

Chapter 9 / Example 11

Initial state vectors

Dockless bicycle company Mathbike open their business by distributing a number of bicycles in a city according to the initial state vector $S_0 = \begin{pmatrix} 110 \\ 80 \\ 50 \end{pmatrix}$.

- Calculate the likely number of bicycles in each zone of the city after 5 days using the transition matrix given in example 10.
- Find the likely steady state of Mathbikes.

Enter the transition matrix $T = \begin{pmatrix} 0.50 & 0.30 & 0.10 \\ 0.30 & 0.35 & 0.30 \\ 0.20 & 0.35 & 0.60 \end{pmatrix}$

Press $\boxed{2\text{nd}} \boxed{[x^{-1}]} \boxed{[\text{MATRX}]} \blacktriangleright \blacktriangleright$ EDIT 1:[A] and press $\boxed{[\text{ENTER}]}$.

NAMES MATH EDIT
1:[A]
2:[B]
3:[C]
4:[D]
5:[E]
6:[F]
7:[G]
8:[H]
9↓[I]

Change the dimensions of the matrix to 3×3 and press $\boxed{[\text{ENTER}]}$.

MATRIX[A] 3 × 3
[0 0 0]
[0 0 0]
[0 0 0]
[A](1,1)= 0

Enter the values of the elements of the 3×3 matrix, using $\boxed{[\text{ENTER}]}$ to move through the matrix.

MATRIX[A] 3 × 3
[.5 .3 .1]
[.3 .35 .3]
[.2 .35 .6]
[A](3,3)= .6

Press $\boxed{2\text{nd}} \boxed{[x^{-1}]} \boxed{[\text{MATRX}]} \blacktriangleright \blacktriangleright$ EDIT 2:[B] and press $\boxed{[\text{ENTER}]}$.

NAMES MATH EDIT
1:[A] 3×3
2:[B]
3:[C]
4:[D]
5:[E]
6:[F]
7:[G]
8:[H]
9↓[I]

Chapter 9 / Example 11

Initial state vectors

Change the dimensions of the matrix to 3×1 and press **ENTER**.

MATRIX[B] 3 \times 1
 $\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

Enter the values of the elements of the 3×1 matrix, using **ENTER** to move through the matrix.

MATRIX[B] 3 \times 1
 $\begin{bmatrix} 110 \\ 80 \\ 50 \end{bmatrix}$
[B](1,1)= 110

Press **2nd** **MODE** **[QUIT]**.

Press **2nd** **x^{-1}** **[MATRX]** 1:[A]

Press **\wedge** **5** **\rightarrow** **\times**

Press **2nd** **x^{-1}** **[MATRX]** 2:[B] and press **ENTER**.

There would be approximately 66 Mathbikes in zone C, 76 in Zone I and 98 in Zone O.

[A]⁵*[B]
 $\begin{bmatrix} 65.7459 \\ 75.789475 \\ 98.464625 \end{bmatrix}$

Repeat the calculation with some higher powers of the matrix. You can return to the entry line and change the value of the index. (Do not make it too big!)

The system reaches an equilibrium at 65 bikes in C, 76 in I and 99 in O.

[A]⁵*[B]
 $\begin{bmatrix} 65.7459 \\ 75.789475 \\ 98.464625 \end{bmatrix}$
[A]⁵⁰*[B]
 $\begin{bmatrix} 65.26315789 \\ 75.78947368 \\ 98.94736842 \end{bmatrix}$