RESEARCH STATEMENT

Original Creative Work

Citation: Noel Patson, Recorded or Rendered Work, Web Exhibition, *Generalized Kaprekar Routine,* Wolfram Mathematica.

http://demonstrations.wolfram.com/GeneralizedKaprekarRoutine/

Research Background

This demonstration shows fractal patterns in the number of steps required to reach a fixed point or cyclic behavior in an application of Kaprekar's routine applied to the natural numbers for different bases. To apply the Kaprekar routine for a positive integer n greater than 1, arrange the digits of n in base b in descending n' and ascending n'' order, compute $n' - n''$ (discarding any initial 0s). Repeating this procedure eventually leads to a cycle or a fixed point. The number of steps required, z, plotted as a coloured square at the position $\{n,b\}$, produces beautiful fractal patterns. A subset of these patterns can be seen by setting starting values and ranges for n and b.

Research Contribution

• Innovation – This presentation is the first time the Kaprekar's routine has been represented in this way. It is a fresh revelation of complex fractal patterns arising from the application of simple rules on simple objects.

Research Significance

The demonstration has been through a rigorous review process†.
　　† http://demonstrations.wolfram.com/FAQ.html
It is expected that studying the fractal patterns that arise from this visualization will reveal underlying properties of numbers and provide answers to long standing mathematical problems.

A link to the demonstration can be found at the following website.
http://mathworld.wolfram.com/KaprekarRoutine.html