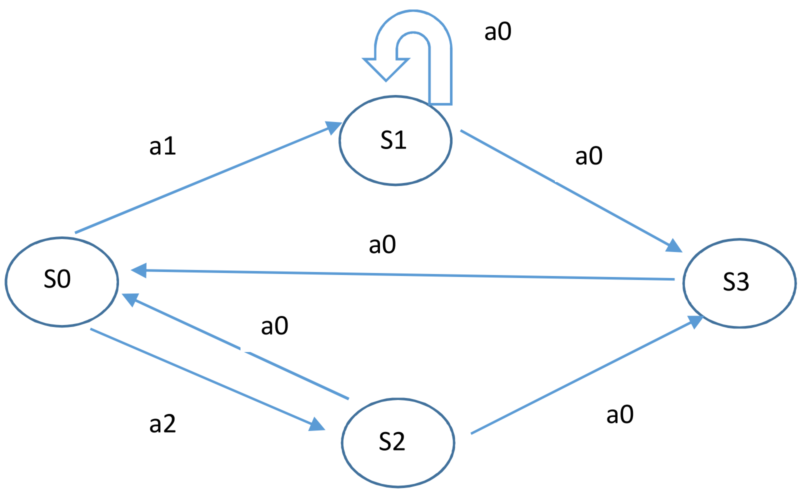
ROB 311- TP 2 – 23 September 2019



In the figure above, the states are depicted by circles (S0, S1, S2, and S3) and the associated actions are indicated on the arrows: a0, a1, and a2. The transition functions for all the actions are shown below.

$$T(S, a0, S') = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 1-x & 0 & x \\ 1-y & 0 & 0 & y \\ 1 & 0 & 0 & 0 \end{pmatrix}$$

$$T(S, a1, S') = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

$$T(S, a2, S') = \begin{pmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

Each of the parameters x and y are in the interval [0, 1], and the discounted factor $\gamma \in [0,1)$

The reward is:

$$R(s) = \begin{cases} 10, for\ state\ S3 \\ 1, for\ state\ S2 \\ 0, otherwise \end{cases}$$

Question 1:

Enumerate all the possible policies

Question 2:

Write the equation for each optimal value function for each state

$(V^*(s0), V^*(s1), V^*(s2), V^*(s3))$

Reminder:

$$V^*(S) = R(s) + max_a \gamma \sum_{S\prime} T(S, a, S') \, V^*(S')$$

Question 3:

Is there exist a value for x, that for all $\gamma \in [0,1), and\ y \in [0,1]$, $\pi^*(s0) = a2$. Justify your answer.

Reminder:

$$\pi^*(s) = \arg max_a \sum_{S\prime} T(S, a, S') \, V^*(S')$$

Question 4:

Is there exist a value for y, that for all $x > 0, and\ \gamma \in [0,1]$, $\pi^*(s0) = a1$. Justify your answer.

Question 5:

Using x=y=0.25 and γ = 0.9 , calculate the π^* and V^* for all states.

Implement value iteration.