1. Consider the 101×3 world shown in Figure 1. In the start state the agent has a choice of two deterministic actions, Up or Down, but in the other states the agent has one deterministic actions, Right. Assuming a discounted reward function.

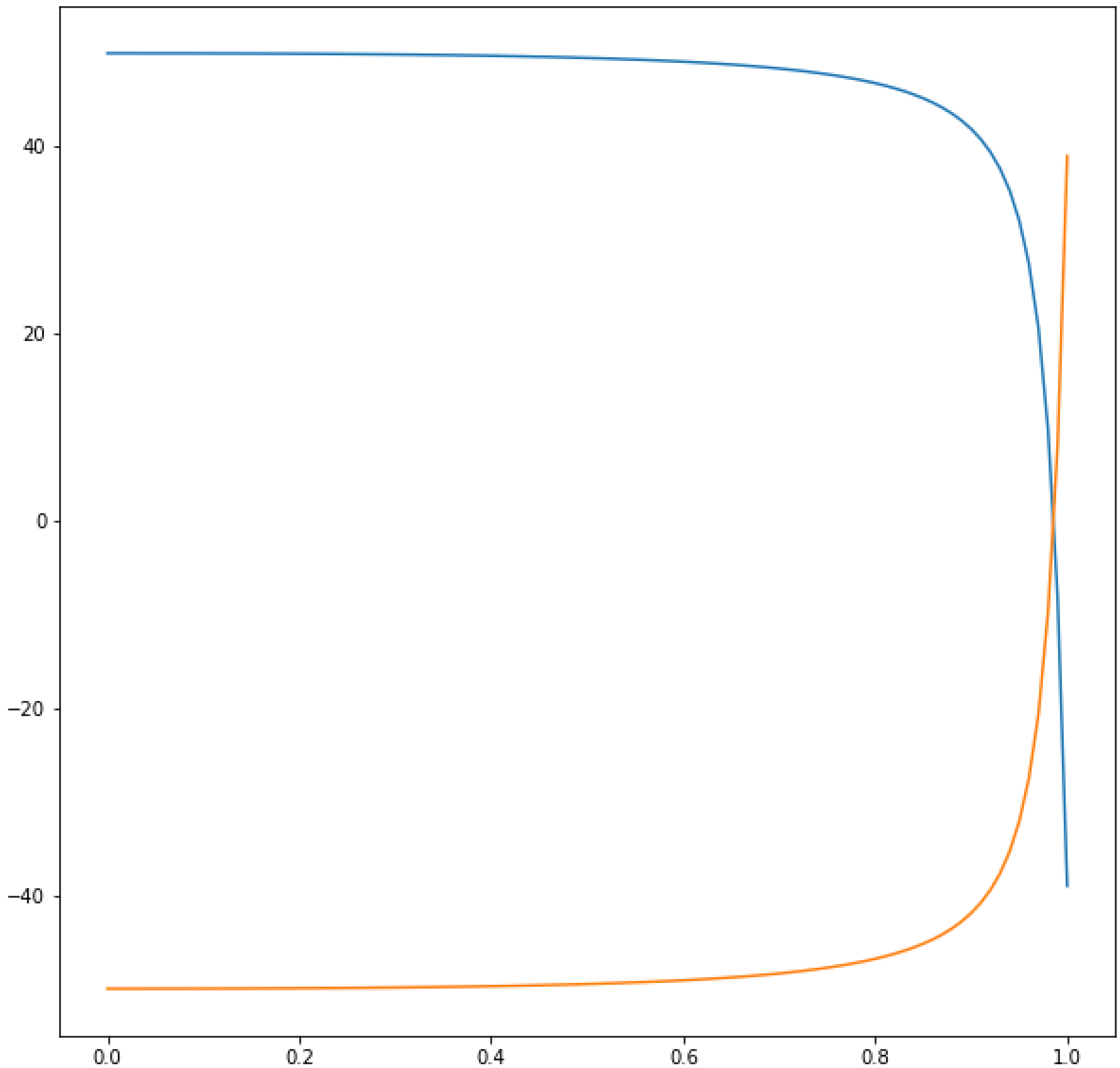
1. Compute the utility of each action as a function of γ.

$$\begin{aligned} U(Up, Right, \ldots, Right) &= 50 - \sum_{i=1}^{100} \gamma^i + 10 \cdot \gamma^{101} \\ U(Down, Right \ldots, Right) &= -50 + \sum_{i=1}^{100} \gamma^i - 10 \cdot \gamma^{101} \end{aligned}$$

   setting the equations to solve for γ.

$$\begin{aligned} U(Up, Right, \ldots, Right) &= U(Down, Right, \ldots, Right) \\ 50 - \sum_{i=1}^{100} \gamma^i + 10 \cdot \gamma^{101} &= -50 + \sum_{i=1}^{100} \gamma^i - 10 \cdot \gamma^{101} \\ 100 &= 2 \cdot \sum_{i=1}^{100} \gamma^i - 2 \cdot \gamma^{101} \\ \gamma &= .986 \end{aligned}$$

2. Draw the utility of each action for the range $0 \leq \gamma < 1$ using Matlab or your familiar numerical analysis software.



1. For $\gamma = \frac{1}{2}$, which action is recommended? Why?

We should go up. The utility is larger.

2. Consider the following data set comprised of three binary input attributes (A_1, A_2 and A_3) and one binary output:

1. Compute $Gain(A_1)$.

   $.9709 - \frac{4}{5} \cdot B(\frac{1}{3}) - \frac{1}{5} \cdot B(0) = 0.1709$

2. Compute $Gain(A_2)$.
   $B(\frac{2}{5}) - \frac{3}{5} \cdot B(\frac{2}{3}) = 0.420$
3. Compute $Gain(A_3)$.
   $B(\frac{2}{5}) - \frac{2}{5} \cdot B(\frac{1}{2}) - \frac{3}{5} \cdot B(\frac{1}{3}) = .0200$

3. Conider the XOR function of three binary input attributes (A_1,A_2 and A_3). Which produces the value 1 if and only if an odd number of the three input attributes has value 1.Draw a minimal-sized decision tree for the three-input XOR function.