

CoCoA-5 - Design #984

GroebnerFanIdeals: order matrices sometimes have "large" entries

26 Nov 2016 17:51 - John Abbott

Status:	New	Start date:	26 Nov 2016
Priority:	Normal	Due date:	
Assignee:		% Done:	0%
Category:	enhancing/improving	Estimated time:	0.00 hour
Target version:	CoCoA-5.?.?	Spent time:	1.30 hour
Description			
After using GroebnerFanIdeals, I noticed that some order matrices can have quite "large" entries (e.g. greater than 1000).			
Because of the way CoCoALib stores order vectors, having such large entries in the order matrix is potentially limiting (i.e. triggering problems of machine integer overflow if degrees become large).			
Is it possible to produce order matrices with smaller entries?			
Related issues:			
Related to CoCoA-5 - Support #973: GroebnerFanIdeals: verbosity and output style		Closed	17 Nov 2016
Related to CoCoA-5 - Support #977: "universal denominator" (related with Groe...		In Progress	17 Nov 2016
Related to CoCoALib - Bug #1069: GroebnerFan: ERROR: Matrix must be invertible		In Progress	17 May 2017
Related to CoCoA-5 - Bug #1634: Unexpected or unhelpful error using GroebnerF...		New	22 Nov 2021
Related to CoCoALib - Slug #1049: GroebnerFan: slow examples		In Progress	19 Apr 2017
Related to CoCoALib - Bug #1371: French students' example with GFan		In Progress	25 Nov 2019

History

#1 - 26 Nov 2016 17:51 - John Abbott

- Related to Support #973: GroebnerFanIdeals: verbosity and output style added

#2 - 26 Nov 2016 17:52 - John Abbott

- Related to Support #977: "universal denominator" (related with GroebnerFanIdeals) added

#3 - 26 Nov 2016 18:02 - John Abbott

Here is the same example as in issue [#973](#)

```
use P:=QQ[x,y,z];
I := ideal(x^5-3*y^3*z+x*y*z-2, y^3-2*z+5, z^2-12*x+7*y);
GF := GroebnerFanIdeals(I);
OrderMats := [OrdMat(RingOf(J)) | J in GF];
[M in OrderMats | max(flatten(GetRows(M))) > 1000]; --> two matrices
```

As far as I can tell the order of the ideals in GF is the same from run to run, so I may refer to certain ideals just by specifying their indices. Anyway, I wanted to see which ideals corresponded to "lex" orderings: on my computer these have indices [36, 38, 94].

I had naively hoped to see that the matrices were just permutations of the identity matrix; instead they have larger entries:

```
>>> OrdMat(RingOf(GF[36]));
matrix(ZZ,
 [[29, 30, 1],
 [842, 870, 0],
 [0, 0, -1]])

>>> OrdMat(RingOf(GF[38]));
matrix(ZZ,
 [[6, 1, 4],
```

```
[37, 0, 24],  
[0, 0, -1]])
```

```
>>> OrdMat(RingOf(GF[94]));  
matrix(ZZ,  
  [[1, 29, 58],  
   [0, 842, 1682],  
   [0, 0, -1]])
```

Can something be done to make the matrix entries smaller?

For instance, it seems to me that the second row of the last matrix could be divided by 2 without affecting the ordering; similarly for second row of first matrix.

#4 - 26 Nov 2016 18:08 - John Abbott

I noticed that in this example the order matrices always have strictly positive entries in the first row. Are zeroes not allowed?

It seems that GFan usually produces the first two rows, and then the last row is just [0,0,-1] with the sole exception of the very first ideal whose order matrix corresponds to StdDegRevLex.

One option could be to determine the "best" order matrix for each ideal once the supports of its reduced G-basis elements have been computed. This appears to be an integer linear programming problem.

#5 - 17 May 2017 15:46 - John Abbott

- Related to Bug #1069: GroebnerFan: ERROR: Matrix must be invertible added

#6 - 22 Nov 2021 20:19 - John Abbott

It seems that the first two rows are "almost parallel" -- why should that be?
Anyway, it should be easy to reduce the size of entries in row 2.

#7 - 22 Nov 2021 20:23 - John Abbott

- Related to Bug #1634: Unexpected or unhelpful error using GroebnerFanIdeals added

#8 - 11 Mar 2024 11:15 - John Abbott

- Related to Slug #1049: GroebnerFan: slow examples added

#9 - 11 Mar 2024 11:15 - John Abbott

- Related to Bug #1371: French students' example with GFan added