Abstract:

We study the following balls and bins stochastic game between a player and an adversary: there are B bins and a sequence of ball arrival and extraction events. In an arrival event a ball is stored in an empty bin chosen by the adversary and discarded if no bin is empty. In an extraction event, an algorithm selects a bin, clears it, and gains its content. We are interested in analyzing the gain of an algorithm which serves in the dark without any feedback at all, i.e., does not see the sequence, the content of the bins, and even the content of the cleared bins (i.e. an oblivious algorithm). We compare that gain to the gain of an optimal, open eyes, strategy that gets the same online sequence.

We name this gain ratio the loss of serving in the dark. The randomized algorithm that was previously analyzed is choosing a bin independently and uniformly at random, which resulted in a competitive ratio of about 1.69. We show that although no information is ever provided to the algorithm, using non-uniform probability distribution reduces the competitive ratio. Specifically, we design a 1.55-competitive algorithm and establish a lower bound of 1.5. We also prove a lower bound of 2 against any deterministic algorithm. This matches the performance of the round robin 2-competitive strategy. Finally, we present an application relating to a prompt mechanism for bounded capacity auctions.