Factorials, Combinations, and Histograms in VPython

To get the factorial and combin functions you must import them. Insert this line at the beginning of your program:

```python
from visual.factorial import *
```

Since you will also want to make graphs, don’t forget:

```python
from visual.graph import *
```

1 factorial

The factorial function takes one argument:

```python
b = factorial(13)
```

will set b to 13!

There is a limit on how big a number can be used in the factorial function, so if you want to calculate combinations of numbers larger than about 160, use the combin function, which takes advantage of cancellations within the formula:

2 combin

The combin function takes two arguments:

```python
c = combin(a,b)
```

The definition of the function is this:

\[
\text{combin}(a,b) = \frac{a!}{b!(a-b)!}
\]

3 Histograms

To make a histogram, create an object of type gvbars. The parameter delta determines the width of a single bar.

```python
myhistogram = gvbars(color=color.red, delta=0.3)
```

To plot a bar, use the usual syntax:

```python
myhistogram.plot(pos=(x,height))
```

4 Natural log

In Python, \(\ln(x)\) is written \(\log(x)\):

5 Looping

Remember that one way to do a calculation using values of a variable from 0 to a maximum is:

```python
amax = 137
a = 0
while a < amax+1:
    ...<calculations>...
    a = a +1
```