

CP

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hw 6 -  
can post

SMTWTFS  
hw 6 Zachariah Ali

1. ① Random Leslie Matrix (4,2)

$$\begin{pmatrix} 0 & 1.53 & 0.72 & 1.05 & 1.13 \\ 0.9 & 0 & 0 & 0 & 0 \\ 0 & 0.18 & 0 & 0 & 0 \\ 0 & 0 & 0.43 & 0 & 0 \\ 0 & 0 & 0 & 0.55 & 0 \end{pmatrix}$$

Max eig 1.34  
grow out of hand

$$\textcircled{2} \begin{pmatrix} 0 & 1.09 & 0.4 & 0.17 & 1.48 \\ 0.52 & 0 & 0 & 0 & 0 \\ 0 & 0.81 & 0 & 0 & 0 \\ 0 & 0 & 0.87 & 0 & 0 \\ 0 & 0 & 0 & 0.34 & 0 \end{pmatrix}$$

Max eig 1.01  
grow out of hand

$$\textcircled{3} \begin{pmatrix} 0 & 1.37 & 1.05 & 1.46 & 0.83 \\ 0.63 & 0 & 0 & 0 & 0 \\ 0 & 0.7 & 0 & 0 & 0 \\ 0 & 0 & 0.36 & 0 & 0 \\ 0 & 0 & 0 & 0.36 & 0 \end{pmatrix}$$

Max eig 1.22  
grow out of hand

$$\textcircled{4} \begin{pmatrix} 0 & 0.1 & 0.4 & 0.66 & 0.27 \\ 0.18 & 0 & 0 & 0 & 0 \\ 0 & 0.98 & 0 & 0 & 0 \\ 0 & 0 & 0.43 & 0 & 0 \\ 0 & 0 & 0 & 0.53 & 0 \end{pmatrix}$$

Max eig 0.61  
doomed to extinction

$$\textcircled{5} \begin{pmatrix} 0 & 0.61 & 0.47 & 0.28 & 0.03 \\ 0.25 & 0 & 0 & 0 & 0 \\ 0 & 0.11 & 0 & 0 & 0 \\ 0 & 0 & 0.37 & 0 & 0 \\ 0 & 0 & 0 & 0.75 & 0 \end{pmatrix}$$

Max eig 0.235  
doomed to extinction

$$\textcircled{6} \begin{pmatrix} 0 & 0.04 & 1.5 & 0.4 & 0.58 \\ 0.43 & 0 & 0 & 0 & 0 \\ 0 & 0.98 & 0 & 0 & 0 \\ 0 & 0 & 0.11 & 0 & 0 \\ 0 & 0 & 0 & 0.3 & 0 \end{pmatrix}$$

Max eig 1.13  
grow out of hand

$$\textcircled{7} \begin{pmatrix} 0 & 1.34 & 0.32 & 0.4 & 1.16 \\ 0.24 & 0 & 0 & 0 & 0 \\ 0 & 0.8 & 0 & 0 & 0 \\ 0 & 0 & 0.46 & 0 & 0 \\ 0 & 0 & 0 & 0.11 & 0 \end{pmatrix}$$

Max eig: 0.763  
doomed to extinction

$$\textcircled{8} \begin{pmatrix} 0 & 0.73 & 1.69 & 1.8 & 1.28 \\ 0.58 & 0 & 0 & 0 & 0 \\ 0 & 0.67 & 0 & 0 & 0 \\ 0 & 0 & 0.81 & 0 & 0 \\ 0 & 0 & 0 & 0.65 & 0 \end{pmatrix}$$

Max eig: 1.15  
grow out of hand

$$\textcircled{4} \begin{pmatrix} 0 & 1.97 & 1.3 & 0.3 & 0 \\ 0.84 & 0 & 0 & 0 & 0 \\ 0 & 0.98 & 0 & 0 & 0 \\ 0 & 0 & 0.94 & 0 & 0 \\ 0 & 0 & 0 & 0.31 & 0 \end{pmatrix} \quad \textcircled{10} \begin{matrix} S & M & T & W & T & F & S \\ \begin{pmatrix} 0 & 0.31 & 0.54 & 0.67 & 1.87 \\ 0.66 & 0 & 0 & 0 & 0 \\ 0 & 0.17 & 0 & 0 & 0 \\ 0 & 0 & 0.49 & 0 & 0 \\ 0 & 0 & 0 & 0.9 & 0 \end{pmatrix} \end{matrix}$$

Max eig: 1.51  
Surv out of hand

Max eig: 0.708  
doomed to extinction

2. The probability of  $S_m \rightarrow S_n$ ,  $m \neq n$   
is  $\frac{1 - P(S_m)}{3}$ .

Where  $P(S_m)$  is the probability  
of staying at  $S_m$ .

i.e. The probability of going from  $S_1$  to  $S_2$  is  $\frac{1 - 0.5}{3} = \frac{1}{6}$ .

a) I do not know what the transition matrix is but  
from looking online:

$$P = \begin{pmatrix} \frac{1}{2} & \frac{1}{6} & \frac{1}{6} & \frac{1}{6} \\ \frac{1}{5} & \frac{2}{5} & \frac{1}{5} & \frac{1}{5} \\ \frac{2}{30} & \frac{7}{30} & \frac{3}{10} & \frac{7}{30} \\ \frac{4}{15} & \frac{4}{15} & \frac{4}{15} & \frac{1}{5} \end{pmatrix}$$

b) Intuitively  $S_1 \rightarrow S_2 \rightarrow S_3 \rightarrow S_4$

$\frac{1}{2}$  stay at  $S_1$

$\frac{2}{5}$  at  $S_2$

$\frac{3}{10}$  at  $S_3$

$\frac{2}{10}$  at  $S_4$