Assignment 9: Confidence Limits for Rates of Population Change (λ)

The purpose of this exercise is to learn how to calculate confidence limits for λ for projection matrices, using the methods learned in class. To complete this assignment, you will need to install Matlab onto your own computer.

Question 1. Fiedler et al. (1998) summarized projection matrices for endangered species of orchids. For one endangered species, *Calochortus howelli*, they presented matrices calculated for six different years. Use the series approximation to calculate λ and the 95%CI for λ for this set of matrices.

Year 1

0.50	0.00	0.01
0.50	0.44	0.05
0.00	0.54	0.93

Year 2

0.75	0.00	0.09
0.25	0.58	0.06
0.00	0.43	0.93

Year 3

0.79	0.01	0.10
0.06	0.43	0.01
0.00	0.56	0.98

Year 4

0.77	0.02	0.10
0.13	0.05	0.05
0.00	0.44	0.92

Year 5

0.67	0.00	0.04
0.11	0.48	0.04
0.02	0.43	0.92

Year 6

0.84	0.11	0.05
0.07	0.65	0.10
0.00	0.21	0.86

Question 2. Lande (1988) modeled the population dynamics of the Spotted Owl (*Strix occidentalis*). The 3 by 3 post-breeding model he used was:

$$\begin{vmatrix} 0 & 0 & Sa \times b \\ So \times Sd & 0 & 0 \\ 0 & Sj & Sa \end{vmatrix}$$

where b = clutch size, So = the probability of fledging of juveniles, Sd = the probability of successful dispersal, Sj = the probability of survival for juveniles and Sa = the probability of survival for adults. His estimates for these rates are as follows.

Parameter	Mean	Variance
b	0.24	7.12×10^{-4}
So	0.62	1.78×10^{-3}
Sd	0.18	3.36×10^{-3}
Sj	0.71	2.94×10^{-2}
Sa	0.94	7.92×10^{-4}

Lande (1988) used series approximation and calculated the 95%CI of λ to be approximately $\lambda = 0.961 \pm 0.0562$. Use 1000 iterations of the boot-strapping technique to calculate the 95%CI..

Hand-in: Brief answers to the questions and copies of your Matlab m-files documenting the program that you have written to complete this assignment.