Project Bolognese

Solving the Bologna process scheduling problem

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Outline

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TUDelft

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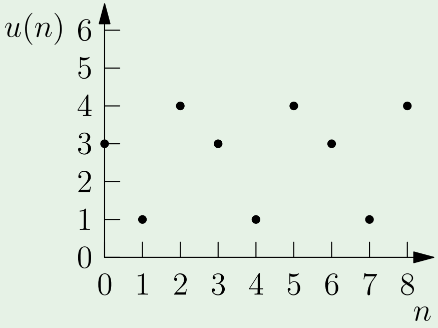
Example



$u(n) = [3, 1, 4]_n$

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Definition

Let n be a discrete variable, i.e. $n \in \mathbb{Z}$. A 1-dimensional periodic number is a function that depends periodically on n.

$$u(n) = [u_0, u_1, \ldots, u_{d-1}]_n = \begin{cases} u_0 & \text{if } n \equiv 0 \pmod{d} \\ u_1 & \text{if } n \equiv 1 \pmod{d} \\ \vdots & \\ u_{d-1} & \text{if } n \equiv d-1 \pmod{d} \end{cases}$$

d is called the period.

TU Delft

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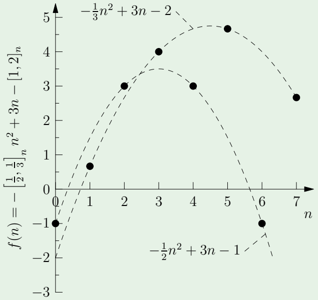
Example

$$f(n) = -\left[\tfrac{1}{2}, \tfrac{1}{3}\right]_n n^2 + 3n - [1,2]_n$$
$$= \begin{cases} -\frac{1}{3}n^2 + 3n - 2 & \text{if } n \equiv 0 \pmod 2 \\ -\frac{1}{2}n^2 + 3n - 1 & \text{if } n \equiv 1 \pmod 2 \end{cases}$$



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Definition

A polynomial in a variable x is a linear combination of powers of x:

$$f(x) = \sum_{i=0}^{g} c_i x^i$$

Definition

A quasi-polynomial in a variable x is a polynomial expression with periodic numbers as coefficients:

$$f(n) = \sum_{i=0}^{g} u_i(n) n^i$$

with $u_i(n)$ periodic numbers.

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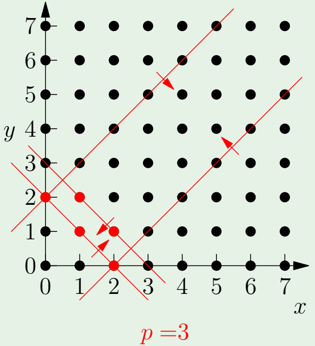
Section 1 - subsection 2 - page 1

Example



$x + y \leq p$

p	$f(p)$
3	5
4	8
5	10
6	13

$$\frac{5}{2}p + \left[-2, \frac{-5}{2}\right]_p$$

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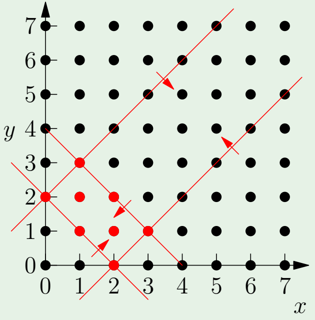
Example



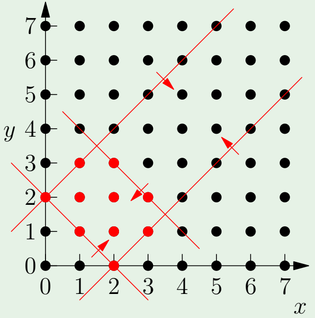
$p = 4$

$x + y \leq p$

p	$f(p)$
3	5
4	8
5	10
6	13

$$\frac{5}{2}p + \left[-2, \frac{-5}{2}\right]_p$$

Example



$p = 5$

$x + y \leq p$

p	$f(p)$
3	5
4	8
5	10
6	13

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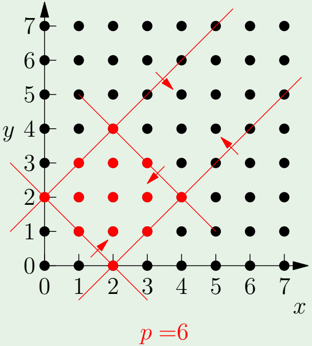
Example



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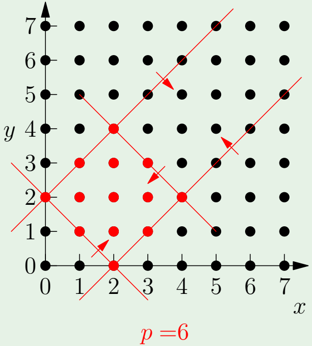

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- The number of integer points in a parametric polytope P_p of dimension n is expressed as a piecewise a quasi-polynomial of degree n in p (Clauss and Loechner).
- More general polyhedral counting problems:
  Systems of linear inequalities combined with $\vee, \wedge, \neg, \forall$, or $\exists$ (Presburger formulas).
- Many problems in static program analysis can be expressed as polyhedral counting problems.

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TUDelft

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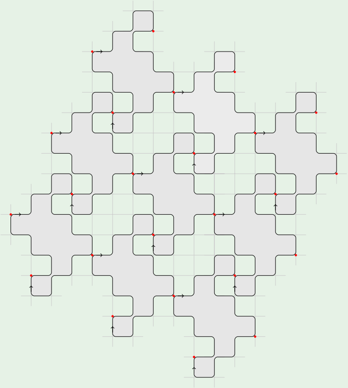
A picture made with the package TiKz

Example



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Section 2 - subsection 1 - page 1

Problem

This page gives an example with numbered bullets (enumerate) in an "Example" window:

Example

Discrete domain $\Rightarrow$ evaluate in each point

Not possible for

1. parametric domains
2. large domains (NP-complete)

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Summery

End of the beamer demo
with a TUDelft lay-out.
Thank you!