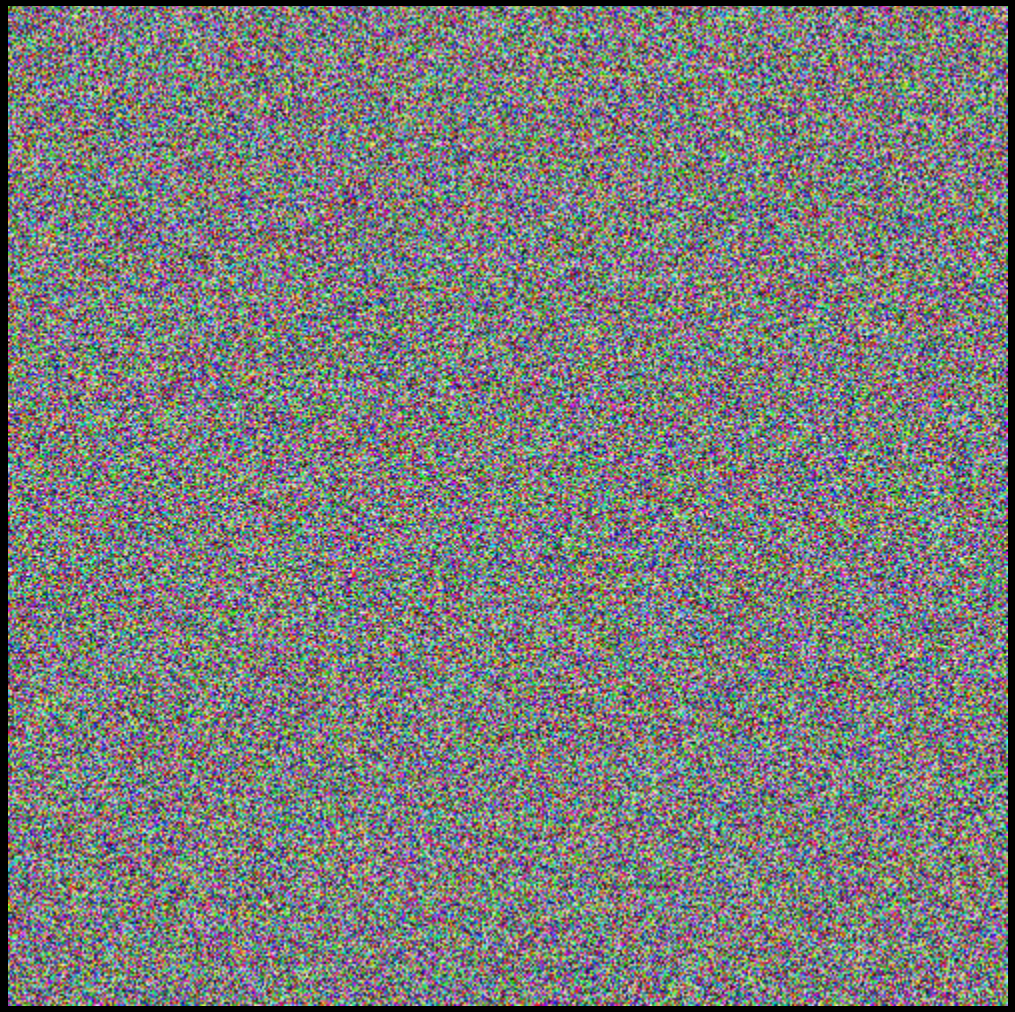
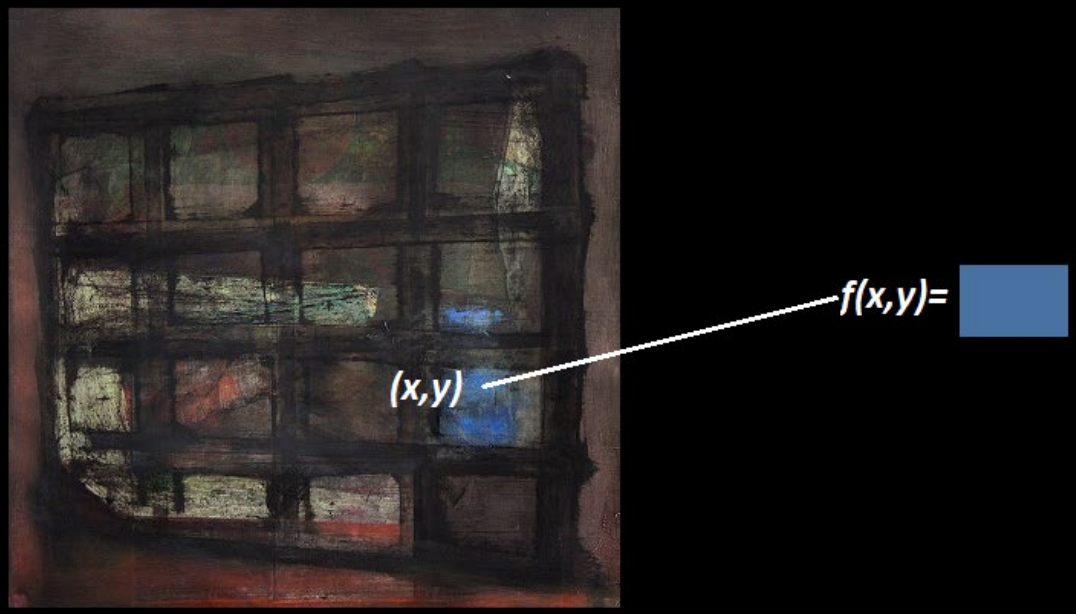
Images, Functions, and Reflections

