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Algorithms and Uncertainty

Summer Term 2021

Tutorial Session - Week 4

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.