding returns if the product starts with low sales are 7 and -2. Using advertisement will result in returns of 7 if the product starts with high sales and continues to be so and 6 if it does not. If the sales start low, the returns are 3 and -5, depending on whether or not they become high. Determine the company’s optimal policy over an infinite horizon with discount factor $\alpha = 0.8$ using the LP method.