

CoCoALib - Bug #853

NearestInt can needlessly throw InsufficientPrecision

23 Mar 2016 16:52 - John Abbott

Status:	Closed	Start date:	23 Mar 2016
Priority:	Normal	Due date:	
Assignee:	John Abbott	% Done:	100%
Category:	Maths Bugs	Estimated time:	7.70 hours
Target version:	CoCoALib-0.99550 spring 2017	Spent time:	7.55 hours
Description The current impl of NearestInt with an arg from a RingTwinFloat can throw InsufficientPrecision when it should not. The cause is a speculative call to IsRational which does not catch the error. Fix impl of NearestInt.			
Related issues:			
Related to CoCoALib - Support #696: test-OrderedRing: activate or eliminate?		Closed	08 May 2015
Related to CoCoALib - Bug #858: floor for TwinFloat can produce ERR::SERIOUS		Closed	26 Mar 2016

History

#1 - 23 Mar 2016 16:53 - John Abbott

- Related to Support #696: test-OrderedRing: activate or eliminate? added

#2 - 23 Mar 2016 17:12 - John Abbott

- Status changed from New to In Progress

- Assignee set to John Abbott

- % Done changed from 0 to 10

What properties should the result of NearestInt have?

- an obvious property is $\text{abs}(\text{NearestInt}(X) - X) \leq 1/2$

What should happen to halves?

Recall that there is a function called RoundDiv(N,D) and a closely related function round(q) for a rational number. It seems reasonable to expect that $\text{NearestInt}(X) = \text{round}(Q)$ if $\text{IsRational}(Q,X)$; or equivalently, given a rational number Q then $\text{round}(Q) = \text{NearestInt}(\text{RingElem}(R,Q))$ for any ring R where $\text{NearestInt}(R,Q)$ is defined.

How to implement NearestInt so that it is surely compatible with round?

The hard case is when the ring is RingTwinFloat.

#3 - 23 Mar 2016 17:29 - John Abbott

Which is the better design?

- **(A)** A normal C++ fn (as currently implemented), or
- **(B)** mem fns for the rings which actually need to implement it.

An advantage of **(A)** is that all the code is together so it should be (relatively) easy to see that halves are rounded consistently for all rings.

An advantage of **(B)** is that the impls can exploit knowledge of the explicit internal representation of the values.

A disadvantage of **(B)** is that every ring must have an impl of `myNearestInt` even when this makes no sense; of course, there can be a default impl which gives an error (but that is a bit ugly).

#4 - 25 Mar 2016 14:54 - John Abbott

Currently the only ordered domains are: `RingZZ`, `RingQQ` (since a `FractionField` of an ordered domain is an ordered domain), and `RingTwinFloat`.

A disadvantage of implementation approach **(A)** in the previous comment is that the function must (really ought to be) be reviewed every time a new ordered domain is added to make sure that it works properly also for the new ring. JAA is now inclined to think that this disadvantage outweighs the disadvantages of approach **(B)**.

[of course this means rewriting the current implementation]

#5 - 25 Mar 2016 14:59 - John Abbott

I am thinking of making the test for `NearestInt` of twin float values work as follows:

fix an integer N , for ever smaller positive values of ϵ verify that after setting $x = N + \epsilon$ we have that `NearestInt(x) == N` gives exactly the same response as $N \leq x$ && $x < N + 1$. Repeat also for values of $\epsilon = 1 - \eta$ where η is small and positive.

Do the test for N small and positive, large and positive, small (abs val) and negative, large (abs val) and negative.

#6 - 25 Mar 2016 15:12 - Anna Maria Bigatti

John Abbott wrote:

Which is the better design?

- **(A)** A normal C++ fn (as currently implemented), or
- **(B)** mem fns for the rings which actually need to implement it.

can't we have a member function with an abstract implementation (or error), and concrete implementations only for special cases (i.e. `TwinFloat`)?

#7 - 25 Mar 2016 22:04 - John Abbott

I think I have fixed the problem. I have completely rewritten the code to do with `floor`, `ceil` and `NearestInt`.

Part of the problem was a test something like $\text{abs}(x - N) \leq 1/2$ where the problem was $x - N$ would throw `InsuffPrec` because the result could not be calculated with the precision required by the twin-float ring (even though it could be calculated quite accurately enough to recognize that the difference was less than $1/2$).

A new, clearer test now passes as I expect it to. So marking this as in feedback.

#8 - 25 Mar 2016 22:11 - John Abbott

- *Status changed from In Progress to Feedback*
- *% Done changed from 10 to 90*

I followed design (B); we just have to be careful if we want to change policy about how halves are handled. Perhaps some vagueness in exactly how they are handled is not such a bad thing?

#9 - 26 Mar 2016 11:03 - John Abbott

- *Related to Bug #858: floor for TwinFloat can produce ERR::SERIOUS added*

#10 - 30 Mar 2016 18:23 - John Abbott

- *Estimated time set to 7.70 h*

I have cleaned the impl considerably; it is now obviously correct (but possibly slower than necessary as a wasteful temporary is created).

Maybe I'll try a version without the temporary to see if it is usefully faster (but the code will be less clear).

#11 - 25 Jun 2016 12:19 - John Abbott

- *Status changed from Feedback to Closed*
- *% Done changed from 90 to 100*

This has been in feedback for 3 months without any reports of problems.
Apparently the (new-ish?) test test-OrderedRing2.C covers the problems reported here.
Closing!

#12 - 05 Oct 2016 16:33 - John Abbott

- *Target version changed from CoCoALib-0.99560 to CoCoALib-0.99550 spring 2017*