

Average Case Analysis of Bounded Space Bin Packing Algorithms

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We investigate several variants of bin packing problems in which items may be fragmented into smaller size pieces called fragments. While there are a few applications to bin packing with item fragmentation, our model of the problem is derived from a scheduling problem present in data over CATV networks. Fragmenting an item is associated with a cost which renders the problem NP-hard. The first part of this paper is concerned with worst case analysis; We analyze the following problems: Bin packing with size increasing fragmentation, packing variable size bins with item fragmentation and the problem of size-preserving fragmentation, i.e., when fragmentation does not change the size of items. For each problem we investigate the performance of some well known algorithms such as Next-Fit and First Fit Decreasing, as well as of other algorithms. The second part of the paper is devoted to average case analysis. We present a new technique of average case analysis and use it to analyze the performance of the Next-Fit algorithm for the problem of bin packing problem with item fragmentation.