

Random Iteration Overview

The Random Iteration fractal generator allows the user to create fractals by entering and removing rows in the table that represent each transformation and their respective values and probability. The user can also choose one of three preset fractals: Fern, Sierpinski Triangle, and Koch Curve. The fractal can be shown in color or in black and white.

Random Iteration Initial Screen

The screenshot shows the initial screen of the Random Iteration fractal generator. On the left is a large drawing area containing a fractal image of a fern leaf, colored with blue, red, and cyan. To the right of the drawing area are several controls: a 'START' button, a 'Copy to Clipboard' button, a 'Presets' dropdown menu set to 'Fern', a checked 'Color' checkbox, an 'Add New Row' button, and a 'Remove Selected Row' button. Below these controls is a table with transformation parameters. Arrows point from text labels to specific parts of the interface: 'Click to draw fractal' points to 'START'; 'Click to copy drawing area to clipboard' points to 'Copy to Clipboard'; 'Select preset fractal' points to the 'Presets' dropdown; 'Show fractal in Color/Not in Color' points to the 'Color' checkbox; 'Drawing Area' points to the fractal image; 'Click to add a new row in the transformation table' points to 'Add New Row'; 'Click to remove the selected row' points to 'Remove Selected Row'; 'Transformation Values' points to the table; 'Probability Values' points to the 'P' column; and 'Transformation Colors' points to the 'Color' column.

a	b	c	d	e	f	P	Color
0.0	0.0	0.0	0.16	0.0	0.0	0.01	Green
0.85	0.04	-0.04	0.85	0.0	1.6	0.85	Blue
0.2	-0.26	0.23	0.22	0.0	1.6	0.07	Red
-0.15	0.28	0.26	0.24	0.0	0.44	0.07	Cyan

How Random Iteration Generates Fractals

This algorithm generates fractals from values specified in the transformation value table. Each row in the table corresponds to one of the affine transformations used to draw the fractal, and each affine transformation has the following form:

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} e \\ f \end{pmatrix}$$

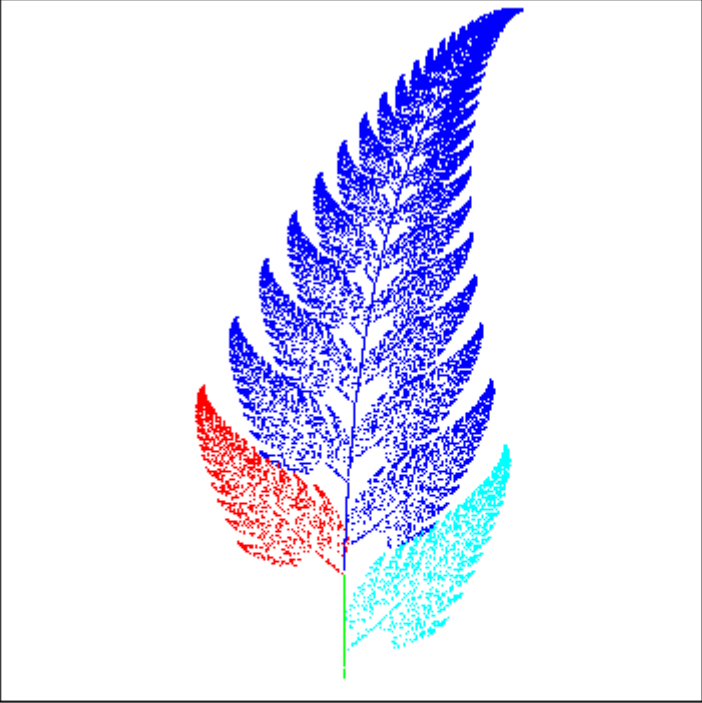
This means that for each point (x, y) in the fractal at the current stage, the next stage will have a point (x', y') according to the preceding values. The green transformation in the image below indicates that the fractal is to be scaled by one half in both the x and y directions, and then it is translated half a unit in the x direction.

a	b	c	d	e	f	P	Color
0.5	0.0	0.0	0.5	5	0.0	0.33	Green
0.5	0.0	0.0	.5	0.0	0.5	0.33	Blue
0.5	0.0	0.0	0.5	0.5	0.0	0.34	Red

Random Iteration Tutorial

Starting the Application

When the application is started, the Fern fractal is already drawn and its appropriate values are filled into the accompanying table. By editing values in this table or entering new values, the user is able to define their very own fractals.



