Homework 5
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(a)

$$\mathcal{A} = \{up, down, left, right\}$$
$$\mathcal{X} = \{(x, y) : 0 \leq x \leq 4, 0 \leq y \leq 2, x \in \mathbb{N}, y \in \mathbb{N}\} \quad (1)$$

where (0,0) corresponds to the bottom left corner cell, x is the horizontal coordinate and y the vertical one

$$C(x) = \begin{cases} 0 & x = (4,1) \\ 1 & otherwise \end{cases}$$

(b) $x_0 = (0,1)$
$a_0 = right$
$c_0 = 1$
$x_1 = (1,1)$
$a_1 = right$
$c_1 = 1$
$x_2 = (2,2)$

(c) Using the Q-learning formula:

$$Q(x_t, a) = Q(x_t, a) + \alpha(c_t + \gamma min_{a'} Q(x_{t+1}, a') - Q(x_t, a)) \quad (2)$$

We have that:

$$Q(x_0, a_0) = Q((0,1), right) = Q((0,1), right) + 0.1(1 + 0.95 min_{a'} Q((1,1), a') - Q((0,1), right)) = 0.1 \quad (3)$$

$$Q(x_1, a_1) = Q((1,1), right) = Q((1,1), right) + 0.1(1 + 0.95 min_{a'} Q((2,2), a') - Q((1,1), right)) = 0.1 \quad (4)$$