# M447 - Mathematical Models/Applications 1 - Homework 2

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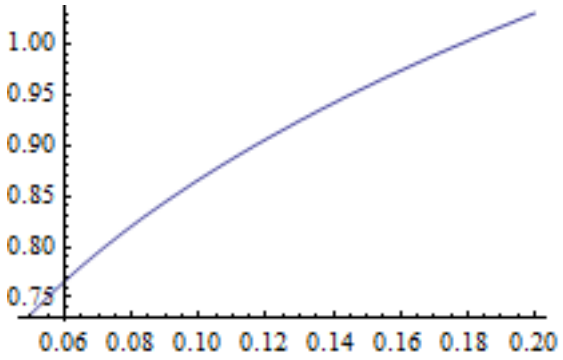
**Chapter 2, Section 2.5**

(8) In the situation discussed in Example 2.20, the largest eigenvalue, $\lambda_0$, of the matrix of vital rates depends on the survival rate $s_1$. Graph $\lambda_0$ as a function of $s_1$ for $.05 \leq s_1 \leq .2$. Also, determine the long-run fraction of the population in the adult stratum for the same range of values $s_1$.

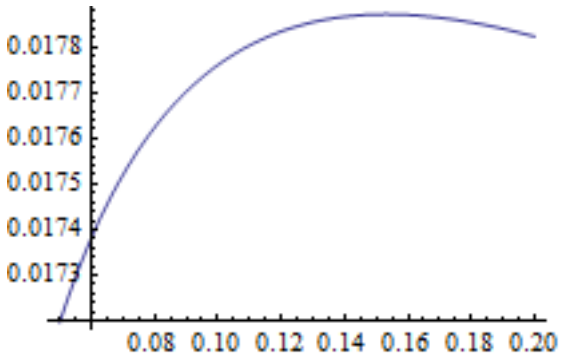
**Solution:** The following code in Mathematica does the job: to get the graph of $\lambda_0$ as a function of $s$

```
getEigenValue[s_] := Module[{M},
        M = { {0, 0, 10, 25}, {s, 0, 0, 0}, {0, .2, .2, 0}, {0, 0, .4, .2}};
         Eigenvalues[M][[1]]
         ]

Plot[getEigenValue[s], {s, 0.05, 0.2}]
```




Next, to find the long-run fraction of the population in the adult stratum we can use the function:

```
longRunAdultFraction[s_] := Module[{M, V},
        M = { {0, 0, 10, 25}, {s, 0, 0, 0}, {0, .2, .2, 0}, {0, 0, .4, .2}};
        V = Eigenvectors[M];
        V[[1]][[4]] / Plus @@ V[[1]]
        ]

Plot[longRunAdultFraction[s], {s, .05, .2}]
```




This function makes sense: if we increase the proportion of eggs and hatchlings, eventually these will make a larger proportion of the population and so the fraction in the adult stratum will decrease.