Online and approximation algorithms

Due April 30, 2014 before class!

Exercise 1 (Dynamic list update problem - 10 points)

We modify the list update problem by adding the operations INSERT(a) and DELETE(a). Let n be the current length of the list. Whenever INSERT(a) is called, the list is searched for element a. If a is already in the list, the costs for the operation are equal to its position. If not it is inserted to position $n + 1$ of the list. In this case the cost is $n + 1$. In addition we are allowed to move the inserted item to any position in the list. If DELETE(a) is called we delete a from the list. The operation's cost is equal to a's position in the list. Move-To-Front (MTF) moves the newly inserted element to the front of the list. Show that MTF is still 2-competitive.

Exercise 2 (Paid exchanges - 10 points)

(a) Show that paid exchanges are necessary, i.e. that every optimal offline algorithm for the list update problem uses paid exchanges.
Hint: 3 list elements and 4 requests are sufficient.

(b) Show that there exists an optimal offline algorithm that uses **only** paid exchanges.