1. Let's create some aRt!

   (a) Install the `aRtsy` package. Provide the code in an R chunk that does not run. You only need to install it one time.
   Solution:

   ```
   # Code to install the aRtsy package
   install.packages("aRtsy")
   ```

   (b) Load the `aRtsy` package. Provide the code in an R chunk that does run. We need to load the library each time it is run.
   Solution:

   ```
   library("aRtsy")
   ```

   (c) Running `demo("aRtsy")` or `vignette("aRtsy")` don't return any helpful demos or tutorials. However, if you run `help("aRtsy")` you will find a link to a tutorial. Recreate the first figure they make using `canvas_collatz()`. Make sure to update the caption.
   Solution:

   ```
   # help("aRtsy")
   set.seed(1)
   canvas_collatz(colors = colorPalette("tuscany1"))
   ```

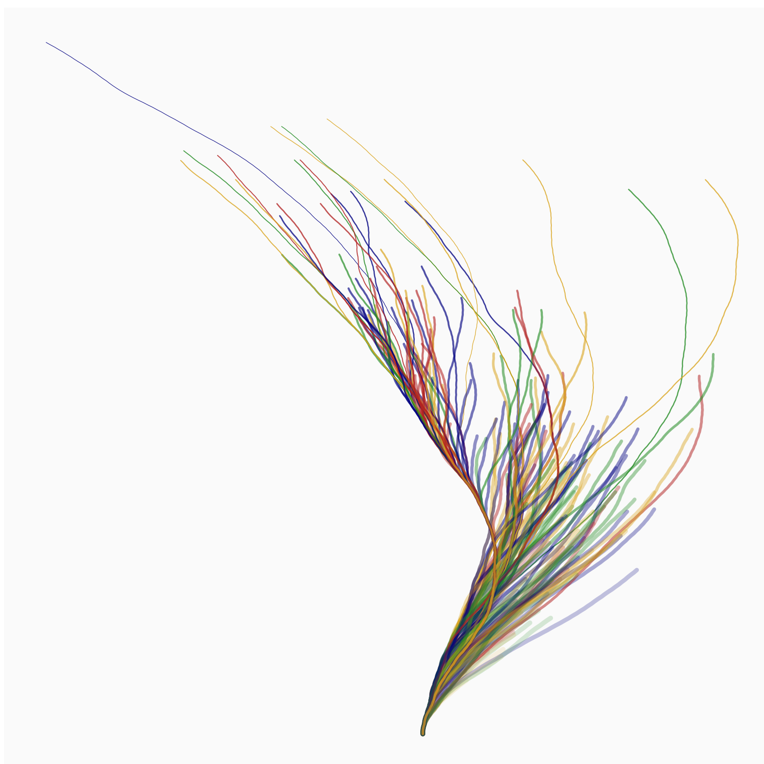

Figure 1: Collatz Plot 1

   (d) Change the randomization seed to 1313, which will change the random numbers generated to create the plot. Can you see the difference? Make sure to update the caption.
   Solution:

   ```
   set.seed(1313)
   canvas_collatz(colors = colorPalette("tuscany1"))
   ```

