gfun[guessgf] - find a generating function from a list

gfun[guesseqn] - find a differential equation satisfied by the generating function

Calling Sequence

guessgf(L, x, <[typelist]>)

guesseqn(L, y(x), <[typelist]>)

Parameters

L - list
x - name
y - name
[typelist] - (optional) list of generating function types

Description

• The procedure guessgf attempts to find a closed form for the generating function for the series defined by L. The optional variable typelist specifies the kind of generating functions, (such as ordinary (ogf) or exponential (egf)) to try. For a full list of available choices see gftypes.

• If typelist contains more than one element, these types are tried in order.

• If typelist is not provided, the default are ordinary and exponential generating functions, specified by the parameter optionsgf=['ogf','egf'].

This function

1. first tries to find a rational function with listtoratpoly,
2. calls listtohypergeom to try to find hypergeometric functions,
3. tries listtodiffeq to find a linear differential equation with polynomial coefficients which is then passed to dsolve.

• The function guesseqn only tries to find an equation satisfied by the generating function. It might succeed where guessgf fails because it does not attempt to solve this equation in closed-form.

• One should give as many terms as possible in the list L.

Examples

> with(gfun):
> guessgf([1,2,4,7,11,16,22],x);

\[
\begin{bmatrix}
-1 + x - x^2 \\
(x - 1)^3
\end{bmatrix}, \text{ogf}
\]  

(2.1)

> guessgf([1,1,3,10,41,196,1057],x,['lgdegf']);

(2.2)
\[
[\exp + \exp x, \operatorname{lgdegf}]
\]
\[
> l := [1, 4, 36, 400, 4900, 63504, 853776, 11778624, 165636900, 2363904400, 34134779536, 497634306624, 7312459672336];
guessseqn(l, y(z));
\]
\[
\left\{ \begin{array}{l}
D(y)(0) = 4, 4y(z) + (-1 + 32z) \left( \frac{d}{dz} y(z) \right) + (-z + 16z^2) \left( \frac{d^2}{dz^2} y(z) \right), y(0) = 1
\end{array} \right., \operatorname{ogf}
\]

\textbf{See Also}

\texttt{gfun}, \texttt{gfun[parameters]}, \texttt{gfun[listseries]}, \texttt{gfun[listodiffeq]}, \texttt{gfun[listtohypergeom]}, \texttt{gfun[listtoratpoly]}