Re: Good algorithm for Inverse of cumulative Student's t?

Source: http://sci.tech−archive.net/Archive/sci.stat.math/2006−08/msg00728.html

- *From*: iandjmsmith@xxxxxxx
- *Date*: 19 Aug 2006 00:36:26 −0700

Schizoid Man wrote:

> Hi,
>
> I'm trying to set up a credit risk model that employees a Student t
> copula. For this purpose, I need algorithms for:
>
> a. the cumulative distribution function of the Student t
> b. the inverse of the cumulative distribution function of the Student t
>
> I nicked the CDF from Numerical Recipes and it seems to do the job quite
> well, but I have not had much luck with the inverse algorithm.
>
> I also needed to setup a Gaussian copula for which I used Excel's
> built−in NORMSDIST() for the CDF which was good enough, and P.J.
> Acklam's inverse algorithm, since NORMSINV() is meant to be quite horrible.
>
> Thanks,
> Schiz

You could use the inv_tdist code in
http://members.aol.com/iandjmsmith/Examples.xls (VBA code only in
http://members.aol.com/iandjmsmith/Examples.txt)

It requires a accurate algorithm for the cdf of the t−distribution and
a function to invert the normal distribution.

The accuracy of the cdf of the t−distribution from NR is not very high
so you will have to reduce the accuracy to which the code for inv_tdist
works.

If you wish an algorithm rather than code

Choose a decent starting approximation. I use the one given in
Abramowitz & Stegun (26.7.5)
For probabilities <= 0.5 use Newton Raphson to solve

log(cdf(tapprox,df)) = log(prob)
which is done using

new tapprox = tapprox −
log(cdf(tapprox,df)/prob).cdf(tapprox,df)/pdf(tapprox,df)

if prob and cdf(tapprox,df) are not close together or

new tapprox = tapprox −
log1p((cdf(tapprox,df)−prob)/prob).cdf(tapprox,df)/pdf(tapprox,df)

if prob and cdf(tapprox,df) are close together. log1p(x) is a function
which evaluates log(1+x) accurately for small x.

For probabilities > 0.5 use −inv_tdist(1−prob,df)

If you want a more accurate function for the cdf of the t−distribution
use cdf_tdist from the same source.

Ian Smith

.