Abstract

Given a multiset S of n positive integers and a target integer t, the subset sum problem is to decide if there is a subset of S that sums up to t. We present a new divide-and-conquer algorithm that computes *all* the realizable subset sums up to an integer u in $\widetilde{O}(\min\{\sqrt{n}u, u^{4/3}, \sigma\})$, where σ is the sum of all elements in S and $\widetilde{O}$ hides polylogarithmic factors. This result improves upon the standard dynamic programming algorithm that runs in $O(nu)$ time. To the best of our knowledge, the new algorithm is the fastest general deterministic algorithm for this problem. We also present a modified algorithm for finite cyclic groups, which computes all the realizable subset sums within the group in $\widetilde{O}(\min\{\sqrt{n}m, m^{5/4}\})$ time, where m is the order of the group.