Grand Canyon University

Project 1 – Visualize ODE With SciPy

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CST-305: Principles of Modeling and Simulation Lecture & Lab

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Responsibilities:

Ryan Scott: Python Code Execution, Flowchart, README
Diego Guerra: Documentation, Flowchart

Specific problem solved:

The current problem that we are solving is finding the data rate of a network using the following equation:

$$y = -k \cdot \log_2(x)$$

Using the "change of base formula" rule that we know about logarithms, we know that:

$$\log_2(x) = \frac{\ln(x)}{\ln(2)}$$

Therefore we can write the equation as the following:

$$y = -k \cdot \frac{\ln(x)}{\ln(2)}$$

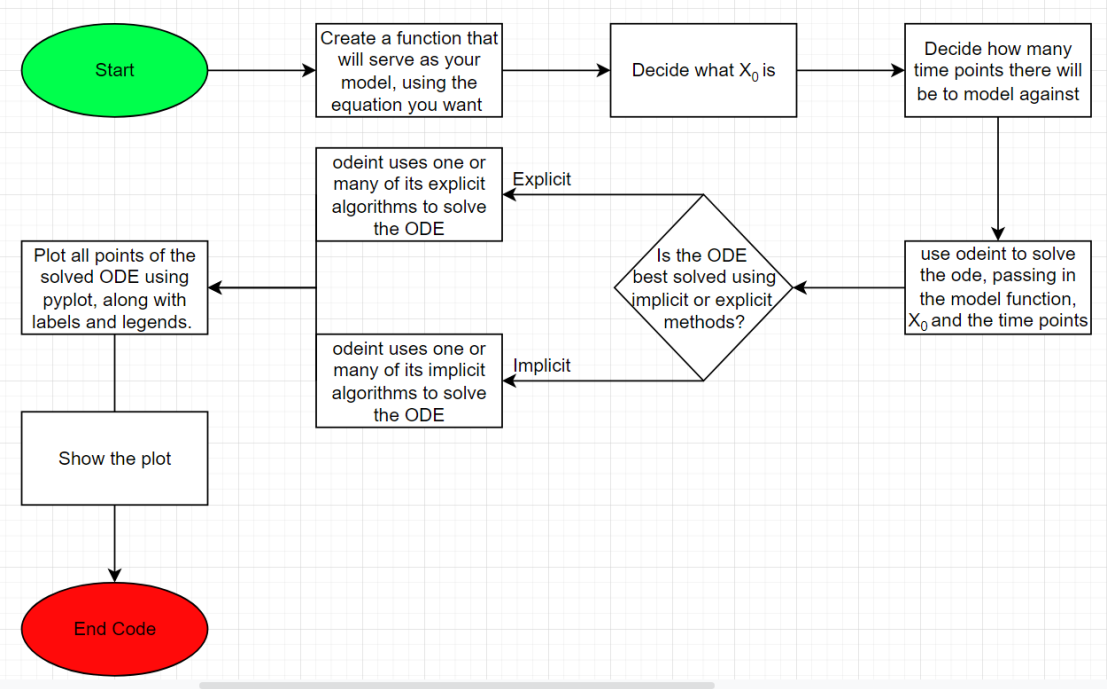
The mathematical approach for solving it is by taking the derivative of the bps , and with that derivative we should have the data rate equation. Solving for the equation gives the following equation.

NEW EQUATION

$$\frac{dy}{dx} = -k \cdot \frac{1}{(x \cdot \log(2))}$$

With k as the value of 0.4

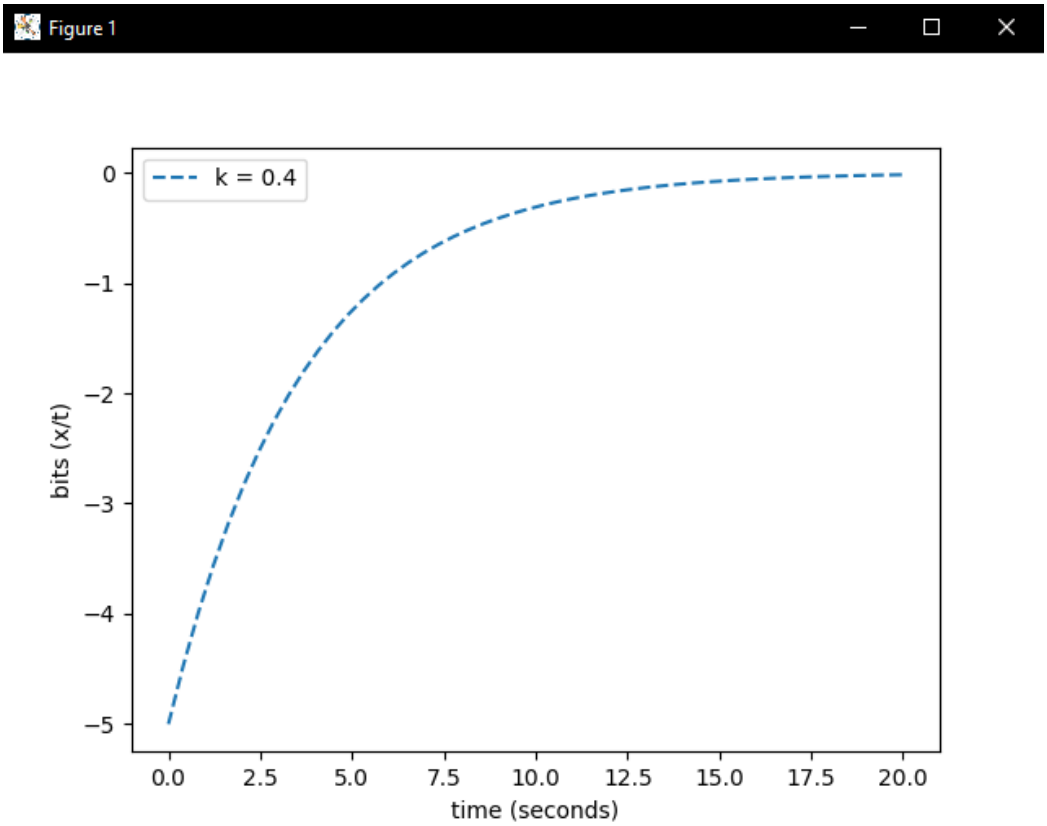
The approach for implementation in code + Flowchart:



Our first step in graphing this ODE was to take the derivative of the initial equation. Once we had the derivative equation, we created a function to match it. A list of time points was run through the function with odeint, and the graph was generated with matplotlib once we were done.

We used https://www.derivative-calculator.net/ to verify our solution, both in equation and graphing.

Screenshots depicting key phases in the program execution:



References:

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http://www.scholarpedia.org/article/Odeint_library
http://mason.gmu.edu/~rmorika2/Baud_Versus_Bits_per_second.htm#:~:text=This%20equation%20is%3A,signaling%20levels%20per%20clock%20cycle.
https://www.youtube.com/watch?v=jPRUMMA_Ex8&ab_channel=MsShawsMathClass