Universität des Saarlandes
FR 6.2 Informatik

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Excercises
Online Algorithms

http://www.mpi-inf.mpg.de/departments/d1/teaching/ss14/OnlineAlgos/

Sheet 6 Deadline: 17.07.2014

Rules: Until the end of the semester you have to reach 50% of the achievable points to be admitted to the exam.

Exercise 1 (*8+8 points*)
Show the lemmas in the analysis of Simulate (slide 26 in the notes):

a)
$$\mathbb{E}[w(M_1)] \geq p \cdot \frac{w(S^*)}{2} \ .$$

b)
$$\mathbb{E}[w(M_2)] \geq (1-p)\frac{w(S^*)}{2} \ .$$

Exercise 2 (*14 points*)
Adjust the Sample-and-Learn with Threshold Algorithm to the secretary matching problem presented in the lecture and show that it is $O(\log n)$-competitive, where $n = |L|$.

Exercise 3 (*10+14* points*)
Consider the secretary problem with batches: In the beginning, an adversary specifies the quality of the n applicants and groups them into $0 < k \leq n$ batches. n and k are public knowledge. Each batch must contain at least one applicant, but there is no upper bound (except $n-k+1$) on the batch size. After the adversary is done, batches arrive in uniformly random order. Once a batch arrives, all applicants in the batch become known to the algorithm. The goal is to select the best applicant.

a) Design an algorithm and show that it has constant competitive ratio.

b) Consider the analogous variant of the secretary matching problem, where the adversary groups the nodes of R into k batches. Design an algorithm and show that is has competitive ratio $O(\log n)$.