Exact and Approximation Multidimensional Subset Sum Algorithms

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Given a polygon $Q$ our approximation algorithm, can return in polynomial time two polygons $A$ and $B$ such that their Minkowski sum almost equals to $Q$. 

$$\mathbb{D}_v(Q) = \mathbb{D}_v(Q+A) = \mathbb{D}_v(Q-B) = \mathbb{D}_v(Q')$$
Overview of the problem 1

Factorization (Bivariate)

Ostrowski

MinkDecomp (2D)

S.Gao, A.Lauder

2D-Subset Sum
Overview of the problem 1

Factorization (Bivariate)

Ostrowski

MinkDecomp (2D)

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2D-Subset Sum

Part I

Part II

future work

MinkDecomp-approx (2D)

2D-SS-approx

kD-SS-opt \notin \text{APX}

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From a polygon to a set of vectors

Given a polygon $Q$, its **edge sequence** $s(Q)$ is a set of vectors in $\mathbb{Z}^2$.

$s(Q)$: subtract successive vertices, ”break” if the edge contains integral points.
**kD-Subset Sum (kD-SS)**

Input: A set of k-dimensional vectors \( S = \{v_i \mid v_i \in \mathbb{Z}^k, 1 \leq i \leq n\} \) and a target vector \( t \in \mathbb{Z}^k \).

Question: Does there exist a subset of vectors, \( S' \subseteq S \), such that

\[
\sum_{v_i \in S'} v_i = t?
\]

\( P \) is the set of all possible vector sums for all subsets of \( S \).