

Sample models for Project 1

$$b(n+1) = b(n) \cdot \left(1 + \frac{r}{12}\right)$$

$$b(n+1) = b(n) \cdot \left(1 + \frac{r}{12}\right) - \begin{cases} \max(10, 0.03 \cdot b(n)) & \max(10, 0.03 \cdot b(n)) > b(n) \cdot \left(1 + \frac{r}{12}\right) \\ b(n) \cdot \left(1 + \frac{r}{12}\right) & \text{otherwise} \end{cases}$$

Assignment: P 135 #1, #7

Example: Page 111

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> A := <<0.4271,0.9924,0>|<0.8498,0,0.9826>|<0.1273,0,0>>;
      A :=  $\begin{bmatrix} 0.4271 & 0.8498 & 0.1273 \\ 0.9924 & 0 & 0 \\ 0 & 0.9826 & 0 \end{bmatrix}$  (1)
> e, V := LinearAlgebra:-Eigenvectors(A):
> e; # eigenvalues
       $\begin{bmatrix} 1.20933698819421176 + 0. I \\ -0.615455457319593946 + 0. I \\ -0.166781530874619082 + 0. I \end{bmatrix}$  (2)
> V; # eigenvectors
[[[0.687130848313017960 + 0. I, -0.312692426679946289 + 0. I, 0.0281120905448862708 + 0. I],
 [0.563869839856687483 + 0. I, 0.504205398695551921 + 0. I, -0.167275348238157790 + 0. I],
 [0.458150631339328928 + 0. I, -0.804984696887627748 + 0. I, 0.985509344571120272 + 0. I]]
> ?realpart
> e := Re(e);
      e :=  $\begin{bmatrix} 1.20933698819421176 \\ -0.615455457319593946 \\ -0.166781530874619082 \end{bmatrix}$  (4)
> V := Re(V);
      (5)

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$$V := \begin{bmatrix} 0.687130848313017960 & -0.312692426679946289 & 0.0281120905448862708 \\ 0.563869839856687483 & 0.504205398695551921 & -0.167275348238157790 \\ 0.458150631339328928 & -0.804984696887627748 & 0.985509344571120272 \end{bmatrix} \quad (5)$$

> **W := LinearAlgebra:-MatrixInverse(V);**

$$W := \begin{bmatrix} 0.847590171966752236 & 0.668093896959176092 & 0.0892209780604506647 \\ -1.47955660270330648 & 1.55433273938086348 & 0.306029548173014254 \\ -1.60256663669292299 & 0.959023304643069618 & 1.22319738751153917 \end{bmatrix} \quad (6)$$

> **?DiagonalMatrix**

> **E := LinearAlgebra:-DiagonalMatrix(e);**

$$E := \begin{bmatrix} 1.20933698819421176 & 0 & 0 \\ 0 & -0.615455457319593946 & 0 \\ 0 & 0 & -0.166781530874619082 \end{bmatrix} \quad (7)$$

> **V.E.W;**

$$\begin{bmatrix} 0.4267 & 0.8496 & 0.1273 \\ 0.9923 & 0.00007 & 0.00001 \\ -0.0002 & 0.9823 & -0.0001 \end{bmatrix} \quad (8)$$

> **A - V.E.W;**

$$\begin{bmatrix} 0.0004 & 0.0002 & 0. \\ 0.0001 & -0.00007 & -0.00001 \\ 0.0002 & 0.0003 & 0.0001 \end{bmatrix} \quad (9)$$

> **Digits := 4: UseHardwareFloats := false:**

> **E^100;**

$$\begin{bmatrix} 1.760 \cdot 10^8 & 0. & 0. \\ 0. & 8.328 \cdot 10^{-22} & 0. \\ 0. & 0. & 1.654 \cdot 10^{-78} \end{bmatrix} \quad (10)$$

> **v := V[1..-1,1];**

eigenvector associated with the dominant eigenvalue

$$v := \begin{bmatrix} 0.687130848313017960 \\ 0.563869839856687483 \\ 0.458150631339328928 \end{bmatrix} \quad (11)$$

> **v/LinearAlgebra:-Norm(v,1);**

(12)

$$\begin{bmatrix} 0.4020 \\ 0.3299 \\ 0.2681 \end{bmatrix} \quad (12)$$

> T := <<.5,.3,.2>|<.3,.6,.1>|<.1,.1,.8>>;

$$T := \begin{bmatrix} 0.5 & 0.3 & 0.1 \\ 0.3 & 0.6 & 0.1 \\ 0.2 & 0.1 & 0.8 \end{bmatrix} \quad (13)$$

> e, V := LinearAlgebra:-Eigenvectors(T);

$$e, V := \begin{bmatrix} 1.000 + 0. I \\ 0.2441 + 0. I \\ 0.6562 + 0. I \end{bmatrix}, \begin{bmatrix} 0.4578 + 0. I & 0.7764 + 0. I & -0.3576 + 0. I \\ 0.5242 + 0. I & -0.6067 + 0. I & -0.4571 + 0. I \\ 0.7179 + 0. I & -0.1702 + 0. I & 0.8143 + 0. I \end{bmatrix} \quad (14)$$

> T^100;

$$\begin{bmatrix} 0.2694 & 0.2694 & 0.2694 \\ 0.3077 & 0.3077 & 0.3077 \\ 0.4233 & 0.4233 & 0.4233 \end{bmatrix} \quad (15)$$

> T := <<.2,.2,.2,.2,.2>|<0,.4,.4,.2,0>|<0,.25,.25,.25,.25>|<0,0,0,1,0>|<0,0,0,0,1>>;

$$T := \begin{bmatrix} 0.2 & 0 & 0 & 0 & 0 \\ 0.2 & 0.4 & 0.25 & 0 & 0 \\ 0.2 & 0.4 & 0.25 & 0 & 0 \\ 0.2 & 0.2 & 0.25 & 1 & 0 \\ 0.2 & 0 & 0.25 & 0 & 1 \end{bmatrix} \quad (16)$$

> e, V := LinearAlgebra:-Eigenvectors(T);

$$e, V := \begin{bmatrix} 0.1995 + 0. I \\ 0.6491 + 0. I \\ -0.0001264 + 0. I \\ 1.002 + 0. I \\ 1.000 + 0. I \end{bmatrix}, \begin{bmatrix} [0.8432 + 0. I, -0.0003766 + 0. I, -0.001175 + 0. I, 0.001004 + 0. I, -0.00004769 + 0. I], \\ [-0.3738 + 0. I, 0.4905 + 0. I, -0.5152 + 0. I, 0.003525 + 0. I, 0.0003339 + 0. I], \\ [-0.3755 + 0. I, 0.4905 + 0. I, 0.8251 + 0. I, 0.001721 + 0. I, -0.0003815 + 0. I], \end{bmatrix} \quad (17)$$

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[ -0.0001000 + 0. I, -0.6297 + 0. I, -0.1035 + 0. I, 0.7994 + 0. I, -0.7686 + 0. I],  
[ -0.09343 + 0. I, -0.3490 + 0. I, -0.2062 + 0. I, 0.6003 + 0. I, 0.6399 + 0. I]]
```

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> T^100;
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      [ 1.268 10-70      0.      0.      0.      0.  
      8.652 10-20 1.197 10-19 7.488 10-20 0.      0.  
      8.652 10-20 1.197 10-19 7.488 10-20 0.      0.  
      0.5714      0.7142      0.5715      1.000      0.  
      0.4285      0.2856      0.4285      0.      1.000 ]
```

(18)