CoCoA-5 - Slug #1025

Example of slow LEX GBasis computation

07 Mar 2017 21:15 - John Abbott

Status:	In Progress	**Start date:**	07 Mar 2017
Priority:	Normal	**Due date:**	
Assignee:		**% Done:**	10%
Category:	enhancing/improving	**Estimated time:**	0.00 hour
Target version:	CoCoA-5.?.?	**Spent time:**	1.80 hour

Description

I am putting this example here just not to lose it:

```
use QQ[x,y,z],lex;
//use ZZ/(32003)[x,y,z],lex;
SetVerbosityLevel(2000);

I := ideal(-x^2*y -x +z^3, -x^2*y +x^2*z +y^2, x^3 +y^3); // --> 78s
t0 := CpuTime();
RGB := ReducedGBasis(I);
println "RGB time: ", TimeFrom(t0);
indent(RGB);
```

The final RGB is not too bad, but one of the polys produced during the computation has coeffs almost 300000 digits long! The computation mod p is instant.

History

#1 - 07 Mar 2017 21:17 - John Abbott

Send the output to a file! (over 40Mbytes)

Biggest coeffs are from the 3rd last polynomial; but several others are large too.

#2 - 08 Mar 2017 18:56 - John Abbott

Here are some simple-looking ideals whose lex GBs cannot be computed (in reasonable time) by CoCoA-5.1.5:

```
use QQ[x,y,z],lex;
I := ideal(2*x*y^2 +x +z^3, 2*x^2 +x*y -y^3, 2*x^3 -x*z +2*y); // -->  > 5400 s  and  >3.3Gbyte
I := ideal(-x^4 +x^2*y -y^2*z^2, -x^3*y +x*y*z -z^4, x^3*y -x^2 -y*z^2); //  --> > 1800s  almost 1Gbyte
I := ideal(-x^2*y^2 -x*z^2 -z^4, -x^4 +x*y +y, x^2*z -x*y*z^2 -y^3); // -->  > 600s
I := ideal(-x^2 -x*z +y^3, -x^2*y -x -z, x^2 +x*y*z -x*z); // --> > 10000s  and  > 5.0Gbyte
```

I'm putting them here just not to lose them. They were found using a randomized search, so do not have any particular significance (that I know of).

#3 - 08 Mar 2017 23:59 - John Abbott

Here are some more slow examples:

```
ideal(-2*x^3 -2*x*z^2 +z^2, x^2*y +2*x^2*z +x*y, -2*x^2*y -2*x*z^2 +2*y^3); --> > 100s
ideal(x^3 +x*y*z -z^2, -x^2 +x*z +y*z, -x^2*z +x*y -y^3);  --> > 90s
ideal(x^2 +x*z^2 -y*z^2, -x^2*z -x*y -y^3, x^3 -x^2 -z^2); --> > 130s
ideal(-x^3 +y*z^2 +z^3, x^2*y +x*y^2 -y*z^2, x^2 -x*z^2 -y^3); --> > 160s
ideal(-x^3 -x*y -y^3, x^3 +y^2 +z^2, -x^2 -x*z -z^3); --> > 130s
ideal(x*y^2 +x -y^2*z, x^3 +y^3 -z^3, -x^3 +x^2*y -y); --> > 130s
```

#4 - 09 Mar 2017 16:30 - John Abbott

More examples: these all have support a 3-subset of supp((x+y+z)^3+x) and coeffs +1 or -1

```
ideal(x^3 -x^2*y +z^3, x^3 -x +y*z^2, x^3 -x*z^2 -y^3); -->  > 110s
ideal(x^3 -y*z^2 -z^3, x^2*y +x +y^3, -x^2*y +x^2*z +x); -->  > 340s
ideal(-x^2*z +x -y^3, x^3 +x*y^2 +x*y*z, -x^2*y -x*z^2 +z^3); --> > 450s
ideal(x^2*y +x +z^3, x^2*y -x*z^2 -y^2*z, -x^3 -x^2*y -y^3); --> > 540s
ideal(x^2*z -x -y^3, -x^3 +x*y^2 +z^3, -x^2*y -x*z^2 -z^3); --> > 200s
ideal(x^2*y +x +z^3, x^2*y +x^2*z +y^3, x^3 +x*z^2 +y^3);  --> > 360s
ideal(x^2*z +x +y^3, x^2*y +x*z^2 +y^2*z, x^3 +x^2*z +z^3); -->  > 900s
```

I tried also in degree 2, but the random search found no "very slow" examples.
I also tried 1 or 2 gens with degree 3 and the rest of degree 2, but again there were no "very slow" examples.
Here "very slow" means longer than 10 seconds.

#5 - 09 Mar 2017 17:31 - John Abbott

This is really unrelated: it is an ideal with a surprisingly "large" DegRevLex RGBasis

```
use QQ[x,y,z];
I := ideal(-y^2*z^2 -x*z^3 +z^4, -x*y^3 +y^3 +z, x^3*y -x +1); indent(ReducedGBasis(I));
```

Putting it here just not to lose it.

#6 - 15 Nov 2017 14:57 - John Abbott

- Status changed from New to In Progress

- % Done changed from 0 to 10

Here is a zero-dim ideal with simple DegRevLex RGB

```
L:=[x^3 -x,  y^3 +x^2 +y*z,  z^3 +x*y -x*z];
```

CoCoA takes about 130s to compute the lex-RGB; the basis itself looks fairly simple.

NOTE with verbosity at 100 I noticed that it spent a long time in **Final clean up**