QUIZ #7
STARS UPON STARS

Here you will acquire a new programming tool which is quite effective in producing graphic objects of great complexity with a minimum of effort, and that is “procedures that call themselves”.

To see how this comes about, let us call “recstar(5,1)” the graphic object consisting of 5 5-pointed stars whose centers are at the peaks of a 5-pointed star. Call “recstar(5,2)” the graphic object consisting of 25 5-pointed stars whose centers are at the peaks of a recstar(1,5). More generally, having defined a “recstar(5,k-1)”, we define a “recstar(5,k)” to be the graphic object consisting of $5^k$ 5-pointed stars whose centers are at the peaks of a recstar(5,k-1). Even if $k$ is to be a user chosen parameter, this can be achieved by a very simple procedure that calls itself.

More precisely, construct a procedure with heading “starpeaks[x_, y_, r_, n_, k_]” which for $k = 0$ concatenates to a global sequence “stars”, the graphic commands that yield an $n$-pointed star of outer radius $r$, inner radius 1, with center $(x, y)$, and for $k > 0$ it calls starpeaks[x’, y’, r, n, k – 1] with $x’$, $y’$ running over the list of peaks of an $n$-pointed star with center at the point $(x, y)$ and outer radius $r$ and inner radius 1.

Note that the following procedure computes the graphic commands that yield a randomly colored $n$-pointed star with outer radius $r$ and inner radius 1’ centered at $(x, y)$, where you can set

\[
ra[k_] := N[(1 + Random[Integer, k])/(k + 1)]
\]

You can then get your showpiece display by calling a procedure with heading showstars[n_, r, k_] which initializes stars to an empty sequence, then calls starpeaks[x’, y’, r, n, k – 1] with $x’$, $y’$ running over the list of peaks of an $n$-pointed star with center at the point $(x, y)$ and outer radius $r$ and inner radius 1.

If you want adventure, try using the twisted stars that are produced by the following procedure.

Of course you can make them in a random color as well.