CoCoALib - Bug #15

Adjoint of a non-invertible matrix

28 Oct 2011 16:48 - Anna Maria Bigatti

Status:	Closed	**Start date:**	28 Oct 2011
Priority:	High	**Due date:**	
Assignee:	John Abbott	**% Done:**	100%
Category:	New Function	**Estimated time:**	3.55 hours
Target version:	CoCoALib-0.99800	**Spent time:**	3.55 hours

Description

Problem with

```
Fp5 := NewZZmod(5);
adj(mat(Fp5, [[1,2],[3,1]]));
```

Related issues:

Related to CoCoALib - Slug #675: Matrix determinant over multivariate poly ring	**In Progress**	**28 Mar 2015**
Related to CoCoALib - Bug #1280: Determinant & Inverse of matrix over non int...	**In Progress**	**03 May 2019**
Related to CoCoALib - Bug #1331: adj: for matrices 7x7 and bigger	**Closed**	**08 Oct 2019**

History

#1 - 08 Nov 2011 10:56 - Anna Maria Bigatti

- Category set to New Function

#2 - 01 Apr 2014 17:35 - Anna Maria Bigatti

- Target version set to CoCoALib-0.99533 Easter14

#3 - 07 Apr 2014 18:09 - John Abbott

- Target version changed from CoCoALib-0.99533 Easter14 to CoCoALib-1.0

#4 - 25 Mar 2015 14:52 - John Abbott

- Status changed from New to In Progress

- Priority changed from Normal to High

I do not recall when, but adj has aleady been added to CoCoALib.

It has a **VERY BAD SLUG**: even after several minutes it has not yet computed adj of a 5x5 matrix whose entries are distinct indeterminates. The result should be a 5x5 matrix each of whose entries contain a polynomial of 24 terms (just the det of the "co-matrix").

Boosting priority because I need adj for some work I'm doing now.

#5 - 25 Mar 2015 15:22 - John Abbott

adj is a very simple function: it chooses between AdjByDetOfMinors and AdjByInverse.

What do you think AdjByInverse should do?

1. accept a matrix over a field, otherwise error
2. accept a matrix over an integral domain (otherwise error), create field of fractions if necessary...
3. accept any (square) matrix, do those it can, otherwise pass the matrix to AdjByDetOfMinors?

Currently, the implementation is a combination of (2) and (3).

I have doubts about (3): if I say to compute via the inverse then it shouldn't switch to some other method if my explicit choice of method does not work in that case.

I even have some doubts about (2); perhaps it would better to have another fn called AdjByInverseOverFrF?

Comments? Opinions?

#6 - 25 Mar 2015 15:59 - John Abbott

Even AdjByDetOfMinors takes too long for a 6x6 matrix of distinct indets. Why?

2015-03-26 NOTE I think the problem is probably very slow GCD (via G-bases) during arithmetic in a fraction field of a multivariate polynomial ring.

#7 - 26 Mar 2015 11:53 - John Abbott

- % Done changed from 0 to 10

I am planning to implement a direct algorithm: each entry in the adj is just a determinant, and each determinant is just a sum of products of (n-1) matrix entries.

In the case of a matrix of indeterminates the direct approach should be fine (essentially it just "writes down" the answer) even though the complexity is not good
(probably N*factorial(N), but that is the size of the answer!).

#8 - 08 May 2015 11:50 - John Abbott

- % Done changed from 10 to 20

I have implemented a first version of AdjByDetOfMinors; it may already be obsolete because I have also implemented an improved version of det which calls DetDirect in the cases that interest me.

NEXT reimplement AdjByDetOfMinors to call explicitly det and let the latter choose the best way to compute the det of each submatrix.

#9 - 03 May 2019 13:57 - John Abbott

- Related to Bug #1280: Determinant & Inverse of matrix over non integral domain added

#10 - 08 Oct 2019 15:26 - John Abbott

- Related to Bug #1331: adj: for matrices 7x7 and bigger added

#11 - 14 Oct 2020 12:52 - John Abbott

- Description updated

- Assignee set to John Abbott

- Target version changed from CoCoALib-1.0 to CoCoALib-0.99800

- % Done changed from 20 to 100

- Estimated time set to 3.55 h

This now works (since when?).
Surely the impl for adj can be improved; there are several later issues about adj too (*e.g.* #1280 and #1331)
Closing this one (mostly because it is old... and also rather too vague).

PS I modified the original description because of some later syntax changes; the revised description is equivalent to the original one.

#12 - 16 Sep 2021 13:48 - John Abbott

- Status changed from In Progress to Closed