Can we generate a random image?



Images and Functions

An image is a function from a canvas to some colors.

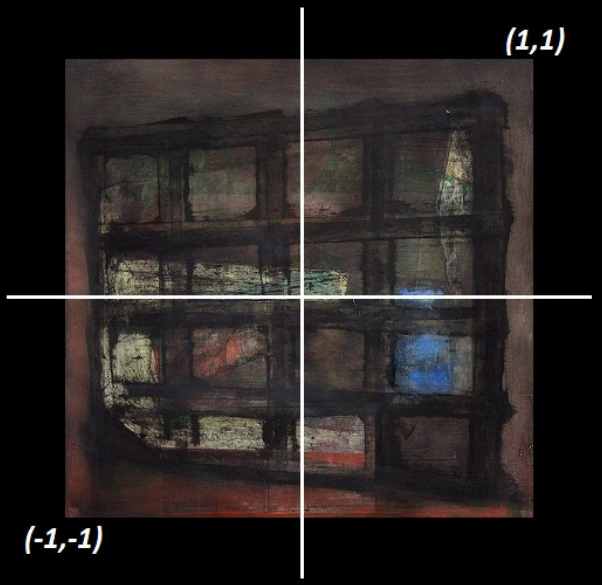


Random image = Random function

Using standard mathematical functions can provide structure which gives the illusion of intent.

How do we build a random function using standard mathematical functions?

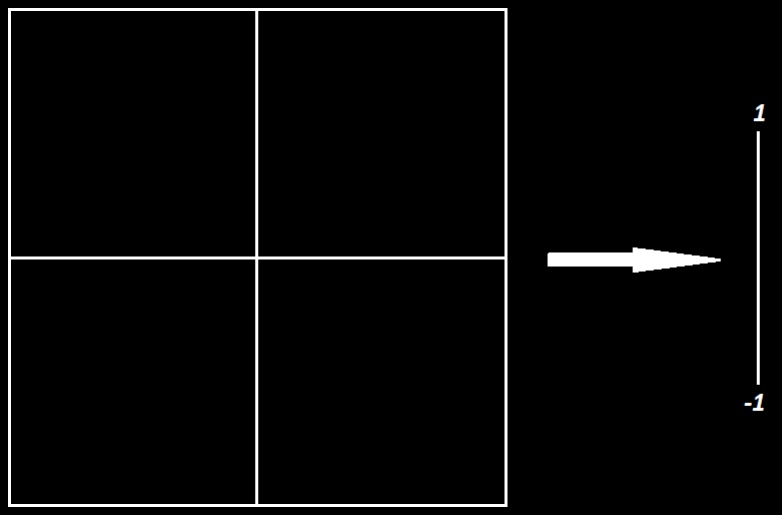
Special Functions



- Impose a coordinate system on the canvas.
  - Place $(1,1)$ at the top right and $(-1,-1)$ at bottom left.
- Call a binary function that maps $[-1,1] \times [-1,1]$ to $[-1,1]$ a *special function*.
- When we compose *special functions*, we get new special functions.

Random Functions

- Make a list of some *special functions*.
- Randomly compose these *special functions*.
- This gives a random*ish* function to $[-1,1]$.

