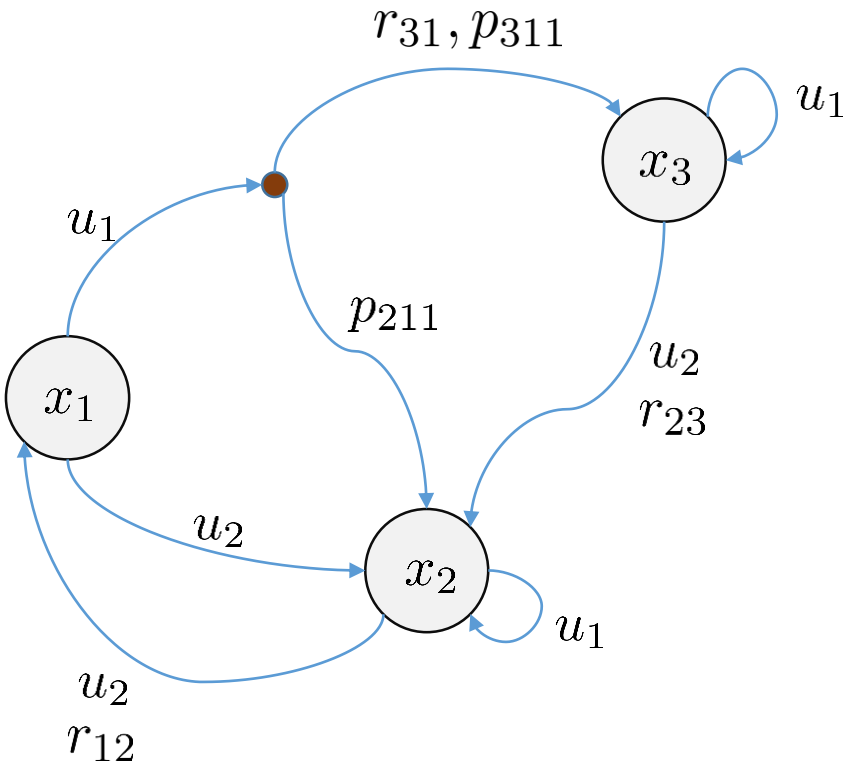
Exercise 1:

An MDP is given in the figure below, with x describing the states, u the actions, r the reward

and p additional transition probabilities. The discount factor to be considered is $\gamma = 0.5$. For transitions where no reward is defined, assume r=0. Round your results to 3 decimal places.



$$r_{31} = 5$$
$$r_{23} = -1$$
$$r_{12} = 0.5$$

$$\pi(u_1|x_1) = 0.4$$
$$\pi(u_2|x_1) = 0.6$$
$$\pi(u_1|x_2) = 0.2$$
$$\pi(u_2|x_2) = 0.8$$
$$\pi(u_1|x_3) = 0.2$$
$$\pi(u_2|x_3) = 0.8$$

$$p_{311} = p(x_3|x_1, u_1) = 0.5$$
$$p_{211} = p(x_2|x_1, u_1) = 0.5$$

a) Calculate the value function of all the states

b) Calculate the values of the action value function $Q(x_2, u_1)$, $Q(x_2, u_2)$ and $Q(x_1, u_1)$.

c) Based on the results in b), would a greedy policy pick action u_1 or u_2 in state x_2? For which reason?

d) If you derived an ϵ-greedy policy based on the Q function from b), with $\epsilon = 0.2$, what would be the probability to pick u_2 in state x_2?