

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:**

```
# 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("blackwhite"))
```



Figure 1: Canvas 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("blackwhite"))
```



Figure 2: Canvas 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.even=0.0145, angle.odd=-0.05)
```

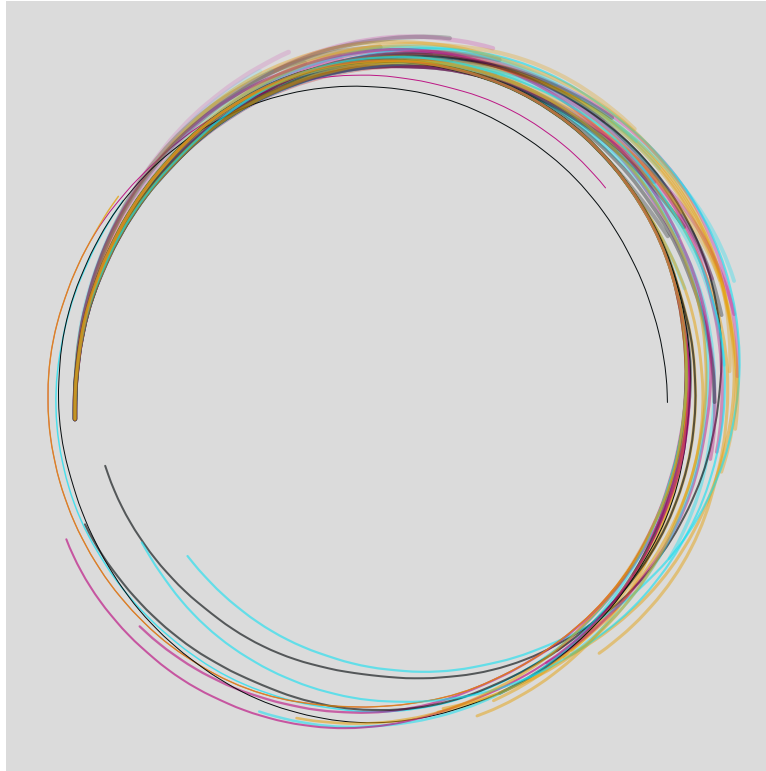


Figure 3: Canvas collatz plot 3

- (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("blossom"), background="#1e1e2f", n=300, angle.even=0.15, angle.odd=-0.1)
```

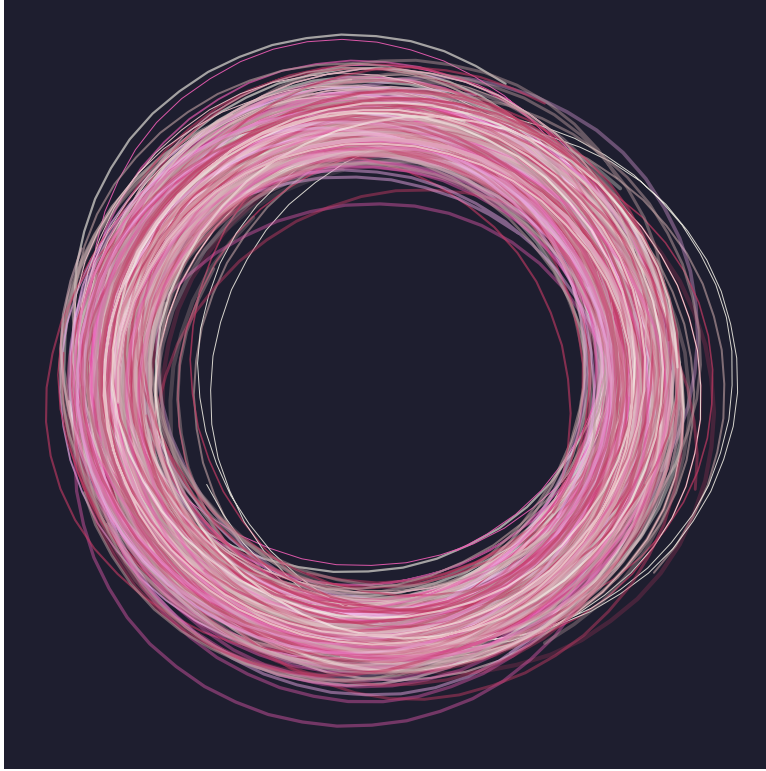


Figure 4: Canvas collatz plot 4

- (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:**

```
num.vec <- 0:10
num.vec

## [1] 0 1 2 3 4 5 6 7 8 9 10
```

- (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:**

```
results <- 2^(num.vec+1)+2^(num.vec-1)
results

## [1] 2.5 5.0 10.0 20.0 40.0 80.0 160.0 320.0 640.0 1280.0
## [11] 2560.0
```

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

**Solution:**

```
index.of.result.40 <- which(results==40)
index.of.result.40

## [1] 5
```

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

**Solution:**

```
solution <- num.vec[index.of.result.40]
solution

## [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 approach only works when the solution is an integer because we are evaluating the equation for a strict set of integer values within the num.vec vector. For this example, this method would not find an exact solution since it does not evaluate any non-integer  $x$  values.

## References

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