Introduction to the \texttt{gfun} Package

**Calling Sequence**

\texttt{function(args)}

\texttt{gfun[function](args)}

**Description**

The \texttt{gfun} package has been designed as a help for the manipulation and discovery of functions or sequences satisfying linear differential or recurrence equations. The name of the package comes from its combinatorial application to generating functions.

The basic principle of the package is that linear differential equations or recurrences can be used as data-structures to represent their solutions. Procedures that convert to such a representation are:

\texttt{algfuntoalgeq} \hspace{1cm} \texttt{algeqtodiffeq} \hspace{1cm} \texttt{holexpoldtodiffeq}

The differential equations and recurrences can then be manipulated by

\texttt{algebraicsubs} \hspace{1cm} \texttt{diffegtorec} \hspace{1cm} \texttt{rectodiffeq} \hspace{1cm} \texttt{poltdiffeq}

\texttt{poltorec}

and the following ones that perform more elementary operations

\texttt{borel} \hspace{1cm} \texttt{cauchyproduct} \hspace{1cm} \texttt{diffeg+diffeq}

\texttt{diffeg*diffeq} \hspace{1cm} \texttt{diffegtohomdiffeq} \hspace{1cm} \texttt{hadamardproduct}

\texttt{invborel} \hspace{1cm} \texttt{Laplace} \hspace{1cm} \texttt{rec+rec}

\texttt{rec*rec} \hspace{1cm} \texttt{rectohomrec}

Useful information can then be extracted from these equations by one of

\texttt{algeqtoseries} \hspace{1cm} \texttt{ratpolytocoeff} \hspace{1cm} \texttt{rectoproc} \hspace{1cm} \texttt{the NumGfun subpackage}

Given the first terms of the sequence, the \texttt{gfun} package also contains functions that will help conjecture what the generating function is. In some cases, this answer will be "explicit". In most cases though, such an explicit expression will not exist, and the answer will be an equation (either differential or algebraic) satisfied by the generating function. The functions dealing with numbers and series are:

\texttt{listtodiffeq} \hspace{1cm} \texttt{seriestodiffeq}

\texttt{listtorec} \hspace{1cm} \texttt{seriestorec}

\texttt{listtoalgeq} \hspace{1cm} \texttt{seriestoalgeq}

\texttt{listtoratpoly} \hspace{1cm} \texttt{seriestoratpoly}

\texttt{listtohypergeom} \hspace{1cm} \texttt{seriestohypergeom}

\texttt{guesseqn} \hspace{1cm} \texttt{guessgf}

The way the guessing proceeds can be controlled by modifying \texttt{parameters}.

There are different types of generating functions that can be manipulated in \texttt{gfun}, such as ordinary (ogf) and exponential generating functions. For a description of the predefined types see \texttt{gftypes}.

The following conversion routines transform from one type to another:
Information about the computations that are being done can be obtained by setting infolevel[gfun] to anything between 1 and 5.

**References**


**See Also**

`with gfun[parameters]`