Generalized Assignment and Knapsack Problems in the Random-Order Model

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Abstract

We study different online optimization problems in the random-order model.
There is a finite set of bins with known capacity and a finite set of items arriving in a random order.
Upon arrival of an item, its size and its value for each of the bins is revealed and it has to be decided
immediately and irrevocably to which bin the item is assigned, or to not assign the item at all.
In this setting, an algorithm is α-*competitive if the total value of all items assigned to the bins is at least an* α-*fraction of the total value of an optimal assignment that knows all items beforehand.*
We give an algorithm that is α-*competitive with* $\alpha = (1-\ln(2))/2 \approx 1/6.52$ *improving upon the previous best algorithm w*
$1/6.99$ *for the generalized assignment problem and the previous best algorithm with* $\alpha \approx 1/6.65$ *for the integral knapsack p*
We then study the fractional knapsack problem where we have a single bin and it is also allowed to pack items fractionally. For th
competitive with $\alpha = 1/e \approx 1/2.71$ *improving on the previous best algorithm with* $\alpha = 1/4.39$. *We further show that this c*
possible for this model.

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