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 5 Deadline: 01.07.2014

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

Exercise 1 (*4+8+8 points*)
Consider the algorithm for fractional online set cover from the lecture and adjust it as follows. Upon arrival of element e, we execute the same algorithm, but change the update of the primal variables x_S with $e \in S$. Consider the following update rules:

a) $x_S = x_S(1 + 1/c_S) + 1/(mc_S)$

b) $x_S = x_S(1 + 1/c_S) + 1/c_S$

c) $x_S = x_S + 1/(dc_S)$

What is the best competitive ratio in m or d you can show for each case?

Exercise 2 (*8+6 points*)
Consider an adjusted algorithm for the revenue optimization problem. Upon arrival of item j we assign it greedily to the buyer i that yields the maximum revenue (i.e., over all buyers, i maximizes the minimum of b_{ij} and his remaining budget).

a) Show that the competitive ratio of this algorithm cannot be better than 2. It should also show that the lower bound holds for any value of $R_{\max} \leq 1$.

b) What is the best upper bound you can prove on the competitive ratio of this algorithm?

Exercise 3 (*6 points*)
Consider the load balancing problem with identical machines, where the load of task j is the same on every machine i, i.e., $p_{ij} = p_j \geq 0$. The greedy algorithm assigns a task upon arrival to the machine where the current load is minimum. Show that the greedy algorithm is 2-competitive.