

Exercise sheet 2

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The first three exercises are from Vijay Vazirani's book.

1. Exercise 2.14
2. Exercise 8.1
3. Exercise 10.1
4. Show that the following two algorithms are $\Omega(1)$ -competitive for the List Update problem. That is, these algorithms do not have a constant competitive ratio. Hint: give input sequences that can be served cheaply, but for which these algorithms have high costs.
 - (a) TRANSPOSE: each time that an item is requested, exchange it with the item which immediately precedes it (i.e., move the item one place closer to the start of the list)
 - (b) FREQUENCY COUNT: at all times, sort the items in the list by the amount of requests for them, so that the most requested items are at the start of the list
5. The offline List Update problem is NP-hard. Show that it is sometimes necessary to use paid transpositions to get an optimal solution. Hint: it is sufficient to consider a list that contains only three items. Find a request sequence that forces a paid transposition. That is, if an algorithm only moves items that are requested (for free), then it is not optimal.