

**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);
```

$$\left[ \frac{-1+x-x^2}{(x-1)^3}, \text{ogf} \right] \quad (2.1)$$

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

(2.2)

$$[e^x + e^x x, \text{lgdegf}] \quad (2.2)$$

```
> l:=[1, 4, 36, 400, 4900, 63504, 853776, 11778624, 165636900,
2363904400, 34134779536, 497634306624, 7312459672336]:
guesseqn(l,y(z));
```

$$\left[ \left\{ D(y)(0) = 4, 4y(z) + (-1 + 32z) \left( \frac{d}{dz} y(z) \right) + (-z + 16z^2) \left( \frac{d^2}{dz^2} y(z) \right), y(0) = 1 \right\}, \text{ogf} \right] \quad (2.3)$$

### See Also

[gfun](#), [gfun\[parameters\]](#), [gfun\[listtoseries\]](#), [gfun\[listtodiffeq\]](#), [gfun\[listtohypergeom\]](#), [gfun\[listtoratpoly\]](#)