

Programming Assignment 03

COSC 4320 System Modeling and Simulation

Due Date: April 9th

Spring 2020

What to submit:

- Documented Python code implementation. Include your full name at the top of the code
- Graphical output
 - Phase-Space visualization
 - Cobweb plot
- Don't submit code in doc or pdf. 4 points will be deducted if you do so

1. Consider the following iterative map ($a > 0$, $b > 0$)

$$x_t = x_{t-1} + a * \sin(b x_{t-1})$$

Conduct linear stability analysis to determine whether this model is stable at its equilibrium point $x_{eq} = 0$

2. A two dimensional difference equation model is given

$$x_t = x_{t-1} + 2 x_{t-1} (1 - x_{t-1}) - x_{t-1} y_{t-1}$$

$$y_t = y_{t-1} + 2 y_{t-1} (1 - y_{t-1}) - x_{t-1} y_{t-1}$$

1. Find all equilibrium points
2. Calculate the Jacobian matrix at the equilibrium point where $x > 0$ and $y > 0$
3. Calculate the Eigenvalues of the matrix obtained
4. Determine whether the equilibrium point is stable, unstable or Lyapunov stable