Peter Ly

Task 1

Given (State space, Action space, Transition Model, Rewards) as (S, A, T, R):

Consider the concept of crop rotation on a farm – over time, specific nutrients in the dirt of a plot of land will be used up by the plants in it to grow. In order to prevent the complete loss of those nutrients to that specific area, a plot should be "rotated" to a different crop if its currently used nutrients are too low. While this leads to long term profit and economic stability, crop rotation requires extra planning and setup that can be represented as a financial cost.

Let's try and represent this problem for a single plot We can represent the state space as a series of nodes, High Nutrients, Low Nutrients, and No Nutrients that signify the nutrient levels in the soil. At each stage, there are always one of two actions to select – to either keep the same crop (and sell them for money), or spend money to rotate the crop.

If a farmer keeps the crop, they will earn a set positive reward, but there will be a medium chance that the state of the plot drops down a nutrient level (High Nutrients - > Low Nutrients - > No Nutrients).

If a farmer chooses to rotate the crops, there will be a high chance for the state of the plot to move up a nutrient level (No nutrients -> Low nutrients -> High nutrients), but there will be a negative reward (representing money spent to rotate crops). The negative reward for No Nutrients -> Low Nutrients is larger in magnitude than Low nutrients -> High nutrients to represent the additional costs of dealing with environmentally damaged soil.

A model's objective would be to find the optimal strategy on when to keep and sell the existing crops in a plot to maximize the net amount of (reward) money gained while minimizing the amount of (reward) money lost from having to rotate crops.