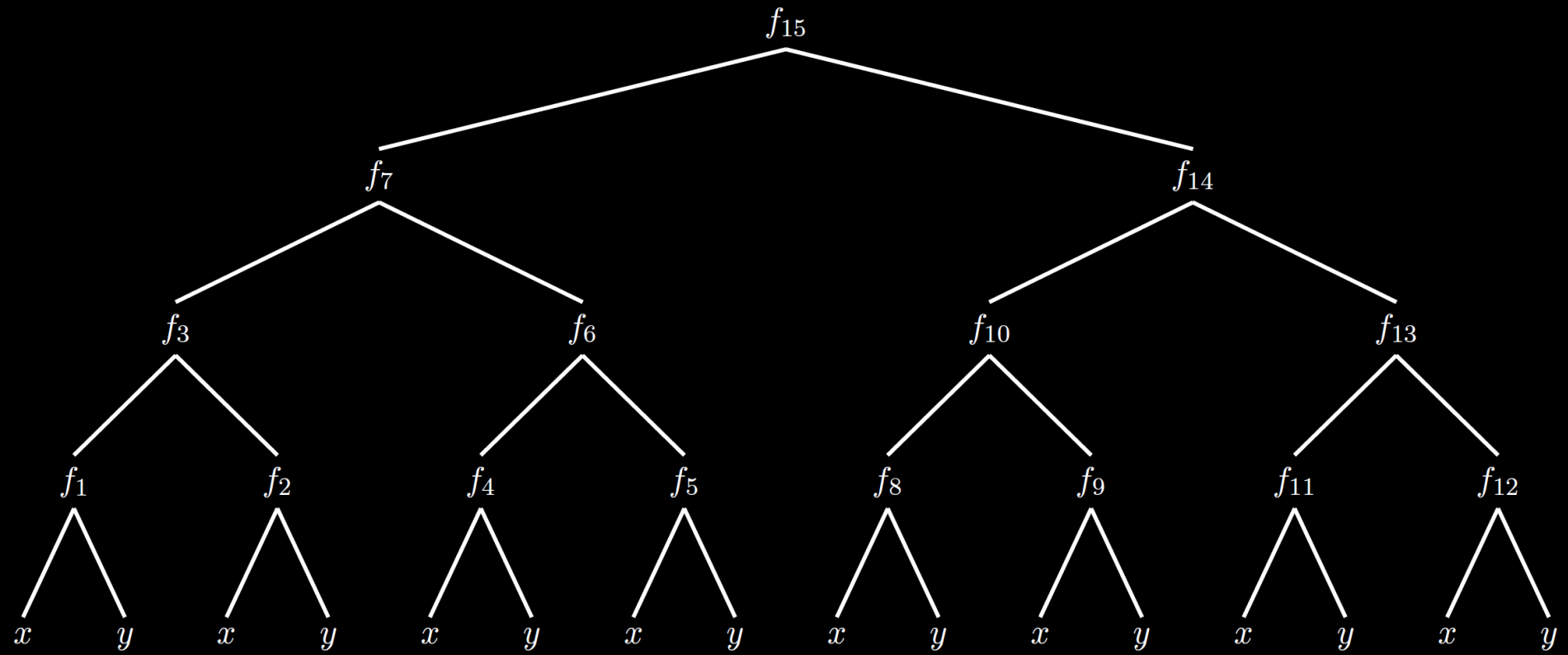


Simple Functions

- $\sin(x \cdot \pi)$
- $\cos(x \cdot \pi)$
- $\sin(2x \cdot \pi)$
- $\cos(2x \cdot \pi)$
- $\sin\left(\pi \cdot \left(x^2 + y^2\right)\right)$
- $\mathrm{Avg}(x, y)$

- x
- y
- $x \cdot y$
- x^2
- x^3
- $\min(x, y)$
- $\max(x, y)$

Random Composition



Random Composition

procedure randomFunction($height$){

if ($height = 0$)

return x half the time and y half the time

else{

$g(x, y)$ =randomFunction($height - 1$)

$h(x, y)$ =randomFunction($height - 1$)

