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Bifurcation and Chaos in the Logistic Map

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ABSTRACT

The logistic map is a simple nonlinear difference equation that displays various behaviors ranging from stable fixed points to periodic oscillations and chaotic dynamics. For this project, we generated generated the bifurcation diagram of the logistic map over the parameter range $2.4 < \mu < 4.0$. We followed the standard approach of discarding transient iterations to remove dependence on initial conditions and recording the long-term dynamics of x for each μ. The resulting bifurcation diagram illustrates the progression from stability to successive period-doubling behavior and the eventual onset of chaos. The transition occurs near $\mu \approx 3.57$, which is consistent with Feigenbaum's universal period-doubling scenario Feigenbaum (1978). Overall, our results agree with the mathematical analysis of the logistic map Bubulo (2018) and highlight the importance of visualization for understanding nonlinear systems Boeing (2016).

Keywords: logistic map — bifurcation diagram — chaos — nonlinear dynamics

1. INTRODUCTION

This is the intro section.

2. DATA

This is the data section.
Maybe add some lists/tables/whatever is needed.

3. INFORMATION ABOUT OBSERVATIONS

Write info about observations here.

3.1. *Specific Topic Pt 1*

topic 1

3.2. *Specific Topic Pt 2*

topic 2

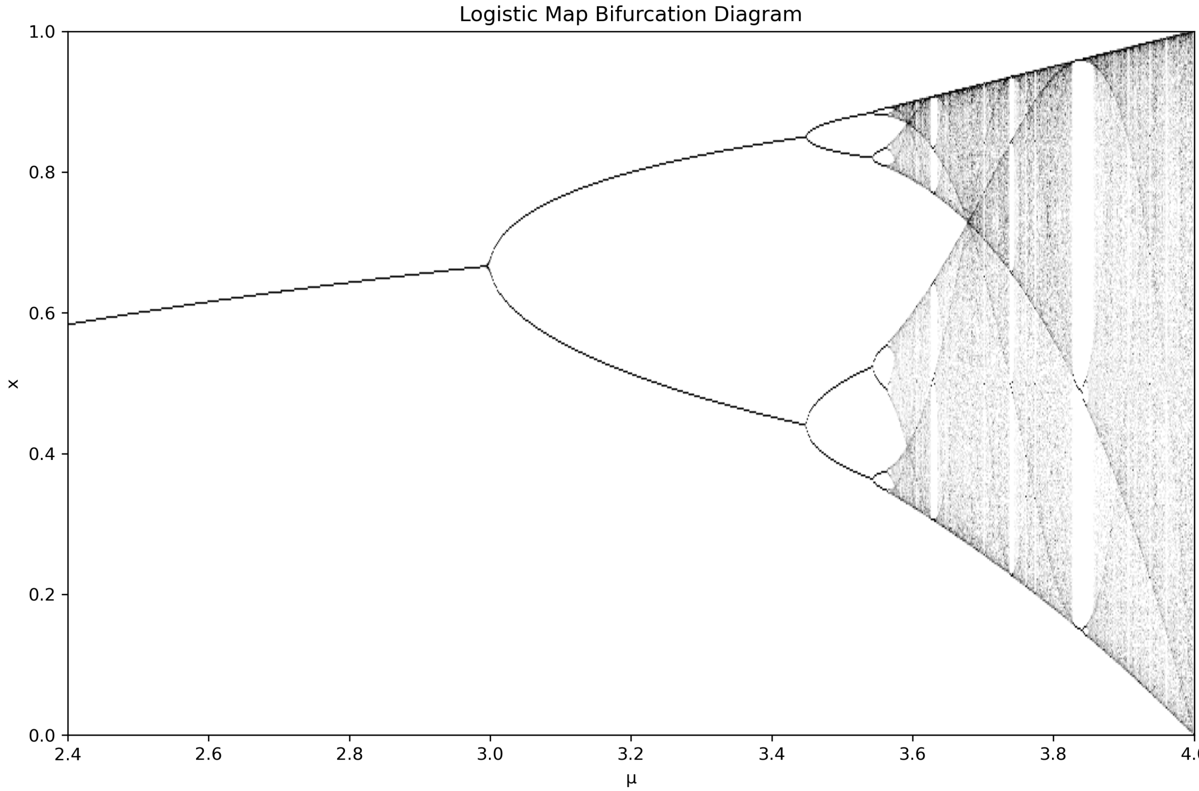

Figure 1. The logistic map bifurcation diagram for $2.4 \leq \mu \leq 4.0$. Stable fixed points exist for low values of μ, followed by successive period-doubling bifurcations that lead to chaotic behavior near $\mu \approx 3.57$.

3.3. *Specific Topic Pt 3*

topic 3

4. RESULTS

write about the results here.

5. SUMMARY AND CONCLUSION

Put the summary and conclusions here.

5.0.1. *References*

This is me citing Boeing (2016) in-text. This is me citing Bubolo at the end of this sentence (Bubolo 2018).

REFERENCES

Boeing, G. 2016, Systems, 4, 37, doi: https://www.mdpi.com/2079-8954/4/4/37

Bubulo, M. 2018, The Dynamics of the Logistic Map and Difference Equations

Feigenbaum, M. J. 1978, Journal of Statistical Physics, 19, 25, doi: 10.1007/BF01020332