Notes for Week 5 Lab Section

* Housekeeping time:

1. The assignment this week is now posted on our course website and NTU cool. In this assignment, you will see example answers to the questions. Please follow the instructions and the examples to work on your assignment.
2. I will be grading your assignment last week after the deadline, which is this midnight. So if you want to change your answers, you still have a bit of time and please go ahead and upload the new answers.
3. Again, we do not accept late submission. So make sure you upload your answers on time. If you have any difficulties, do let Prof. Ke or me know in advance so that we can work out a solution for you.

* Lab section:

Today, we are going to analyze a simple Leslie matrix using for loop and matrix algebra as well as eigenanalysis, and then we’ll visualize the population trajectories and age distribution. We don’t need to do any hand calculation, just let R do it. Isn’t it great?

**Part 1 - Analyzing Leslie matrix**

1. So we begin by creating a 3 by 3 Leslie matrix and asking R to fill in the elements by row.
2. Then we will create an empty data frame to store the for loop results. Here we simulate 50 time steps, and assign the initial age classes to the first row of this empty data frame. Inside the for loop, we’ll multiply the Leslie matrix with the age classes and iterate over the time steps, and the new age classes will be stored subsequently in the data frame.
3. Let’s take a look at the results: so we have the size of each age class and the total population size at each time step.
4. We can compute the asymptotic growth rate by dividing the pop size at the last time step by the pop size at the second-last time step. We get lambda larger than 1, so this population will grow.
5. For the stable age distribution, it’s the proportion of each age class at the last time step.
6. We can also do eigenanalysis to get the asymptotic growth rate and stable age distribution. The results are pretty much the same to what we got from the for loop. If we simulate for long enough time, the two results will converge.
7. Any questions?

**Part 2 - Visualizing population dynamics and age distribution**

1. So now we can visualize the size of each age class as well as the total pop size over time. Here the y-axis is on a log scale. And you can see that after roughly 35 time steps, the age classes become parallel to each other, meaning that they grow proportionally and thus have approached stable age distribution.
2. This animation shows how the proportions of the three age classes change over time. So initially the bars change quite a bit, but as time goes by, the bars gradually stabilize.
3. Any questions?

**Part 3 - In-class exercise**

1. Now it’s your turn to get your hands dirty. Here we have a transition diagram of a herb species common teasel. So your goal is to convert this diagram into a matrix and derive its asymptotic growth rate in R.
2. After you’re finished, you can ask Prof. Ke or me to take a look. You cannot leave the classroom unless you complete the practice. So go ahead!

**Part 4 - Density-dependent transitions**

1. This part is an advanced topic. So instead of fixed transitions, we can make it density-dependent. The resulting population size will be bounded rather than growing exponentially. I will not go through the details. If you are interested, please study the code and feel free to ask questions later.

**Part 5 - COM(P)ADRE: A global database of population matrices**

1. Hand over to PJ to introduce the database.