Re: Calculation of critical p−, z−, t− and F−values

Source: http://sci.tech−archive.net/Archive/sci.stat.math/2007−11/msg00204.html

- *From*: "Nasser Abbasi" <nma@xxxxxxxxx>
- *Date*: Wed, 14 Nov 2007 05:58:47 −0800

<iandjmsmith@xxxxxxx> wrote in message
news:1195043423.480673.177500@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

> I've got it. The problem was you asked for
> Quantile[StudentTDistribution[100000000], 0.975] and the 0.975 causes
> it to work to machine precision. The method of calculation is very
> poor and hence only delivers a results with relative error of 3e−8.

That is correct. As I said, when there is a 'numeric' value in the
expression, this will force the computation to be done in non−symbolic.

> You can ask for exact calculations with
> Quantile[StudentTDistribution[100000000], 975/1000]

Yes.

> According to
> http://reference.wolfram.com/mathematica/ref/N.html?q=N&lang=en
> N[%, n] attempts to give a result with n−digit precision.

Yes.

> It is not clear what is stopping it giving rather than attempting to
> give a result with n−digit precision. The + operation is going to lose
> about 8 figures so InverseBetaRegularized[1, −(19/20), 50000000, 1/2]
> must be calculated to about 58 digits to give 50 digit accuracy. I am
> still lost as to why it has printed out 68 digits. Maybe that is how
> many figures it did the calculations to.

Ian Smith

Well, Mathematica floating point model is a little hard for me to comprehend without spending more time on it, and I am no expert at this aspect of Mathematica, may be a Mathematica expert can comment on this. I know it sometimes uses "significance arithmetic" and is implemented in software.

I copied a reply I wrote sometime ago in another newsgroup which has a link to a detailed paper about Mathematica floating point model if anyone is interested in some reading over their coffee break :)

"There is this paper that goes into all the details you ever wanted to know about Mathematica handling of floating point arithmetic (LONG URL)

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6W8D−4FFGJ35−1&_coverDate=07%2F31%2F200

"M. Sofroniou and G. Spaletta. Precise numerical computation. The Journal of Logic and Algebraic Programming 64:113−134. 2005."

There is a 1999 version of the paper that anyone can download for free (I am not sure what is the difference):
http://citeseer.ist.psu.edu/sofroniou99precise.html

Any way, I am trying to understand it. But related to significant arithmetic use in Mathematica, the paper says that is not done all the time, here is the quote:

"Indeed Mathematica uses fixed−precision arithmetic instead of significance arithmetic in its large scale numerical routines, such as in linear algebra and the numerical solution of differential equations; the error bounds provided by these numerical methods are well studied and provide much tighter bounds than those based on assumptions of independent error accumulation."

There is also standard way to tell Mathematica to use hardware floating point arithmatics as well if you want by setting some global options at the start of the session.

Nasser "

Nasser

.