A 2-approximation for 2D Bin Packing

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16:00–16:20

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We study the two-dimensional geometrical bin packing problem (2DBP): given a list of rectangles, provide a packing of all these into the smallest possible number of 1×1 bins without rotating the rectangles. This problem is the obvious generalization of the classical (one-dimensional) bin packing problem and has a wide variety of practical applications, such as ad placement and VLSI chip design.

Unlike the one-dimensional counterpart, 2DBP cannot be approximated to $2-\varepsilon$ in polynomial time, whether or not the items may be rotated, and it does not admit an asymptotical approximation scheme (APTAS).

We present a 2-approximation algorithm, which improves over the previous best known ratio of 3, matches the best results for the rotational case and also matches the known lower bound of approximability. Our approach combines a previously known algorithm with asymptotic ratio better than two [3] with a recently-discovered PTAS [2] for a related 2D knapsack problem and a new algorithm that can pack instances into $\mathrm{OPT}+2$ bins for any constant OPT.

[1] Jansen, K., Prädel, L., Schwarz, U. M.: A 2-approximation for 2D bin packing. Technical Report 0904, Universität Kiel, 2009.
[2] Jansen, K., Prädel, L.: How to maximize the total area of rectangles packed into a rectangle? Technical Report 0908, Universität Kiel, 2009.
[3] Bansal, N., Caprara, A., Sviridenko, M.: Improved approximation algorithms for multidimensional bin packing problems. In: Proceedings of FOCS 2006.