Homework for Lecture 14 of Dr. Z.'s Dynamical Models in Biology class

Email the answers (as .pdf file) to

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by 8:00pm Monday, Oct. 27, 2025.

Subject: hw14

with an attachment hw14FirstLast.pdf and/or hw14FirstLast.txt (preferred)

Using

`http://sites.math.rutgers.edu/~zeilberg/Bio25/DMB14.txt`

1. Copy-and-paste the following line into your worksheet (once you have donwloaded and read `DMB14.txt`):

```
T:=RT([x],10);SSSg(T,[x]); SSg(T,[x],z);ORB(T,[x],[6.],1000,1010)[-1];
```

Run it **twenty** times. Out of these twenty times, how many times did the first and third numbers agree?

0 times they were the same but twice if the absolute value counted

2. Copy-and-paste the following line into your worksheet (once you have donwloaded and read `DMB14.txt`):

```
T:=RT([x,y],10);SSg(T,[x,y]); SSSg(T,[x,y]);ORB(T,[x,y],[6.,8.],1000,1010)[-1];
```

Run it **twenty** times. Out of these twenty times, how many times did the first and third numbers agree?

only once identically, if rounding was included it would have been about 13 more

3. Copy-and-paste the following line into your worksheet (once you have donwloaded and read `DMB14.txt`):

```
T:=RT([x,y,z],10);SSg(T,[x,y,z]); SSSg(T,[x,y,z]);
ORB(T,[x,y,z],[6.,8.,11.],1000,1010)[-1];
```

None identical as the 8th-10th digits sometimes varied but 4 times if rounding was considered.

Run it **twenty** times. Out of these twenty times, how many times did the first and third numbers agree?

4. Copy-and-paste the following line into your worksheet (once you have donwloaded and read `DMB14.txt`:

```
f:=RR([z[1],z[2]],10); T:=RecToTs(2,z,f);SSg(T,[z[1],z[2]]); SSSg(T,[z[1],z[2]]);
```

`Orbk(2,z,f,[5.,8.],2000,2010)[-1];`

7 times identically
9 times if rounding was appropriate
4 times did not match up

5. Copy-and-paste the following line into your worksheet (once you have donwloaded and read `DMB14.txt`):

```
f:=RR([z[1],z[2],z[3]],10); T:=RecToTs(3,z,f);SSg(T,[z[1],z[2],z[3]]);
```

```
SSSg(T,[z[1],z[2],z[3]]); Orbk(3,z,f,[5.,8.,11.],2000,2010)[-1];
```

Run it **twenty** times. Out of these twenty times, how many times did the last coordinate of the first point and the third numbers agree?

8 times identically
11 times the 9th and/or 10th decimal place was off
1 time it didn't match up

6. Copy-and-paste the following line into your worksheet (once you have donwloaded and read `DMB14.txt`):

```
L:=rand(1..3)(); a:=rand(1..50)()/20.;c:=rand(1..50)()/20.; T:=NicholsonBailey(L,a,c,N,P)
;SSg(T,[N,P]);SSSg(T,[N,P]);
```

20/20 had an empty set

Run it **twenty** times. Out of these twenty times, how many times did you get a non-empty set of stable steady-states? (ignore those that have an error message)

7. Copy-and-paste the following line into your worksheet (once you have donwloaded and read `DMB14.txt`):

```
a:=rand(1..10)()/10.:  r:=rand(1..10)()/10.:  K:=rand(1..10)():
```

```
T:=NicholsonBaileyM(a,r,K,14,N,P); SSSg(T,[N,P]);
```

Run it **100** times. Out of these fifty times, how many times did you get a non-empty set of stable steady-states? (ignore those that have an error message)

54 non-empty sets

46 empty sets