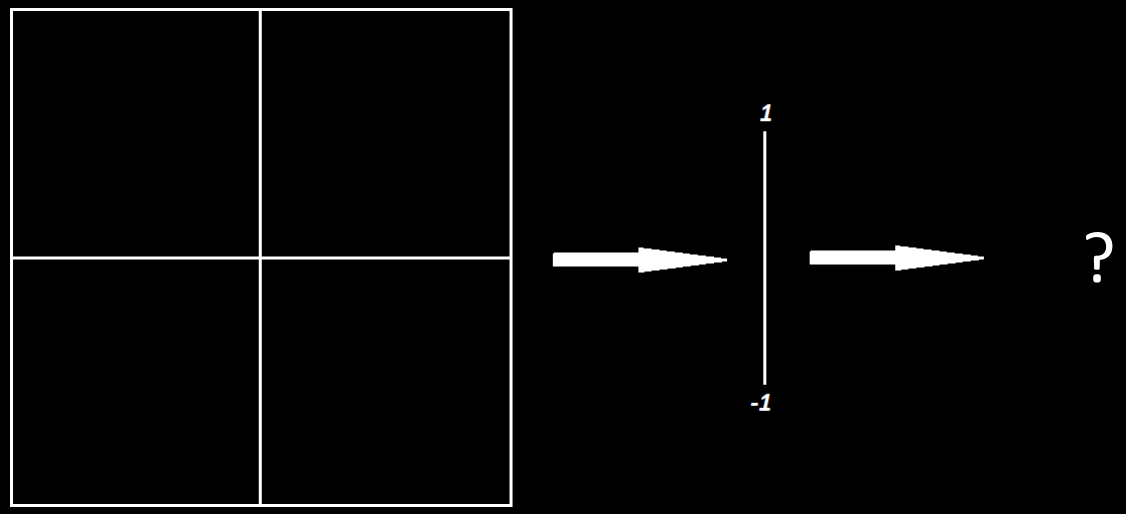
$f(x, y)$ =specialFunctions.random()

