Approximation Algorithms
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Approximation algorithms for allocation problems: Improving $1 - 1/e$

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Abstract

We consider the problem of allocating m items to n players, where each player has a utility function assigning nonnegative values to subsets of $[m]$. The objective is to maximize the total utility of all players. Many variants arise, depending on what we assume about the utility functions and how we can query the players about their utilities. We improve the previously known results for two allocation problems:

1. with submodular utilities that can be accessed using a "demand oracle",
2. with linear utilities and capacity contraints for each player(the "Generalized Assignment Problem").

Both problems are special cases of the allocation problem with "fractionally subadditive" utility functions, which allows a $(1-1/e)$-approximation and this is optimal. We prove that that in both special cases, the factor of $1 - 1/e$ is suboptimal and can be improved by a constant $\varepsilon > 0$.

This is joint work with Uriel Feige.