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The postage-stamp problem: an application of geometry to number theory

Given a set A of finitely many positive integers (the denominations), the Frobenius problem comes in two flavors:

(1) determining, for a given target M, whether some nonnegative combination of the denominations sums to M, and if so, finding a representation;

(2) computing the Frobenius number $f(A)$, which is the largest M that is not representable.

For example, if $A = 6, 9, 20$, then $f(A) = 43$. The main approaches to (2) have used graph theory and have been limited to denominations no greater than about 10 million. We will show how a detailed study of a certain geometrical polyhedron leads to a fast solution that works with no restriction on the size of the denominations.

Joint work with David Einstein, Daniel Lichtblau, and Adam Strzebonski.