



Sample presentation using Beamer

Delft University of Technology

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Outline

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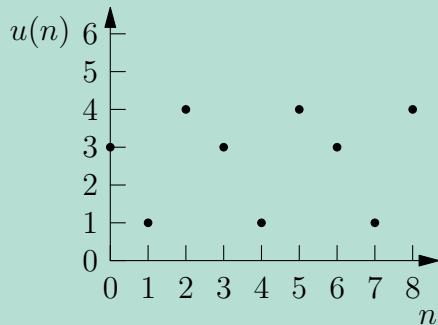
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Example



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

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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 .

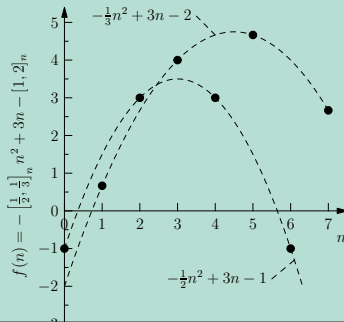
$$u(n) = [u_0, u_1, \dots, u_{d-1}]_n = \begin{cases} u_0 & \text{if } n \equiv 0 \pmod{d} \\ u_1 & \text{if } n \equiv 1 \pmod{d} \\ \vdots & \\ u_{d-1} & \text{if } n \equiv d-1 \pmod{d} \end{cases}$$

d is called the period.

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Example

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



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Definition

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

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

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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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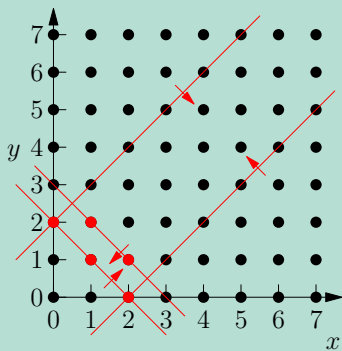
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Example



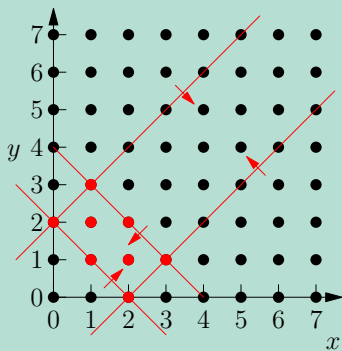
$$p = 3$$

$$x + y \leq p$$

$$\frac{p}{3} \quad \frac{f(p)}{5}$$

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Example



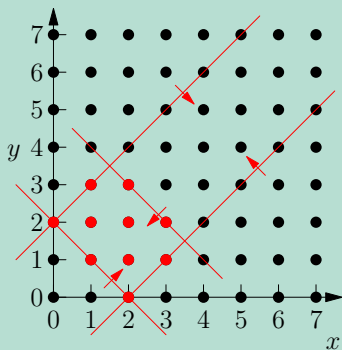
$$p = 4$$

$$x + y \leq p$$

p	$f(p)$
3	5
4	8

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Example



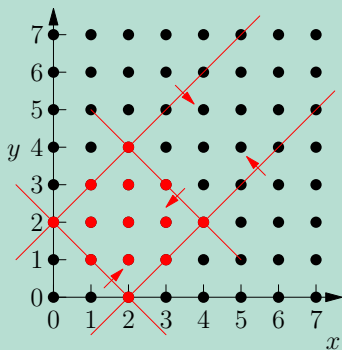
$$p = 5$$

$$x + y \leq p$$

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

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Example



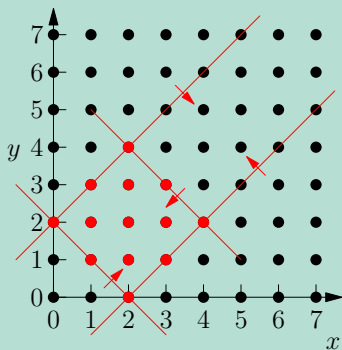
$$p = 6$$

$$x + y \leq p$$

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

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Example



$$p = 6$$

$$x + y \leq p$$

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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- 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 (Claus and Loechner).

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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 (Claus and Loechner).
- More general **polyhedral counting problems**:
Systems of linear inequalities combined with $\forall, \wedge, \neg, \exists$, or \exists (Presburger formulas).

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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 (Claus and Loechner).
- More general **polyhedral counting problems**:
Systems of linear inequalities combined with $\forall, \wedge, \neg, \exists$, or \exists (Presburger formulas).
- Many problems in **static program analysis** can be expressed as polyhedral counting problems.

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2 Second Section

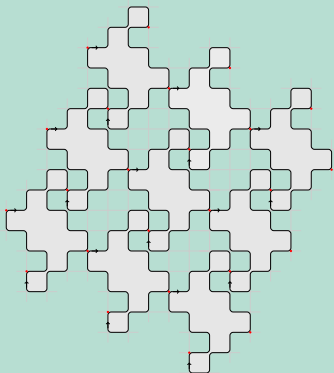
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A picture made with the package TiKz

Example



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Alertblock

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

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Alertblock

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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Summary

End of the beamer demo
with a *tidy* TU Delft lay-out.
Thank you!