return($f(g(x, y), h(x, y))$

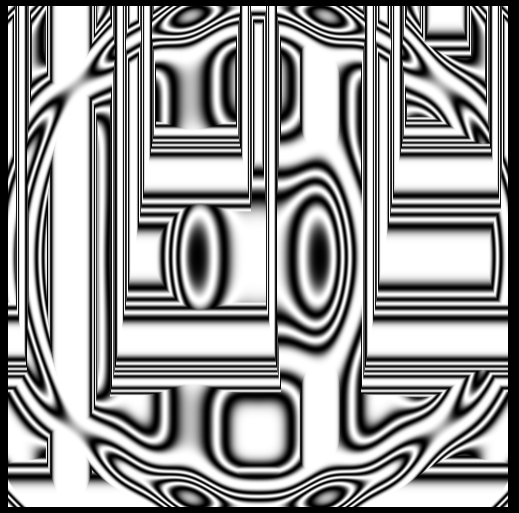
}

}

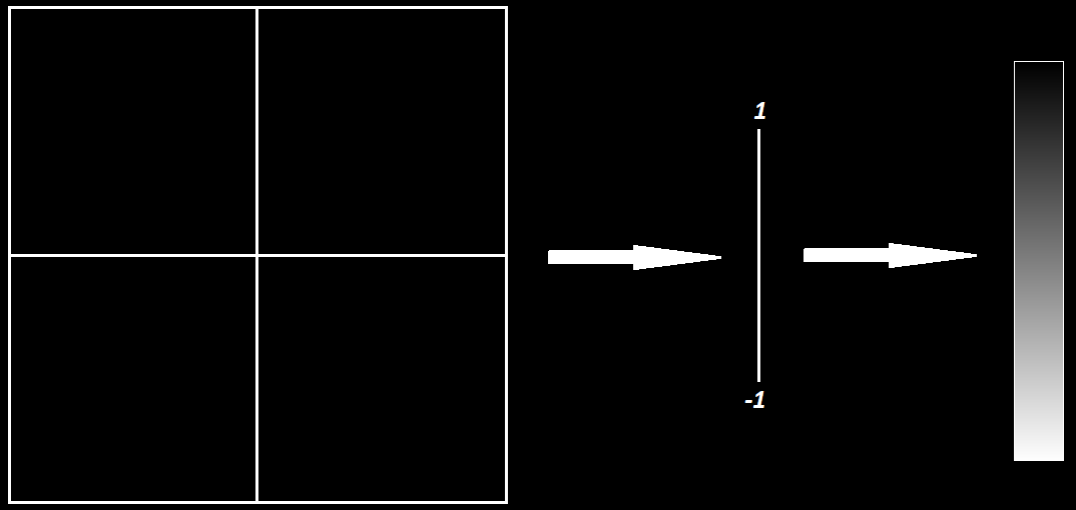
Random Functions



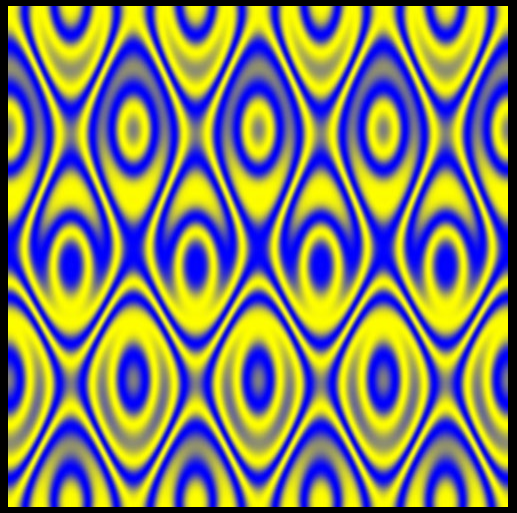
Numbers to Colors



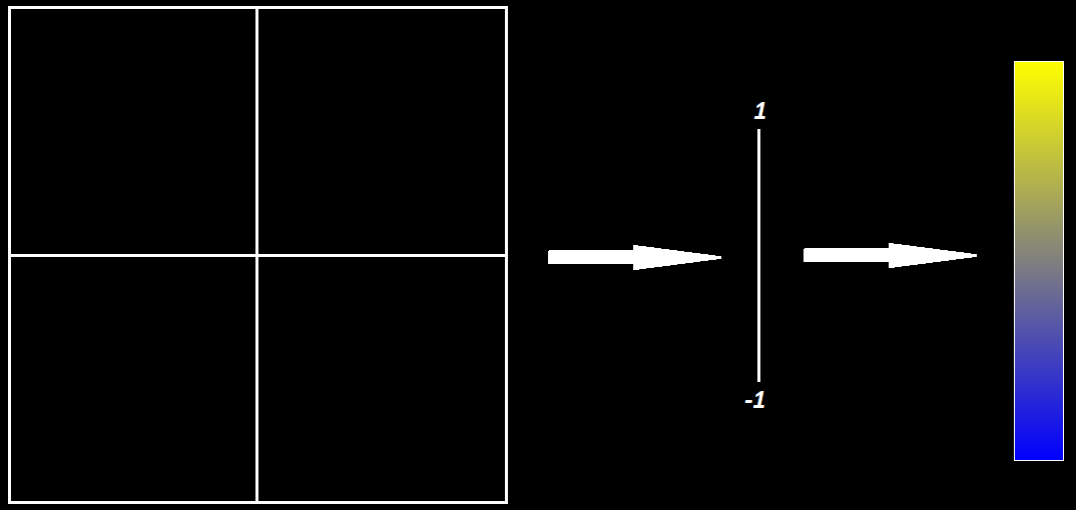
[Grayscale]



