Math151 at the University of Tennessee, Knoxville - Chat for October 21, 2015 with the course instructor, Louis Gross.

I will be online starting at 7:30PM and will be happy to answer questions regarding any aspect of the course, assignments, etc. You can type in this document to ask questions.

When you ask a question, please do not use your name because this document will be saved and publicly posted after we close it. I will be on-line at least until 8:30PM but will stay on longer if there are still questions. Note that I do not know the identity of anyone posting questions - each participant shows up as “Anonymous” animal.

I have a question about question number 3 on the exam. Creating a matrix I understand alright, as well as running the model through the short period of two years. However for parts c and d, It asks for the long term growth rate, as well as what fractions would be F and S stage. Is the first part related to our work today, with per capita growth and so on? And with the fractions, do we need a exclusive set of numbers to start the model, what do we do to find the requested fraction? Is it like that of percentages, one percentage is adults, the other juveniles?

OK - first I assume you understand how to do (a) and (b) for this. So then the (c) part is asking about long term growth rate which is given by the dominant eigenvalue. So to find the dominant eigenvalue you write down the characteristic equation. We went over this and it is given in the text on page 158. So it is
lambda^2 - 9 = 0 so this means lambda = 3
an this is the long term growth rate. That means that approximately after a long time the population size grows by this amount each time period. So if there are **1000 individuals present at time 100 there will be approximately 3000 there at time 101 - OK?**

? how does it go from 100 to 3000, instead of 100 to 300. I am a bit confused on how it rose from the hundreds to thousands. wait wait wait i see. You put 100 individuals present in your explanation above. thats why there was the disjunction. I see what it means now.
i understand, so the lamba serves as the …..slope for the equation. if the time is 100 and the number present is 1000. than you multiply the 1000 by 3000 to reach (101,3000) individuals?

Look back at the problem - it says “If there were 1000 individuals present at time 100” - I just mistyped - that’s all

Lambda is not a slope the equation is quadratic not linear. so there is no slope

Ok, no slope. would there be any way to enter the equation for finding lambda into our calculators, or is that not necessary? should i check the book? I am just trying to see if there is any graph format i could look at to see what the population change over time may look outside of the numbers. we had some graphs last week when we were looking at google earth images.

First, in the above you said multiple 1000 by 3000 - but the growth rate is 3 so you multiple by 3. Second, I did illustrate in class the quadratic equation that is the characteristic equation for a 2x2 matrix and showed that the solutions (e.g. where it crosses the x-axis can be 0, 1 or 2. In the problem 3 there is only one eigenvalue - the quadratic graph of y = x^2 - 9 just touches the x-axis at x=3 - that is the only root of the quadratic equation. So on your calculators you could indeed have it graph the characteristic equation and then zoom in to find the largest root and that is the dominant eigenvalue. However you really should be able to solve the equation using the quadratic formula.

Alright, I’ll redo some of my practice and work to get that right. What about the fraction’s? Is a stable population one that is constantly growing, or at an even size that does not change from cycle to cycle, an equal number entering and exiting the population?

Now that is a really great question! So far, in this course we have focused on population growth models that were linear (both in the sequences section in Chapter 5 and in the Leslie growth models. In these linear models you either get exponential growth, exponential decay, or staying exactly at the same level. In the way we defined eigenvalue, if the eigenvalue > 1 then the population is eventually growing at that rate each time period and the structure of the population is called “stable” because the fraction in each class doesn’t change. But the population size is growing exponentially. That is what problem 3 (d) is asking for - you find it by finding the eigenvector associated with the dominant eigenvalue (3 in this example). We went over finding eigenvectors for a 2x2 matrix in class - should I do it for this case?

If you wanted to, alternatively i can wait until tomorrow during discussion to ask my ta.

I’ll go ahead now but give me a minute to try to format this using the equation editor

$$\begin{bmatrix} 0 & 90 \\ .1 & 0 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = 3 \begin{bmatrix} x \\ y \end{bmatrix}$$

this is the equation for the eigenvector associated with the eigenvalue 3 so we need to find the relationship between x and y to find the eigenvector

the above gives 90 y = 3 x so x = 30 y so the eigenvector is $\begin{bmatrix} 30 \\ 1 \end{bmatrix}$

or we can normalize it so it is

$$\begin{bmatrix} 30/31 \\ 1/31 \end{bmatrix}$$

or

$$\begin{bmatrix} .97 \\ .03 \end{bmatrix}$$

so this means after a long time about 97% of the population will be in the F stage and about 3% will be in the S stage.

OK?

Yes I believe so. Seeing it as 97% to 3% is a bit easier to comprehend. I just went to the answer sheet and it had the answer as 30/31 and 1/31. It is just percentages, will it matter if we keep in fractions or transform it into the decimal format you had?

Nope - whatever way you want to give the fraction (as a fraction or as a digital number) it is fine.

Thank you very much for your help, I have to leave now, but I really appreciate the instruction and help. The part on what defines a “stable” population had really been stuck in my head, thank you for clarifying. Good night.

Any other questions from anyone else?

OK - the only one I see on is Anonymous Racoon so I assume there aren’t other questions for now - I’m going to go offline then.