

Homework 5

Due: Thursday 5 October

For this homework you will use the code

```
logistic_a.py
```

from lab5 to study another nonlinear map the *sine map* which exhibits similar features to the logistic map; that is there are regions of periodic behavior and regions of chaos. While the detailed behavior of this map is different from the logistic map you should be able to see that the transition to chaos occurs via period doubling. Please include a copy of your code with the writeup. The sine map consists of the following iterative procedure

$$x_{n+1} = r \sin(\pi x_n)$$

with $0 < r < 1$ and $0 < x < 1$

1. Find the minimum value of r , call it r_2 , at which period 2 motion is seen (a period 2 motion corresponds a motion under which repeated iteration of the map yields just two distinct values of x .)
2. Similarly find the threshold values of r , call them r_4 and r_8 for which period 4 and 8 motion results.
3. Compute the quantity

$$\delta = \frac{r_4 - r_2}{r_8 - r_4}$$

Comment on its value.

4. (Optional) Continue increasing r to find the threshold r_{16} for period 16 motion. Recompute δ .