Institut for Matematik og Datalogi
Syddansk Universitet – Odense Universitet

December 9, 1999
JFB

DM19 – E99 – Lectures 27 and 28

Lectures, Week 48

We finished chapter 35 in the textbook and covered section 1 from the notes on on-line algorithms.

Lecture, December 8

We covered sections 2, 8.1, and 9 from the notes on on-line algorithms. We began looking at another example of an on-line problem, the seat reservation problem; this is an extra topic, which you are not responsible for on the exam.

Lecture, December 10

We will finish discussing the seat reservation problem and begin on Pollard's ρ-method for factoring, from section 33.9 of the textbook. A few years ago, I wrote some notes myself on the subject. They can be found at: http://www.imada.sdu.dk/ joan/crypt/rho.dvi.

Lectures, Week 50

We will continue discussing integer factoring and hold a question session, so bring any questions you have about the exam on Friday.

Problems to be discussed in week 51

1. Prove Thm 1 (on page 3 of the notes on on-line algorithms) for FIFO. (The proof given in the notes is only for LRU.)

Note: The next 2 problems are from the textbook *Online Computation and Competitive Analysis*, by Allan Borodin and Ran El-Yaniv.

2. If a deterministic algorithm for paging is c-competitive, then $c \geq k$, even if there are only $k+1$ pages in the system, where the fast memory can contain k pages. Prove that MARKING is H_k-competitive, when there are only $k+1$ pages in the system.

3. Show that in general, MARKING is not H_k-competitive. (Hint: It is sufficient to consider the case $k = 2$, with $N = 4$ pages total.)

4. Consider the on-line bin-packing problem: There is a large supply of bins, all of capacity 1. The request sequence is a sequence of objects $< r_2, ..., r_m >$. Object r_i has size s_i, which is known when the object arrives. The goal is put each object in some bin, so that no bin contains objects whose sizes add to more than 1, using as few bins as possible. The algorithm First-Fit places an object in the first bin in which it fits. Show that First-Fit is 2-competitive. (Actually, it is 17/10-competitive, but that's much harder to show.)

5. Show that the First-Fit algorithm for bin-packing cannot be better than 5/3-competitive. (Hint: use items of size $\frac{1}{7} + \epsilon$, $\frac{1}{3} + \epsilon$, and $\frac{1}{2} + \epsilon$, where ϵ is very small.)