Homework for Lecture 18 of Dr. Z.'s Dynamical Models in Biology class

Email the answers (as a .pdf file) to

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by 8:00pm Monday, Nov. 10, 2025.

Subject: hw18

with an attachment hw18FirstLast.pdf

1. In the (continuous) SIRS model with a population of 1000 and parameters $\gamma = 1.2$, $\nu = 1.2$. For each $\beta = 0.01 \cdot i$, for $1 \leq i \leq 20$, how many "removed" people are there?

2. Type

```
a1:=rand(1..100)():  a2:=rand(1..100)():[a1,a2];SEquP(ChemoStat(N,C,a1,a2),[N,C]);
```

20 times. How often did you get a stable equilibrium?

3. Run

```
SIRSdemo(1000,400,1,1,0.01,10);
```

4. After downloading

BOTH DMB.txt and L18.txt from the class web-page run

HWgE(100,1000);

10 times. Are the answers close to each other? Can you estimate the prob. that with a random preferance matrix only one genotype will survive in the long run?

Daniyal Chaudhry HW 18

1. $\gamma = 1.2$ $\nu = 1.2$ $N = 1000$

$\beta = 0.01 \cdot i$, $1 \le i \le 20$

amount of removed people: $N - S_{eq} - I_{eq} = 1000 - \left(\frac{1.2}{\beta}\right) - \left(1.2 \cdot \frac{1000 - \frac{1.2}{\beta}}{2.4}\right) = 500 - \frac{0.6}{\beta}$

format: (i): removed

(1): 440 (3): 480 (6): 490 (9) 493.3 (12) 495 (15) 496 (18) 496.67

(2): 470 (4): 485 (7): 491.4 (10) 494 (13) 495.38 (16) 496.25 (19) 496.84

(5): 488 (8): 492.5 (11) 494.6 (14) 495.7 (17) 496.47 (20) 497

2. There was a stable Equilibrium Point for all 20 trials out of 20, regardless of a_1 and a_2.

3. I ran the SIRS demo and saw that as β increases (especially beyond the threshhold value), the proportion of infected individuals in the long term behavior increases as well.

4. The results were: 0.543, 0.529, 0.570, 0.548, 0.551, 0.581, 0.564, 0.543, 0.551, 0.520

The answers are kind of close, and their mean is 0.55, so that is a decent enough estimate for the prob. of genotype extinction