Subject: Re: Confluent Hypergeometric Function of the First Kind
Posted by Spon on Thu, 21 Feb 2008 14:30:10 GMT
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On Feb 20, 3:44 pm, noahh.schwa...@gmail.com wrote:
> Hello everyone,
>
> I am looking for the Confluent Hypergeometric Function of the First
> Kind in the IDL Math Library but it does not seem to be implemented!
>
> I would like to use a function similar to the Hypergeometric1F1[a, b,
> z] of Mathematica [http://reference.wolfram.com/mathematica/ref/
> Hypergeometric1F1.html].
>
> I have not found what I was looking for, and so decided to try to code
> it my self... [sigh...]. Beeing a fresh beginner in IDL this is a hard
> task!
>
> Would anybody know how to code an infinite series expansion like the
> Hypergeometric1F1?
>
> Thank you in advance for your time!
> Noah

Noah,

here's my attempt. It accepts only scalar inputs for A and B, while Z can be a vector. I've tested it for the examples on the mathematica site and it seems to give correct results, and works correctly for complex input too as far as I can tell. 'Precision' is an input variable to specify how close two successive iterations have to be before the function assumes they are the same and aborts the while loop. Default is 7 (i.e. stop when results differ by 10^-7 or less).
If you're finding this programme is running very slow, try decreasing the precision (I was surprised how fast it runs despite the while loop, actually!)

Ideally the input parameters should all be double precision before you make the call to the funcion, but the function converts them if they're not.

If you want all your inputs to be vectors (not just Z), I'm sure it can be done, but it'd be a bit more complicated. :-)

Take care,
Chris

FUNCTION HYPERGEOMETRICONEFONE, A, B, Z, $

```
 PRECISION = Precision, $
 K = K ; K is an output parameter to count No. of WHILE loops
performed.

 ; References:
 ;  http://reference.wolfram.com/mathematica/ref/Hypergeometric1 F1.html
 ;  http://en.wikipedia.org/wiki/Confluent_hypergeometric_functi on

IF N_PARAMS() NE 3 THEN MESSAGE, 'Must input A, B & Z as 3 input
parameters.'
IF N_ELEMENTS(A) GT 1 THEN MESSAGE, 'Variable A must be a scalar.'
IF N_ELEMENTS(B) GT 1 THEN MESSAGE, 'Variable B must be a scalar.'

A *= 1.0D ; Double precision or double complex scalar
B *= 1.0D ; Double precision or double complex scalar
Z *= 1.0D ; Double precision or double complex scalar or vector
IF N_ELEMENTS(Precision) EQ 0 THEN $
  Precision = 7L ELSE $
    Precision = (LONG(Precision))[0]
Cutoff = 10D^(-1D * Precision) > (MACHAR()).EPS ; Cutoff can't be
smaller than machine accuracy!

K = 0L
ThisResult = REPLICATE(0D, N_ELEMENTS(Z))
WHILE (N_ELEMENTS(LastResult) EQ 0) || (MAX(ABS(LastResult -
ThisResult)) GT Cutoff) DO BEGIN
    LastResult = ThisResult
    AK = GAMMA(A + K) / GAMMA(A) ; Define (A)k
    BK = GAMMA(B + K) / GAMMA(B) ; Define (B)k
    F = (AK * Z^K) / (BK * FACTORIAL(K)) ; Evaluate function.
    ThisResult = LastResult + F
    K += 1
ENDWHILE ; Until result is good to Precision

 ; Error if not enough while loops to give accurate results.
IF K LE 1 THEN MESSAGE, 'Function failed. Try greater precision.'

RETURN, ThisResult
END
```