Age in year (x)	S(x)	b(x)
0	500	0
1	400	2.5
2	40	3
3	0	0

Table 1: Life table for problem 4.

Homework 2 for MAT 494 Due on Th. Sept. 28, 2006

1): A population starts with 100 members of age zero. Assume that each member of age zero produces one offspring and that 2/3 survive to age one. All members of age one produce 3 offspring and then die. Find the corresponding Leslie matrix, its dominant eigenvalue and a corresponding eigenvector. Describe the stable age distribution and the asymptotic behavior of the population.

2): For the given Leslie matrix find the dominant eigenvalue (if there is one and you can use MATLAB), the corresponding eigenvector and the stable age distribution. Use MATLAB to simulate the Leslie model (end time=10) for three different initial conditions.

$$A = \begin{pmatrix} 1 & 2 & 1 \\ 0.5 & 0 & 0 \\ 0 & 0.5 & 0 \end{pmatrix}.$$

3): Consider the Usher model with

$$A = \begin{pmatrix} 0 & 0 & 73 \\ 0.04 & 0 & 0 \\ 0 & 0.39 & 0.65 \end{pmatrix}.$$

a). Compute eigenvectors and eigenvalues of the model with MATLAB.
b). What is the intrinsic growth rate? the stable stage distribution?
c). Express the initial vector $X_0 = (100, 10, 1)$ as a sum of the eigenvectors.
d). Use your answer in part (d) to give a formula for the population vector X_n.

4): Here is a set of hypothetical life-table data for a population of snails:
a). Complete the life-table analysis by calculating $l(x), R_0, G$, and the estimate of r. Calculate the exact value of r with the Euler equation.
b). Determine the stable age distributions for this life table.
c). Suppose the snail population consisted of 50 newborns, 100 one-year-olds, and 20 two-year-olds. Construct the Leslie matrix for this life table, and project population growth for the next two consecutive years.

5): Exercise 3, page 62.
6): Exercise 4, page 62.
7): Exercise 11, page 63.
8): Exercise 16, page 65.
9): Exercise 9, page 104.
10): Exercise 11, page 105.
11): Exercise 15, page 105.