Online Bin Stretching: Algorithms and Computer Lower Bounds

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Abstract: We investigate a problem in semi-online algorithm design, called Online Bin Stretching. The problem can be understood as an online repacking problem: the goal of the algorithm is to repack items of various sizes into $m$ containers of identical size $R > 1$. The input items arrive one by one and the algorithm must assign an item to a container before the next item arrives.

A specialty of this problem is that there is a specific guarantee made to the algorithm: the algorithm learns at the start of the input that there exists a packing of all input items into $m$ containers of capacity 1.

Our goal is to design algorithms for this problem which successfully pack the entire incoming sequence one by one while requiring the lowest container capacity $R$ possible.

In this thesis, we show several new results about Online Bin Stretching: First, we design an algorithm that is able to pack the entire input into $m$ containers of capacity 1.5 regardless of what the value of $m$ will be. Second, we show a specialized algorithm for the setting of just 3 containers; this algorithm is able to pack into 3 bins of capacity 1.375. Finally, we design and implement an involved search algorithm which is able to find lower bounds for Online Bin Stretching – and in fact we show the best known lower bounds for $3 \leq m \leq 8$. 