Homework for Lecture 19 of Dr. Z.'s Dynamical Models in Biology class

Email the answers (either as .pdf file and/or .txt file) to

ShaloshBEkhad@gmail.com

by 8:00pm Monday, Nov. 8,, 2021.

Subject: hw19

with an attachment hw19FirstLast.pdf and/or hw19FirstLast.txt

Also please indicate (EITHER way) whether it is OK to post

1. Carefully read the Maple code for procedure

`SIRSdemo(N,IN, gamma,nu,h,A)` in the Maple code

`https://sites.math.rutgers.edu/~zeilberg/Bio21/M19.txt` ,

and run it for the following parameter values (with $h = 0.01$)

For all of them Population: 1000 people. Initial infected individuals: 200 people; No one dead (or removed) at the start, $t = 0$.

For $\beta = 0.3\nu/N$, $\beta = 0.9\nu/1000$, $\beta = 3.9\nu/1000$, answer

At time $t = 10$: How may people died (or were removed) (recall that the total is always 1000), if the values of ν and γ are as follows:

(i) $\nu = 1$, $\gamma = 3$

(ii) $\nu = 2$, $\gamma = 3$

(iii) $\nu = 3$, $\gamma = 7$

2. Using `RandNice([x,y],8)` 3 times, (call it `F`) each time. For each of them find the following:

(i): The set of equilibrium points

(ii): The set of stable equilibrium points

(iii): Using `Dis2(F,x,y,pt+[0.1,0.1],0.01,10);`

confirm numerically that for `pt` in the stable set it converges to that point, but for the other equilibrium points, the orbit goes elsewhere (and very possibly all over the place, i.e. to ∞).

3. Use `EquPts(F,var)` together with `SIRS` to find all the equilibrium points of the SIRS model, confirming Equations $(29a)$ $(29b)$ in Edelstein-Keshet, section 6.6.

4. Write a Maple code `Chemostat(N,C,a1,a2)` (analogous to `SIRS`) giving the underlying transformation of the *Chemostat model* with parameters $a1, a2$ as given by Equations $(19a), (19b)$ in Edelstein-Keshet section 4.5. Then use `EquPts(F,var)` to confirm Eq. $(25a), (25b)$ there.

5. (Optional, 10 brownie points):

(i) Write `Dis3(F,x,y,z,pt,h,A)`, a 3D analog of `Dis2(F,x,y,pt,h,A)`.

(ii) Run `RandNice([x,y,z],10)`, 2 times, and find, for each case, the equilibrium and stable equilibrium points, and confirm stability (and non-stability) using your `Dis3`. (similar to question **2**, but in three dimensions).