START

Copy to Clipboard

Presets:
Fern ▼

☒ Color


Add New Row

Remove Selected Row

a	b	c	d	e	f	P	Color
0.0	0.0	0.0	0.16	0.0	0.0	0.01	Green
0.85	0.04	-0.04	0.85	0.0	1.6	0.85	Blue
0.2	-0.26	0.23	0.22	0.0	1.6	0.07	Red
-0.15	0.28	0.26	0.24	0.0	0.44	0.07	Cyan

Showing/Not Showing Fractal in Color

Each transformation, or row in the table, is associated with a specific color. The associations are easily noticed as the right-most column titled “Color”. The simplest option in the application is the ability to change the fractal from colored to black and white. This is simply toggled by the check box entitled “Color”. Notice that selecting this option will change the color code in the table to show black for all transformations.



START

Copy to Clipboard

Presets:
Fern ▼

☐ Color

Add New Row

Remove Selected Row

a	b	c	d	e	f	P	Color
0.0	0.0	0.0	0.16	0.0	0.0	0.01	
0.85	0.04	-0.04	0.85	0.0	1.6	0.85	
0.2	-0.26	0.23	0.22	0.0	1.6	0.07	
-0.15	0.28	0.26	0.24	0.0	0.44	0.07	

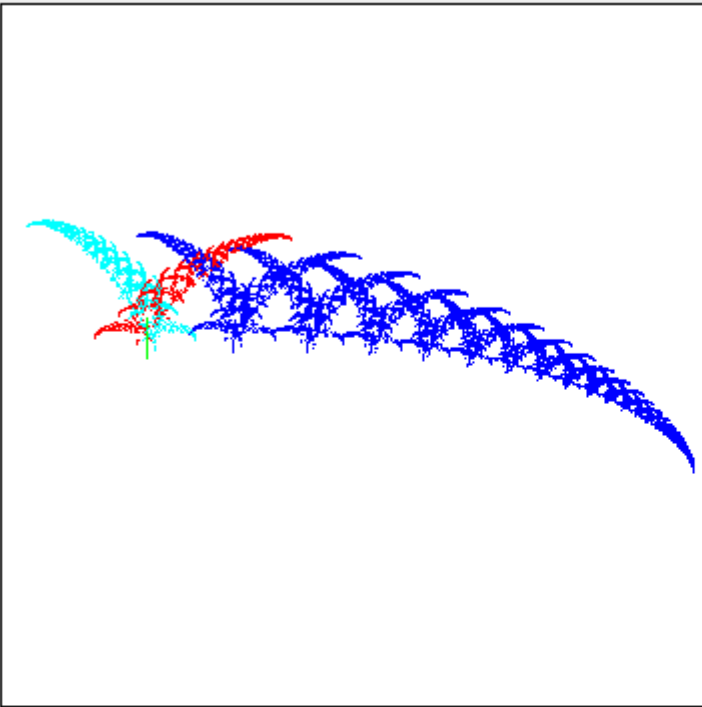
Changing Between Presets

Directly beneath the “Copy to Clipboard” button there is the drop-down menu labeled “Presets”. This is how the fern originally appeared in the drawing area. There are three included fractals that can automatically be selected. To change the fractal, click the box once and then select one of the three fractals. The fractal will automatically be redrawn upon selection and the table below will be filled with appropriate values for that fractal.

Changing the Transformation Table Values

The user is able to select any entry in the transformation table and change the value. By clicking on a cell, the user may change the values within that cell. During this time the fractal will not change. When all the values have been set, to redraw the fractal, click the “START” button. If no changes are made and the “START” button is clicked, the fractal will simply be redrawn.

