M146 Sample #05a for Quiz April 27, 2006

(1) $A = \begin{bmatrix} 1 & 1 & 4 \\ 2 & 1 & 9 \\ 3 & 2 & 13 \end{bmatrix}$; $b = \begin{bmatrix} 1 \\ 3 \\ 4 \end{bmatrix}$; $c = \begin{bmatrix} 1 \\ 3 \\ 2 \end{bmatrix}$. $\vec{0} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$.

Find all solutions of $Ax = b$. Find all solutions of $Ax = c$. Find all solutions of $Ax = \vec{0}$.

(2a) A population is divided into newborns and adults. Each adult produces 3 newborns per year; 10 % of the newborns survive to become adults; each year 70 % of the adults survive to the next year. Give the Leslie matrix L for this population.

(2b) One eigenvalue is $\lambda = 1$. Find a stable population $x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$, totalling 1200. That is $Lx = \lambda x$, and $x_1 + x_2 = 1200$.

(3) A population is divided into calves, yearlings, adults. The Leslie matrix for this population distribution is: $L = \begin{bmatrix} 0 & 0 & 2.5 \\ 0.5 & 0 & 0 \\ 0 & 0.4 & 0.5 \end{bmatrix}$.

(3b) One eigenvalue is $\lambda = 1$. Find a stable population $x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$, totalling 1900. That is $Lx = \lambda x$, and $x_1 + x_2 + x_3 = 1900$.

(3c) A vector of numbers $p = (p_1, p_2, p_3)$ with $p_1 + p_2 + p_3 = 1$ and $Lp = \lambda p$ called the **stable distribution**. What are the percentages of calves, yearlings and adults in the stable distibution?

(4) $A = \begin{bmatrix} 1 & -2 \\ 4 & 7 \end{bmatrix}$ Find two solutions to $Av = \lambda v$ where v is a vector and λ is a scalar.

M146 Sample #05b for Quiz April 27, 2006

(1) $A = \begin{bmatrix} 1 & 1 & 4 \\ 1 & 0 & 5 \\ 3 & 2 & 13 \end{bmatrix}$; $b = \begin{bmatrix} 1 \\ 2 \\ 4 \end{bmatrix}$; $c = \begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix}$. $\vec{0} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$.

Find all solutions of $Ax = b$. Find all solutions of $Ax = c$. Find all solutions of $Ax = \vec{0}$.

(2a) A population is divided into newborns and adults. Each adult produces 2 newborns per year; 30 % of the newborns survive to become adults; each year 40 % of the adults survive to the next year. Give the Leslie matrix L for this population.

(2b) One eigenvalue is $\lambda = 1$. Find a stable population $x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$, totalling 1200. That is $Lx = \lambda x$, and $x_1 + x_2 = 1200$.

(3) A population is divided into calves, yearlings, adults. The Leslie matrix for this population distribution is: $L = \begin{bmatrix} 0 & 0 & 1.8 \\ 0.6 & 0 & 0 \\ 0 & 0.4 & 0.9 \end{bmatrix}$.

(3b) One eigenvalue is $\lambda = 1.2$. Find a stable population $x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$, totalling 1700. That is $Lx = \lambda x$, and $x_1 + x_2 + x_3 = 1700$.

(3c) A vector of numbers $p = (p_1, p_2, p_3)$ with $p_1 + p_2 + p_3 = 1$ and $Lp = \lambda p$ called the **stable distribution**. What are the percentages of calves, yearlings and adults in the stable distibution?

(4) $A = \begin{bmatrix} 3 & 1 \\ -3 & 7 \end{bmatrix}$ Find two solutions to $Av = \lambda v$ where v is a vector and λ is a scalar.