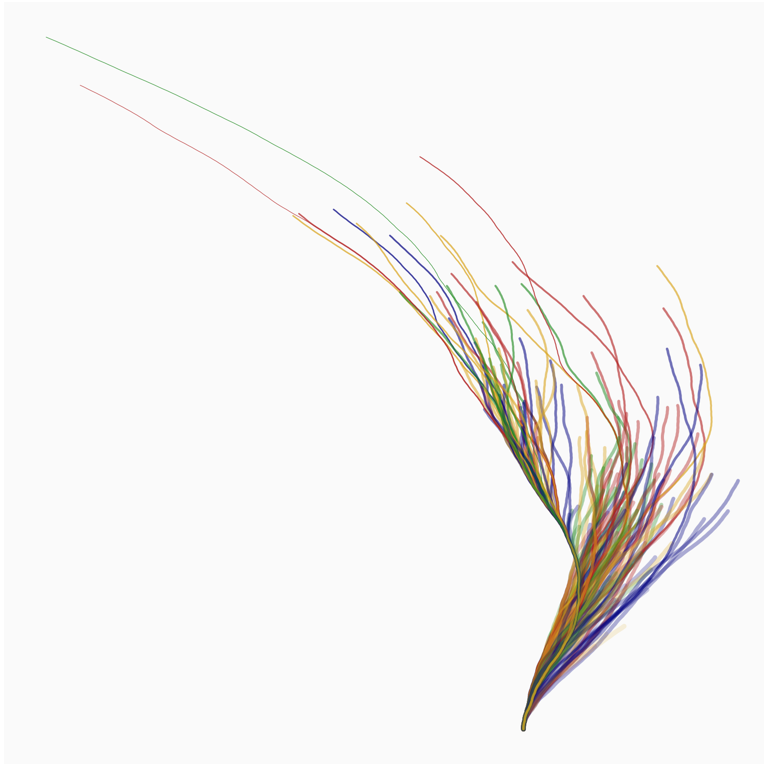

Figure 2: Collatz Plot 2

(e) Now, create a new Collatz conjecture plot by specifying the following arguments. Note you will find the help file for the `canvas_collatz()` function to be rather helpful. Make sure to update the caption.

- Use the `vrolik4` color palette. Note you can find other by running `?colorPalette` in the console.
- Make the background grey. Note a hexcode for grey is `#dbdbdb`.
- Specify that there should be 72 strands.
- Specify the angle used for bending the sequence for odd numbers as -0.05.
- Specify the angle used for bending the sequence for even numbers as 0.0145 (note this is the default).

Solution:

```
set.seed(1313)
canvas_collatz(
  colors = colorPalette("vrolik4"),
  background = "#dbdbdb",
  n = 72,
  angle.odd = -0.05
)
```

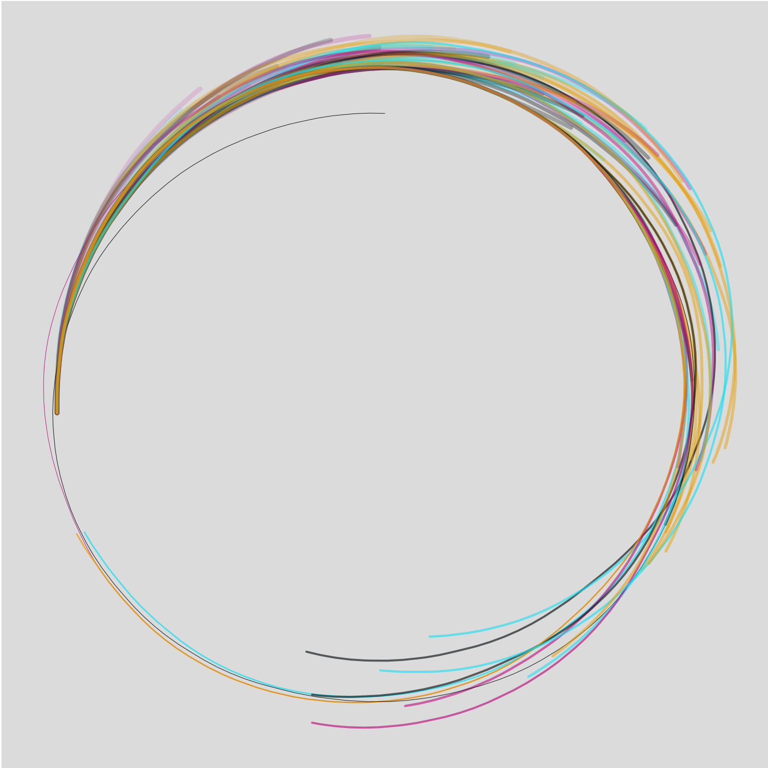

Figure 3: Collatz Plot 3

(f) Make another plot using the tutorial – feel free to be creative here! Note that I leave creating the R chunk and figure environment to you here. Make sure that your code is well-formatted and your plot is appropriately scaled.
Solution:

```
set.seed(1313)
canvas_collatz(
colors = colorPalette("dark2"),
background = "#ffffff",
n = 150,
angle.odd = 0.45,
angle.even = 0.25
)
```

