Exercise 1:
We consider the following stochastic decision problem: There are $n$ boxes; box $i$ contains a prize of 1 Euro with probability $q_i$ and is empty otherwise. The game ends when we have found a non-empty box. That is, the final prize is either 0 Euros or 1 Euro. At each point in time, we can also decide to stop playing. We can open as many boxes as we like but opening box $i$ costs $c_i$ Euros.
Model this problem as a Markov decision process. In particular, give the state and action sets as well as transition probabilities and rewards.

Bonus Task:
Show that no randomized algorithm for the online bipartite matching problem is strictly $c$-competitive for $c > \frac{3}{4}$.

*Hint:* You can mainly use the idea from the lecture - in addition, you should consider that a randomized algorithm is allowed to match two vertices with some probability instead of fixing one particular edge.