The following image shows the resulting fractal when the second row, fifth column value is changed to 100 from the original “fern”. Obviously one change can make drastic differences.



START

Copy to Clipboard

Presets:
Fern ▼

☒ Color

Add New Row

Remove Selected Row

a	b	c	d	e	f	P	Color
0.0	0.0	0.0	0.16	0.0	0.0	0.01	Green
0.85	0.04	-0.04	0.85	100	1.6	0.85	Blue
0.2	-0.26	0.23	0.22	0.0	1.6	0.07	Red
-0.15	0.28	0.26	0.24	0.0	0.44	0.07	Cyan

Adding New Rows

By clicking “Add New Row”, a new row will be added to the table under the last row. A color will immediately be associated with this new row and filled in the last cell. If enough rows are added, the table will have a scrollable bar on the right side. Note that every value in the new row is initially empty and the user must enter values.

a	b	c	d	e	f	P	Color
0.0	0.0	0.0	0.16	0.0	0.0	0.01	Green
0.85	0.04	-0.04	0.85	0.0	1.6	0.85	Blue
0.2	-0.26	0.23	0.22	0.0	1.6	0.07	Red
-0.15	0.28	0.26	0.24	0.0	0.44	0.07	Cyan
							Magenta

Removing Rows

To remove a row, the user must first select a row in the table. Once selected, the row will be highlighted. Pressing the “Remove Selected Row” button will remove this row from the table. If no row is selected, then no row will be removed. The same follows for no rows being in the table.

a	b	c	d	e	f	P	Color
0.0	0.0	0.0	0.16	0.0	0.0	0.01	Green
0.85	0.04	-0.04	0.85	0.0	1.6	0.85	Blue
0.2	-0.26	0.23	0.22	0.0	1.6	0.07	Red

Receiving a Probability Error

If the user changes the probability column P values and they do not add up to 1 then a fractal will not be drawn, but in its place, a message will be displayed alerting the user of the error.

The screenshot shows a software interface for generating fractals. On the left is a large white rectangular area where the fractal would be displayed. In the center of this area, the text "Probability Values must add up to 1!" is written in red. To the right of this area is a control panel with several buttons and a dropdown menu. The buttons are "START", "Copy to Clipboard", "Add New Row", and "Remove Selected Row". There is a "Presets:" dropdown menu currently set to "Fern". Below the dropdown is a checked checkbox labeled "Color". At the bottom of the interface is a table with 8 columns: a, b, c, d, e, f, P, and Color. The table contains four rows of data. The first row has values 0.0, 0.0, 0.0, 0.16, 0.0, 0.0, 0.01, and a green color swatch. The second row has 0.85, 0.04, -0.04, 0.85, 0.0, 1.6, 0.85, and a blue color swatch. The third row has 0.2, -0.26, 0.23, 0.22, 0.0, 1.6, 0.07, and a red color swatch. The fourth row has -0.15, 0.28, 0.26, 0.24, 0.0, 0.44, 0.06, and a cyan color swatch.

a	b	c	d	e	f	P	Color
0.0	0.0	0.0	0.16	0.0	0.0	0.01	Green
0.85	0.04	-0.04	0.85	0.0	1.6	0.85	Blue
0.2	-0.26	0.23	0.22	0.0	1.6	0.07	Red
-0.15	0.28	0.26	0.24	0.0	0.44	0.06	Cyan

Receiving a Null Values Error

Similarly, if the user modifies a table cell, but does not put a value into the cell the program will again not draw a fractal and prompt the user for the input.

Copying the Fractal to the Clipboard

The next point of interest is the "Copy to Clipboard" button. This button's actions are only usable in the stand-alone JAR executable, and not the Web page. By clicking this button, a copy of the created fractal is automatically copied to the system clipboard. The image can then be pasted into a number of programs, such as Microsoft Word, Paint, or Adobe Photoshop. Note, simply clicking "Copy to Clipboard" will not save the image anywhere, it is up to the user to save the image.