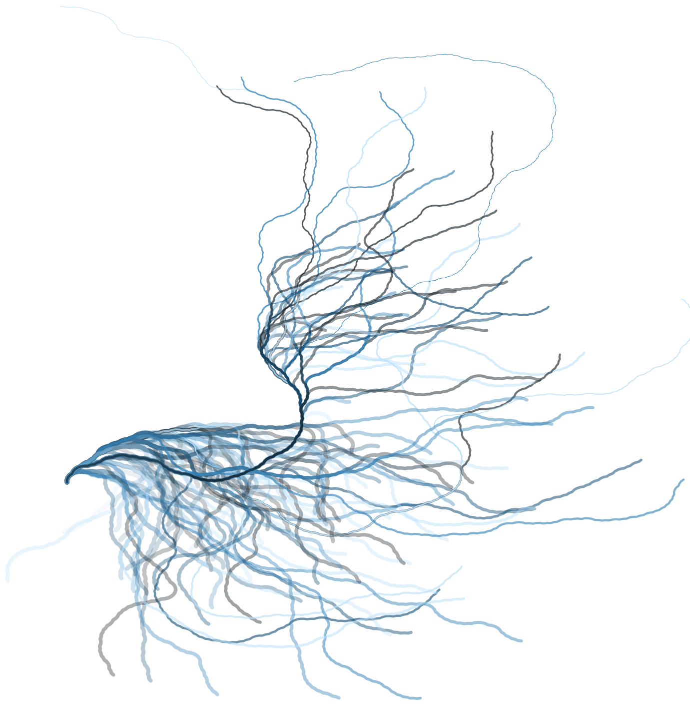

Figure 4: Creative Collatz

(g) Use `citation()` to get the BiBTeX citation for the `aRtsy` package and use `\citep{}` to add a parenthetical citation to the end of the sentence below. **Solution:** We created the generative art in Question 1 using the `aRtsy` package for `R`. (Derks, 2024)

2. Suppose we wanted to solve $2^{x+1} + 2^{x-1} = 40$ for x. While this is a pretty straightforward algebra problem, it's useful for demonstrating the use of objects in R.

    (a) Create a numeric vector containing the integers from 0 to 10 inclusive. Hint – the solution to this problem is one of these values.
    Solution:

    ```
    vect <- seq(from=0, to=10, by=1)
    ```

    (b) Complete the algebra to compute $2^{x+1} + 2^{x-1}$ for each value in the numerical vector created in step 1. Make sure to save the result to a new numeric vector.
    Solution:

    ```
    answers <- numeric(length = 10)
    j <- 1
    for (i in vect) {
      answers[j] <- (2^(i+1) + 2^(i-1))  # Add the missing closing parenthesis here
      j <- j + 1
    }
    ```

    (c) Use the which() function to ask which result is 40.
    Solution:

    ```
    which(answers == 40)

    ## [1] 5
    ```

    (d) What is the solution? That is, what value of x yields $2^{x+1} + 2^{x-1} = 40$?
    Solution:

    ```
    vect[which(answers == 40)]

    ## [1] 4
    ```

    (e) Explain why this approach wouldn't work for something like $3^{x+2} + 5(3^x) = 84$ where the solution is $x \approx 1.6309$.
    Solution: This method is dependent on evaluating the problem for whole integer values. Because, $3^{x+2} + 5(3^x) = 84$ has a decimal solution, this approach wouldn't work.

References

Derks, K. (2024). *aRtsy: Generative Art with 'ggplot2'*. R package version 1.0.0.