Mathematics 172

Quiz 17 Name:_____

You must show your work to get full credit.

For a Leslie matrix

$$L = \begin{bmatrix} f_1 & f_2 & f_3 \\ p_1 & 0 & 0 \\ 0 & p_2 & 0 \end{bmatrix}$$

the Euler-Lotka equation is

$$\frac{f_1}{\lambda} + \frac{p_1 f_2}{\lambda^2} + \frac{p_1 p_2 f_3}{\lambda^3} = 1$$

and the vector of stable age distributions is

$$\begin{bmatrix} \frac{1}{n} \\ \frac{p_1}{n\lambda} \\ \frac{p_1 p_2}{n\lambda^2} \end{bmatrix} \quad \text{where} \quad n = 1 + \frac{p_1}{\lambda} + \frac{p_1 p_2}{\lambda^2}.$$

For the Leslie matrix

$$\begin{bmatrix} .15 & 8.0 & 3.2 \\ 0.1 & 0 & 0 \\ 0 & 0.25 & 0 \end{bmatrix}$$

1. What is the growth ratio of the stable age distribution?

The Euler-Lotka equation is

$$\frac{.15}{\lambda} + \frac{(.1)(8)}{\lambda^2} + \frac{(.1)(.25)(3.2)}{\lambda^3} - 1 = 0$$

i.e. \Y1 = .15/X + .1*8/X^2 + .1*.25*3.2 − 1

$\lambda =$ 1.0154

use 2nd calc zero

2. What is the per capita growth rate of the stable age distribution?

$r = \lambda - 1$

$r =$ .0154

3. What is the stable age distribution?

$$n = 1 + \frac{.1}{\lambda} + \frac{.1 \times .25}{\lambda^2} = 1.227$$

Proportion in stage 1 $\frac{1}{n} = .8907$

Proportion in stage 2 $\frac{p_1}{n\lambda} = .0877$

Proportion in stage 3 $\frac{p_1 p_2}{n\lambda^2} = .0216$