

## CoCoALib - Slug #1324

### Improve RootBound

30 Sep 2019 19:40 - John Abbott

<b>Status:</b>	In Progress	<b>Start date:</b>	30 Sep 2019
<b>Priority:</b>	Normal	<b>Due date:</b>	
<b>Assignee:</b>		<b>% Done:</b>	10%
<b>Category:</b>	Improving	<b>Estimated time:</b>	0.00 hour
<b>Target version:</b>	CoCoALib-1.0	<b>Spent time:</b>	1.00 hour
<b>Description</b>			
It maybe possible to improve RootBound (in some cases) by using SqfreeFactor.			
Also the CoCoA-5 prototype GoodShiftForRootBound should be translated into C++.			

#### History

##### #1 - 30 Sep 2019 19:42 - John Abbott

**CAREFUL** with the suggestions below: it is likely the RootBound is used internally when factorizing or computing sqfr factors.

If we can obtain quickly a factorization of  $f$  then  $\text{RootBound}(f)$  is just max of the  $\text{RootBound}$  for each factor.

I think that  $\text{SqfreeFactor}$  should be a good candidate for being quick enough.

It would be nice to have the  $\text{GoodShiftForRootBound}$  in C++; what name should it have? And what result should it give? Result could be the shift ( $\text{BigInt}$ ) and the improved root bound ( $\text{BigRat}$ ); should there also be the shifted poly?

##### #2 - 30 Oct 2019 21:44 - John Abbott

- Status changed from New to In Progress

- % Done changed from 0 to 10

Here is a family of examples where factorization may not work so well:

let  $f$  be a product of  $x^k-1$  where the  $k$  values are chosen so that  $\text{CoeffHeight}(f)$  is small (e.g. 1).  $\text{Sqfr}$  factorization will then give a high power of  $x-1$  and a factor with large coeffs.

I did try a couple of examples: there was some penalty, but it was much less than expected.

Anyway, one could take  $\min(\text{RootBound}(f), \max([\text{RootBound}(fac) \mid fac \text{ in } \text{SqfreeFactor}(f).factors])$ ). Though this is obviously more costly than just computing  $\text{RootBound}(f)$ .

Perhaps the  $\text{sqfr}$  factors can be used only if they "small" compared to the original poly?