CSCI 4446 Spring 2019 PS7
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Resubmission

Please see the attached original assignment for Problems 1 and 2, as those were not altered in any way.

3.

Below are the results of the 12-D variational system. Note that the initial condition of the matrix δ was always the 3x3 Identity Matrix. In vector form: [1, 0, 0, 0, 1, 0, 0, 0, 1]

The column sums represent the total resulting variation along each axis (x,y,z).

Note: In my previous submission, I accidentally had the matrix transposed and thus calculated the wrong column sums. I have amended this below, but I still have the same decimals, just less truncated this time. I am unaware as to why my decimals were off originally, and would point to difference of machines or RK4 implementation. Of note is that I originally was only marked off for ⅔ of the I.C.s for missed decimals. You'd think if my decimals were off, they would be off for all three cases, but that was not reflected on my assignment.

a.

IC:[0, 1, 2]

$$\delta = \begin{bmatrix} 2.36141348 & 1.8860579 & -0.02835606 \\ 5.0870787 & 4.1345133 & -0.08603625 \\ 0.46036853 & 0.35774473 & 0.66497438 \end{bmatrix}$$

Col sums:
[7.90886071, 6.37831593, 0.55058207]

b.

IC:[10, -5, 2]

$$\delta = \begin{bmatrix} 2.11999504 & 1.63114102 & -0.47782094 \\ 3.88431032 & 3.02286124 & -1.10122988 \\ 3.02801499 & 2.46236894 & -0.01029912 \end{bmatrix}$$

Col sums:
[9.03232035, 7.1163712, -1.5893499]

c.

IC: [0, -1, 2]

$$\delta = \begin{bmatrix} 2.36141348 & 1.8860579 & 0.02835606 \\ 5.0870787 & 4.1345133 & 0.08603625 \\ -0.46036853 & -0.35774473 & 0.66497438 \end{bmatrix}$$

Col sums:
[6.98812365, 5.66282647, 0.77936669]

D.

The (a) and (c) initial conditions are very symmetric and, using the Euclidean length of the 12-D delta vector (as directed by Prof. Bradley) as the measure for “speed of growth,” their variational matrices grow at almost the exact same rate, both being faster than the growth starting at (b).

Variation in the x direction (the first entry of the column sums) is the largest in all cases, being largest in the (b) case. There is also fast variation in the y-direction, also largest in the (b) case.

In the case of (b), it looks like the variational matrix is more “balanced” in the sense that final variations are as a result of more cooperative input from each of the additive components. This is why the euclidean length of (b) is less than (a) and (c) while having relatively large column vectors.

Cases (a) and (c) have small z variation, while case (b) has a stronger negative growth in the z-direction.