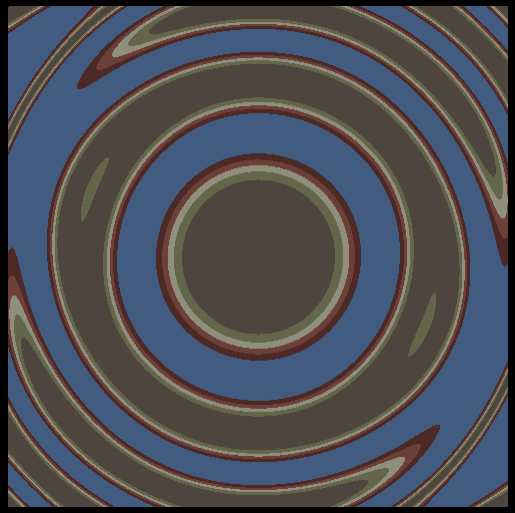
Numbers to Colors



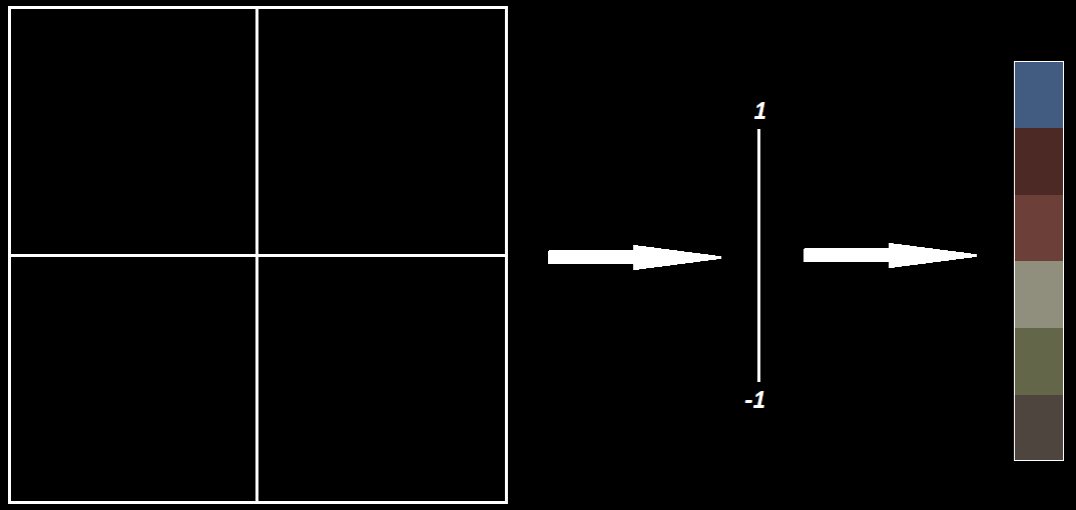
Gradient



Numbers to Colors

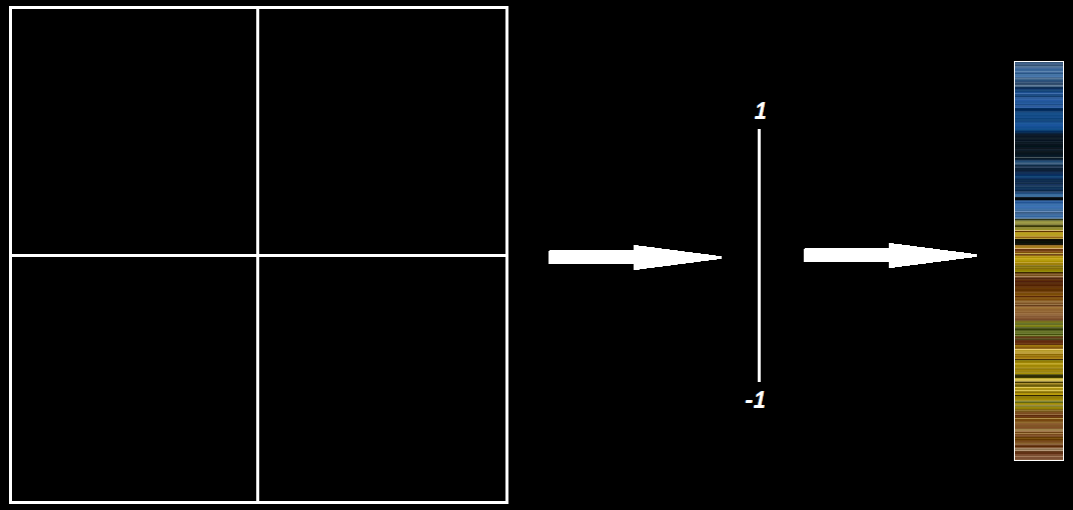


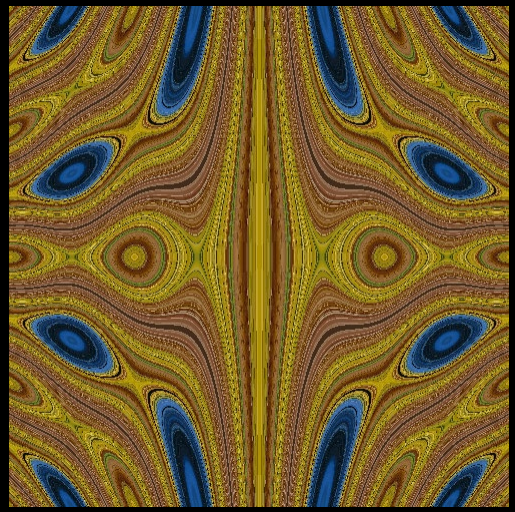
[Color array]



Numbers to Colors

Interval in another image





Numbers to Colors

Use two functions to map the canvas to another image.

- Generate two special functions $f(x, y)$ and $g(x, y)$.
- Let $F(x, y) = \big(f(x, y), g(x, y)\big)$.
- The point (x, y) is colored the same as the point $F(x, y)$ in a seed image.

The picture generated is the inverse image of the seed image under the function $F(x, y)$.

Interactive activity

jwsnow.github.io/reflection

More examples