

CoCoALib Minicourse



<http://cocoa.dima.unige.it/>

J. Abbott

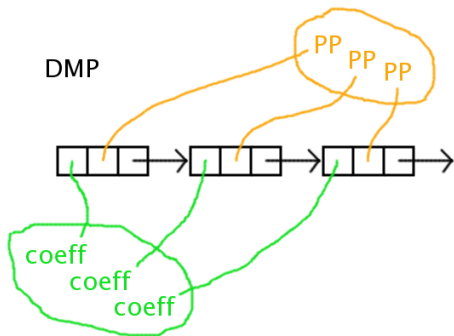
Matrix

- a matrix is a self-contained object
- resizable, can swap rows or cols, ...

MatrixView

- view another object as a matrix
- RowMat, ColMat, DiagMat
- transpose, ...

Internal structure of a polynomial



- + clean, easy to maintain, completely general
- poor locality, slow over F_q

DMPII (in some special cases)



- + good locality, fast
- less clean, harder to maintain

Power-product monoid (PPM)

- models the additive monoid \mathbb{N}^k
- includes term-ordering
- different impls: `PPMonoidEv`, `PPMonoidOV`, ...
- includes names of the indeterminates (for printing)

Term ordering

- special cases: `degrevlex`, `lex`
- general case via integer matrix
- “exponent-vector” and “order-vector”

DivMask

- fast way of saying one PP does not divide another
- probabilistic, but “not divisible” is reliable
- mask has small, fixed size
- different “rules” (mappings $\text{PP} \mapsto \text{mask}$)

Ideals

- general case: generators, hidden G-basis (why hidden?)
- special cases: monomial ideals, ideals of points, in $k[x]$
- 3-way booleans for properties (e.g. primality, maximality)
- other bases: Janet, Pommaret

Example: see `ex-ideal1.C` and `ex-ideal2.C`

Exercise

- 1 write a function to generate a random linear form
- 2 write a function to generate a change-of-coordinate homomorphism
- 3 write a function which accepts an ideal I and a homomorphism ϕ , and returns the ideal generated by $\phi(g)$ for all generators g of I
- 4 write a function `gin1` which accepts an ideal I , and returns the LT ideal of a “random transformation” of I
- 5 experiment with one ideal and several different random transformations; observe that the result is almost always the same
- 6 how does computation time vary with the “size” of the random transformations?
- 7 write a function `gin2` which accepts an ideal I , calls `gin1` repeatedly until the same result is obtained twice in succession.

The End

John Abbott is an INdAM-COFUND Marie Curie Fellow.