

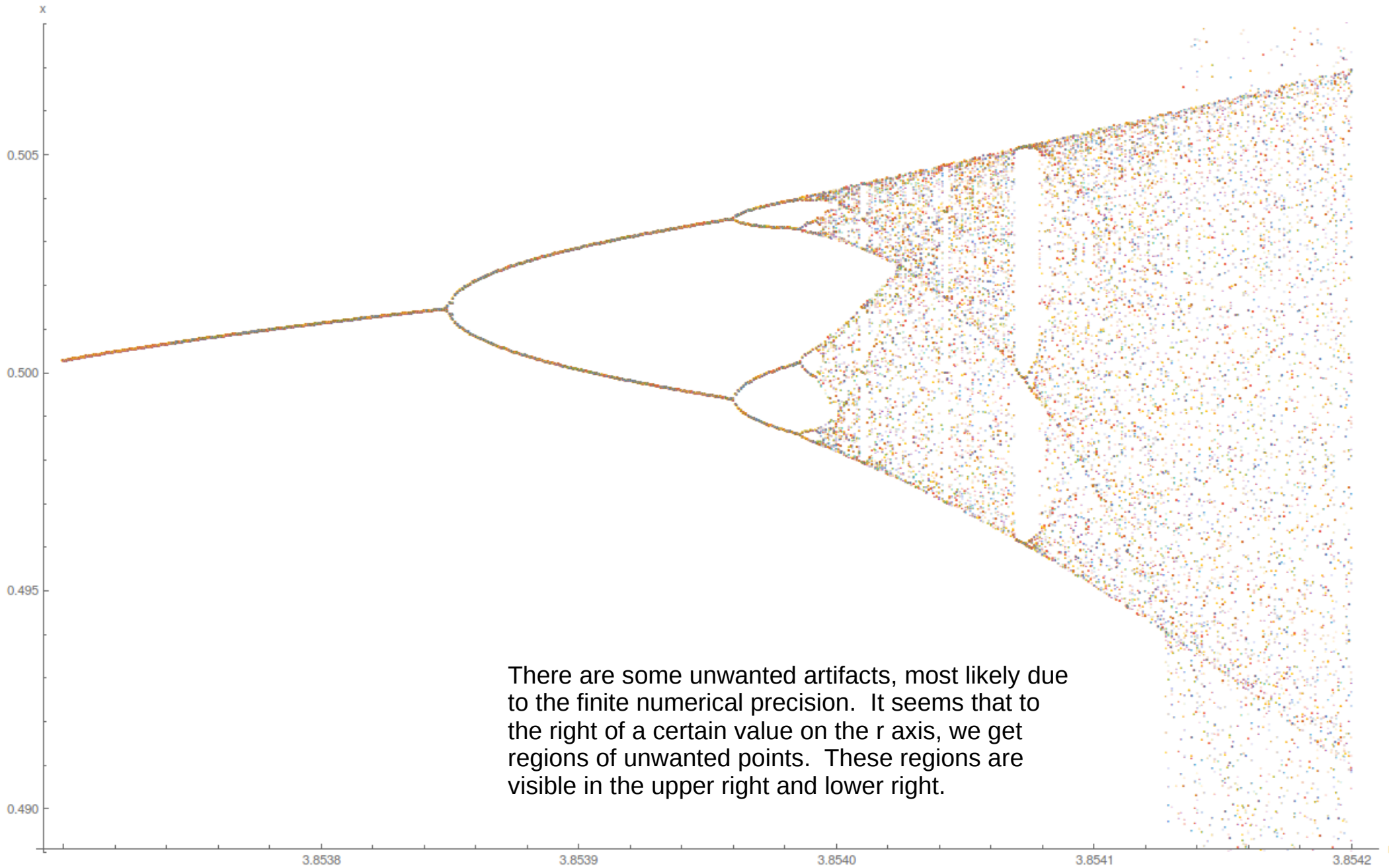
Physics 105, Spring 2018, Reinsch

Homework Assignment 11

Problem 4 Solution

Using the code from the previous problems, we zoom in by plugging in parameters as shown below.

```
Show[rplot[3.8537, 3.8542, 0.000001, {0.489, 0.508}, 4000, 100], ImageSize -> 1200]
```



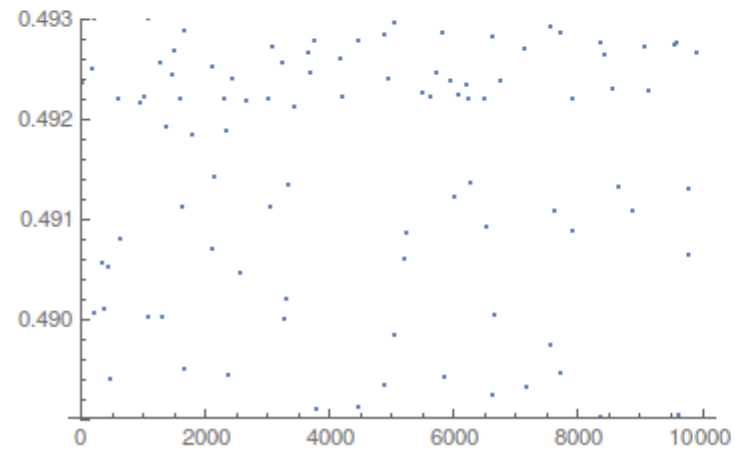
There are some unwanted artifacts, most likely due to the finite numerical precision. It seems that to the right of a certain value on the  $r$  axis, we get regions of unwanted points. These regions are visible in the upper right and lower right.

Here are some notes on investigating the behavior seen on the previous page. Even for a million iterations we still see points in these regions.

```
test = 0.492662

(*
inputs:
  r = r value in the text,
  x0 = initial x value,
  n = number of iterations,
  nreturn = number of values to return, from the end of the list generated
*)
run[3.85414, test, 1000 000, 10 000];

ListPlot[%, PlotRange → {0.489, 0.493}]
```



A great reference is

“Why is Floating-Point Computation so Hard to Debug when it Goes Wrong?”

Prof. W. Kahan

Math. and Computer Science Depts.

Univ. of Calif. @ Berkeley

<https://people.eecs.berkeley.edu/~wkahan/WrongR.pdf>

William Kahan is a mathematician and computer scientist who received the Turing Award in 1989 for "his fundamental contributions to numerical analysis", was named an ACM Fellow in 1994, and inducted into the National Academy of Engineering in 2005.

The Turing Award is generally recognized as the highest distinction in computer science.