Homework #2

Use the following projection matrix:

$$A = \begin{bmatrix} 0.50 & 0 & 2 & 3 \\ 0.20 & 0.20 & 0.10 & 0 \\ 0.15 & 0.45 & 0.40 & 0.20 \\ 0 & 0.15 & 0.25 & 0.30 \end{bmatrix}$$

1. Draw the life cycle diagram that corresponds to this matrix and provide an example of an organism to which this matrix could apply.

2. Interpret the element P_{22}=0.2, especially given the organism you described in 1.

3. Interpret the element P_{42}=0.15

4. Interpret the element P_{34}=0.20

5. Interpret the element P_{13}=2.0

6. Assume that the initial population has 10 individuals of each class. Also assume the projection matrix remains constant (and as defined above). Project that population size 100 time steps (we'll call them years) into the future. What is the population size at t=100 years?

7. What proportion of the population is comprised by each stage: i.e. what is the SAD?

8. Now try to determine the RV of each stage. Do this by rerunning your simulation, but start with (11, 10, 10, 10) or (10, 11, 10, 10) or (10, 10, 11, 10) or (10, 10, 10, 11) as your initial stage structure: i.e., start with one additional individual but vary which stage you put that individual into. Record N(at t=100) for each of the four scenarios.

9. Calculate the difference between the final population size (for each of the four scenarios) and the original one (with 10,10,10,10), and then rescale these differences by dividing by the result for (11,10,10,10). Record these rescaled differences.

Note: if you solved for the left eigenvector of A and rescaled that vector, you'd get (1, 1.75, 3.26, 3.53): these are the Reproductives Values. Is that what you got with your calculations? Think about this result, as a way to think about what RV tells you. BTW, you can get the same result, if you just generate a future N by comparing when you start with (1,0,0,0) vs. (0,1,0,0) vs. (0,0,1,0) vs. (0,0,0,1)