

Mathematics 172

Quiz #19

Name: Key

You must show your work to get full credit.

A species of fish in a lake has a life history is partly summarized by the Leslie matrix

$$\begin{bmatrix} 0.0 & 3.1 & 10.0 \\ 0.15 & 0.0 & 0.0 \\ 0.0 & 0.4 & 0.0 \end{bmatrix}$$

If the lake is without the fish and ten stage one fish are introduced, that is

$$\vec{n}(0) = \begin{bmatrix} 10 \\ 0 \\ 0 \end{bmatrix}$$

1. Find $\vec{n}(50)$ and $\vec{n}(51)$ to four decimal places.

$$\vec{n}(50) = \begin{bmatrix} 13.3756 \\ 1.9576 \\ 0.7640 \end{bmatrix}$$

$$\vec{n}(51) = \begin{bmatrix} 13.7087 \\ 2.0063 \\ 0.7830 \end{bmatrix}$$

2. Is there a λ such that $\vec{n}(51) = \lambda \vec{n}(50)$. If so find λ .

$$\lambda = \frac{13.7087}{13.3756} = 1.0249$$

$$\lambda = \underline{1.0249}$$

$$\lambda = \frac{2.0063}{1.9576} = 1.0249$$

$$\lambda = \frac{0.7830}{0.7640} = 1.0249$$

3. What is the stable age distribution?

Using $\vec{n}(50)$

$$\begin{aligned} \text{total} &= 13.3756 \\ &+ 1.9576 \\ &+ 0.7640 = 16.0972 \end{aligned}$$

Percent in stage 1 is $\frac{13.3756}{16.0972} = 83.09\%$

Percent in stage 2 is $\frac{1.9576}{16.0972} = 12.16\%$

Percent in stage 3 is $\frac{0.7640}{16.0972} = 4.75\%$