I N F O R M A T I K

Universität des Saarlandes
FR 6.2 Informatik

Dr. Ulrich Meyer **SS 2005**

Exercises for Online- and Approximation-Algorithms

1. Assignment Due 05. May 2005

Exercise 1 (*Ski Rental,* 3 *Points*)
Equipment can be rented for 1 monetary unit or bought for $n \geq 2$ units where n is an integer. It is unclear how often one will go skiing in the future. Develop a $(2 - 1/n)$-competitive online strategy.

Exercise 2 (*Biker Problem,* 6 *Points*)
A bike can be rented for one trip at the cost of 10 units. A cheap bike costs 100 units and lasts for 100 trips. An expensive bike costs $1,000$ units but takes $10,000$ trips. It is not know how many trips there will be in the future. What are the best offline and online strategies?

Exercise 3 (*Deterministic Paging,* 3 *Points*)
LFU (Least-Frequently Used) replaces the page that has been requested the least since entering the fast memory. Show that LFU is not competitive.

Exercise 4 (*Deterministic Paging,* 6 *Points*)
The CLOCK replacement is an approximation to LRU in which a single *use bit* replaces the implicit (time of last access) timestamp of LRU. More specifically, CLOCK maintains the addresses of the pages in fast memory in a circular queue. There is a counter that points to the last page brought into the fast memory. Whenever a page is accessed, its use bit is set to 1. Upon a page fault, the counter is incremented and the algorithm seeks a page whose bit is unset; in doing so, it unsets the use bit for each page considered. Show that CLOCK is k-competitive.