Working a Leslie Matrix Equation

$$\underbrace{\begin{bmatrix} m_0 & m_1 & m_2 & m_3 & m_4 & m_5 \\ s_0 & 0 & 0 & 0 & 0 & 0 \\ 0 & s_1 & 0 & 0 & 0 & 0 \\ 0 & 0 & s_2 & 0 & 0 & 0 \\ 0 & 0 & 0 & s_3 & 0 & 0 \\ 0 & 0 & 0 & 0 & s_4 & 0 \end{bmatrix}}_{\mathbf{L}} \times \underbrace{\begin{bmatrix} n_{0,t} \\ n_{1,t} \\ n_{2,t} \\ n_{3,t} \\ n_{4,t} \\ n_{5,t} \end{bmatrix}}_{\mathbf{N}_t} = \underbrace{\begin{bmatrix} n_{0,t+1} \\ n_{1,t+1} \\ n_{2,t+1} \\ n_{3,t+1} \\ n_{4,t+1} \\ n_{5,t+1} \end{bmatrix}}_{\mathbf{N}_{t+1}}$$

The population vector ($\mathbf{N}_t$) is a column of numbers, where each number is the number of females in a particular age class at a particular time ($n_{x,t}$)

The Leslie matrix (**L**) is a square matrix of numbers, where the top row consists of age-specific fertility rates (m_x) and the subdiagonal consists of age-specific survival rates (s_x). The rest of the numbers in the matrix are all zeroes.

For each row in the Leslie matrix (**L**), each value gets multiplied by the corresponding age class in the current population vector ($\mathbf{N}_t$), and the products are added up to produce the value in the projected population vector ($\mathbf{N}_{t+1}$) in that row.
Projected newborns ($n_{0,t+1}$) is the total reproductive output over all age classes

$$\mathbf{L} \times \mathbf{N}_t = \mathbf{N}_{t+1}$$

$$m_0 \times n_{0,t} + m_1 \times n_{1,t} + m_2 \times n_{2,t} + m_3 \times n_{3,t} + m_4 \times n_{4,t} + m_5 \times n_{5,t} = n_{0,t+1}$$

$$m_0n_{0,t} + m_1n_{1,t} + m_2n_{2,t} + m_3n_{3,t} + m_4n_{4,t} + m_5n_{5,t} = n_{0,t+1}$$

For each row in the Leslie matrix (**L**), each value gets multiplied by the corresponding age class in the current population vector ($\mathbf{N}_t$), and the products are added up to produce the value in the projected population vector ($\mathbf{N}_{t+1}$) in that row.
Projected 1-year olds ($n_{1,t+1}$) are current newborns that survive.

$$\mathbf{L} \times \mathbf{N}_t = \mathbf{N}_{t+1}$$

$$s_0 \times n_{0,t} + 0 \times n_{1,t} + 0 \times n_{2,t} + 0 \times n_{3,t} + 0 \times n_{4,t} + 0 \times n_{5,t} = n_{1,t+1}$$

$$s_0n_{0,t} = n_{1,t+1}$$

For each row in the Leslie matrix (**L**), each value gets multiplied by the corresponding age class in the current population vector ($\mathbf{N}_t$), and the products are added up to produce the value in the projected population vector ($\mathbf{N}_{t+1}$) in that row.
Projected 2-year olds ($n_{2,t+1}$) are current 1-year olds that survive.

$$\mathbf{L} \times \mathbf{N}_t = \mathbf{N}_{t+1}$$

$$0 \times n_{0,t} + s_1 \times n_{1,t} + 0 \times n_{2,t} + 0 \times n_{3,t} + 0 \times n_{4,t} + 0 \times n_{5,t} = n_{2,t+1}$$

$$s_1n_{1,t} = n_{2,t+1}$$

For each row in the Leslie matrix (**L**), each value gets multiplied by the corresponding age class in the current population vector ($\mathbf{N}_t$), and the products are added up to produce the value in the projected population vector ($\mathbf{N}_{t+1}$) in that row.
Projected 3-year olds ($n_{3,t+1}$) are current 2-year olds that survive.

$$\mathbf{L} \times \mathbf{N}_t = \mathbf{N}_{t+1}$$

$$0 \times n_{0,t} + 0 \times n_{1,t} + s_2 \times n_{2,t} + 0 \times n_{3,t} + 0 \times n_{4,t} + 0 \times n_{5,t} = n_{3,t+1}$$

$$s_2n_{2,t} = n_{3,t+1}$$

And so on…..