Homework for Lecture 5 of Dr. Z.'s Dynamical Models in Biology class

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

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by 8:00pm Monday, Sept. 20, 2021.

Subject: hw5

with an attachment hw5FirstLast.pdf and/or hw5FirstLast.txt

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

0. Convert the recurrence

$$6\,a(n-1) \,+\, a(n+3) \,+\, 5\,a(n+1) = 0 \quad ,$$

into **canonical form** where $a(n)$ is expressed in terms of $a(n-1), a(n-2), \ldots$.

Use procedure `RecToSeq(INI,REC,N)` from today's Maple code,

`https://sites.math.rutgers.edu/~zeilberg/Bio21/M5.txt`

to find $a(1000)$ if $a(0) = 1, a(1) = 2, a(2) = 4, a(3) = 11$.

1. Using the Maple code done in today's class

`http://sites.math.rutgers.edu/~zeilberg/Bio21/M5.txt`

find the **growth constant** in *two different ways* of the recurrence

$$a(n) = \sum_{i=1}^{10} a(n-i) \quad ,$$

with arbitrary positive initial conditions.

2. Assuming that

- A female older than 45 can no longer have babies
- The youngest age a female can have babies is 16
- the average fertility of a female between ages 16 and 30 is $\frac{1}{2}$
- the average fertility of a female between ages 31 and 45 is $\frac{1}{4}$
- the survival probability from one year to the next is always equal to $\frac{99}{100}$

Find the growth rate of the population, in two ways.

(i) Using procedure `LeslieMod` (followed by using procedure `GrowthCe`).

(ii) Using procedure `LeslieMat` (followed by finding the largest eigenvaue (in absolute value) of the Leslie matrix).

3. Using today's Maple code, Find the growth rate of Salmons given in Eq. [1.1] in Chapter 1, p.5, of the Ellner-Guckenheimer book DMB:

`https://sites.math.rutgers.edu/~zeilberg/Bio21/dmb/dmb1.pdf`

4. Using the box at the bottom of page 16 of Leah Edelstein-Keshet's book

`https://sites.math.rutgers.edu/~zeilberg/Bio21/keshet/keshet1.pdf` and today's Maple code

write a Maple procedure

```
PlantGseq(alpha,beta,gamma,sigma,INI,K)
```

that inputs the relevant botanical parameters and outputs the first K terms. Check whether the two tables in Table 1.1 (p. 18) are correct.

5. Using the box at the bottom of page 16 of Leah Edelstein-Keshet's book

`https://sites.math.rutgers.edu/~zeilberg/Bio21/keshet/keshet1.pdf` and today's Maple code

write a procedure

```
PlantGseq(alpha,beta,gamma,sigma)
```

that inputs the relevant botanical parameters and outputs the growth constant of these plants. Experiment with altering the parameters to get extinction, stability, and explosion.