

CS 141, Advanced Topics in Algorithms
Spring 2004
Homework 5a
Due Wednesday, February 18

1. **[15 Points] Bellady's Anomaly Revisited.** Recall that the class notes show a strange case in which the FIFO page replacement algorithm actually does worse with a large fast memory than it does with a small fast memory. That is, given the same request sequence, a computer with smaller fast memory can actually incur fewer page faults than a computer with larger fast memory when FIFO is used. This is known as *Bellady's Anomaly*. Prove that the LRU algorithm does not have this anomaly. Recall that LRU simply evicts the least recently used page from fast memory when a page fault occurs.

2. **[15 Points] LFU and LIFO are not Competitive!** Prove that LFU and LIFO are not competitive online paging algorithms. LFU, Least-Frequently-Used, is a demand paging algorithm which evicts the page which has been used least since entering fast memory. LIFO, Last-In-First-Out, evicts the page that was most recently moved into fast memory. To show that these algorithms are not competitive, you must show that there is no constant c for which these algorithm are c -competitive.