Pascal’s Triangle Tests: This blows up when \nrows > 7

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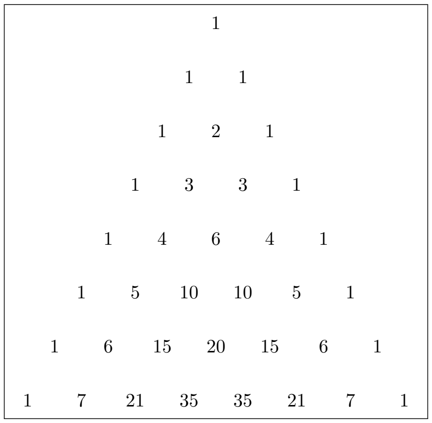
1 Introduction

```
%
% I started looking at this because the below code
% blows up when \nrows > 7.
%
%
\def \nrows {7}                                                                         % number of rows
\pgfmathtruncatemacro \rows {\nrows + 1}                                                % we count from zero
%                                                                                       %
%       Draw the picture, wrapped in a figure                                           % draw the picture
%                                                                                       %
\begin{figure}[H]                                                                       % build the figure
  \centering                                                                            % center everything
  \resizebox{0.50 \textwidth}{!} {                                                      % resize figure if you want
    \fbox {                                                                             % put a box around the figure
       \begin{tikzpicture}[rotate=-90]                                                  % draw the triangle
         \foreach \x in {0,1,...,\nrows} {                                              % loop over the rows
            \foreach \y in {0,...,\x} {                                                 % loop over the columns
               \pgfmathsetmacro \binom {factorial(\x)/(factorial(\y)*factorial(\x-\y))} % calculate the value
               \pgfmathsetmacro \shift {\x/2}                                           %
               \node[xshift=-\shift cm] at (\x,\y) {\pgfmathprintnumber \binom};        % draw the node here
            }                                                                           % \end \foreach \x
         }                                                                              % \end \foreach \y
       \end{tikzpicture}                                                                %
    }                                                                                   % end \fbox
  }                                                                                     % end \resizebox
  \caption{Pascal’s triangle with $\rows$ rows}                                         % \caption
  \label{fig:pascals_triangle}                                                          % \label{}
\end{figure}
```



```
                1
              1   1
            1   2   1
          1   3   3   1
        1   4   6   4   1
      1   5  10  10   5   1
    1   6  15  20  15   6   1
  1   7  21  35  35  21   7   1
```

Figure 1: Pascal’s triangle with 8 rows

2 Acknowledgements

```
From @psu_13@mathstodon.xyz:

@dmm you are probably overflowing LaTeX's poor macro engine...
which was never built to do this kind of heavy lifting.

if you make a small file with just this in it

\tikzmath{
    \x1 = factorial(8)/(factorial(7)*factorial(8-7));
}

you get an arithmetic overflow error when you run TeX.
```

Expanding a bit on @psu_13@mathstodon.xyz's example, note that

```
    \tikzmath {factorial(8);}
```

is enough to get LaTeX to throw an arithmetic overflow error, while

```
    \tikzmath {factorial(7);}
```

does not throw an error.

In addition, Steve VanDevender pointed out that $7! = 5040$ and $8! = 40320$, and that $40320 > 32767$, the largest number you can fit into a 16-bit integer. TeX, due to its age, could be using 16-bit integers, which would explain what we're seeing above.

LaTeX Source

https://www.overleaf.com/read/tgkjgjnjhfjm