

One dimensional semi-on-line bin packing algorithms¹

János Balogh, József Békési, Gábor Galambos, and Gerhard Reinelt

In the talk a family of semi-online bin packing algorithms is defined and analyzed. In case of semi-online algorithms in each step it is allowed to proceed one of certain operations as repacking, reordering or buffering some elements before they having packed. It is clear that such type of algorithms are acceptable if they perform better than the on-line ones. (We require that the more information we need the better algorithm.)

Here we deal with semi-on-line algorithms which allow the repacking. We suppose that in these algorithms any repacking has unit cost independently from the size of an item. Similarly, we assume that the maximum number of elements to be repacked in each step are bounded by a foregiven constant k . We call these algorithms as k -repacking semi-on-line algorithms.

For every positive integer k we define a k -repacking algorithm, called $HFR-k$. We prove that the asymptotic competitive ratio (ACR) for a given k is not larger than $\frac{3}{2} + \frac{b_k}{1-b_k}$ where b_k is the root of the equation $\frac{3}{2} + \frac{b_k}{1-b_k} = \frac{1}{\frac{1}{2} + kb_k}$ for which $b_k \in [0, \frac{1}{6k}]$ holds. One can see that for enough large – but finite – values of k the ACR of the algorithm tends to quick to 1,5. So, in some special cases – already for small k -s – we can improve some on-line results.

The first interesting particular case is the $k = 2$. Then $ACR(HFR-2) = 1,5728\dots$, which is better than the ACR of the best known on-line algorithm (1,58889\dots) [1]. The case $k = 4$ is also remarkable: Here $ACR(HFR-4) = 1,5389\dots$, and so it is smaller than the best known lower bound (1,5401\dots) for the on-line algorithms published in [2]. This means that the 4-repacking semi-on-line algorithms are more competitive than the on-line ones.

These are those results which show that our algorithm uses well the extra informations about the elements of the list and the relaxation of the on-line rule. Two open questions: Is there such a semi-on-line algorithm which may repack only one item in each step and its ACR is smaller than 1,583\dots? Is there such a semi-on-line algorithm which has a better ACR than 1,5401\dots and it repacks less than 4 items in each step?

References

- [1] S.S. Seiden. On the Online Bin Packing Problem. *Journal of the ACM*, 49(5): 640-671, 2002.
- [2] A. van Vliet. An Improved Lower Bound for Online Bin Packing Algorithms. *Information Processing Letters*, 43(5): 277-284, 1992.

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