Linear Algebra from Scratch: Introduction

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Matrices are not Digital Constructions of the Environment

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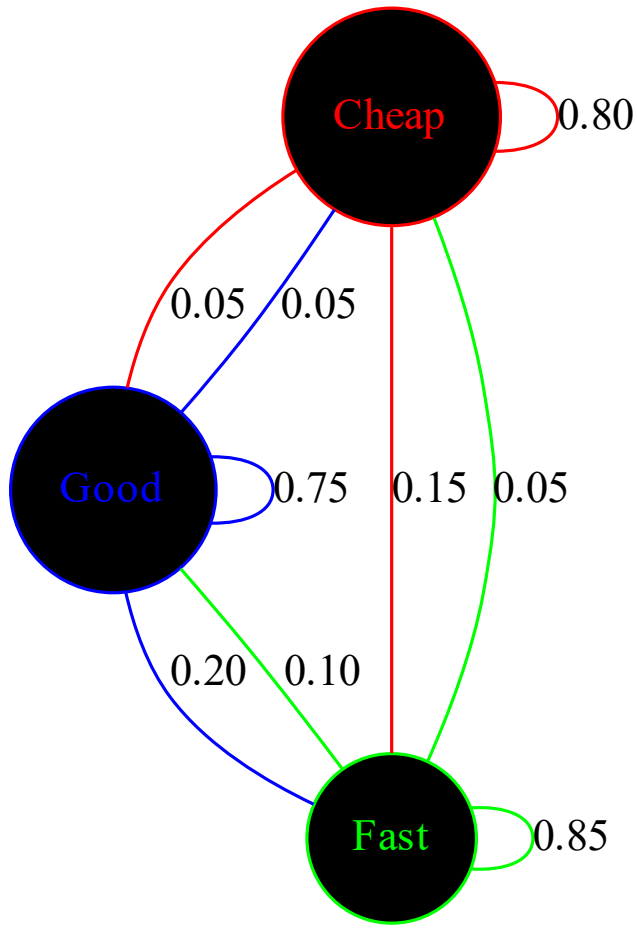
Reference: Leon, 2014 [2]

A Matrix is a collection of elements

1. $a_1 \sim$ *Cheap*
2. $a_2 \sim$ *Good*
3. $a_3 \sim$ *Fast*



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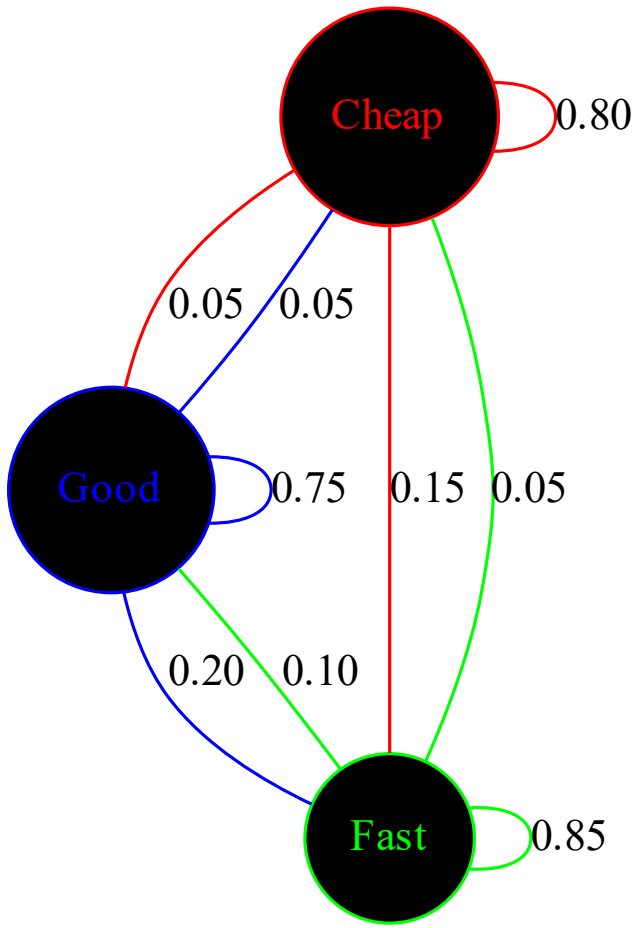
4. The probability of changing to the i_{th} state to the j_{th} state can be expressed as:



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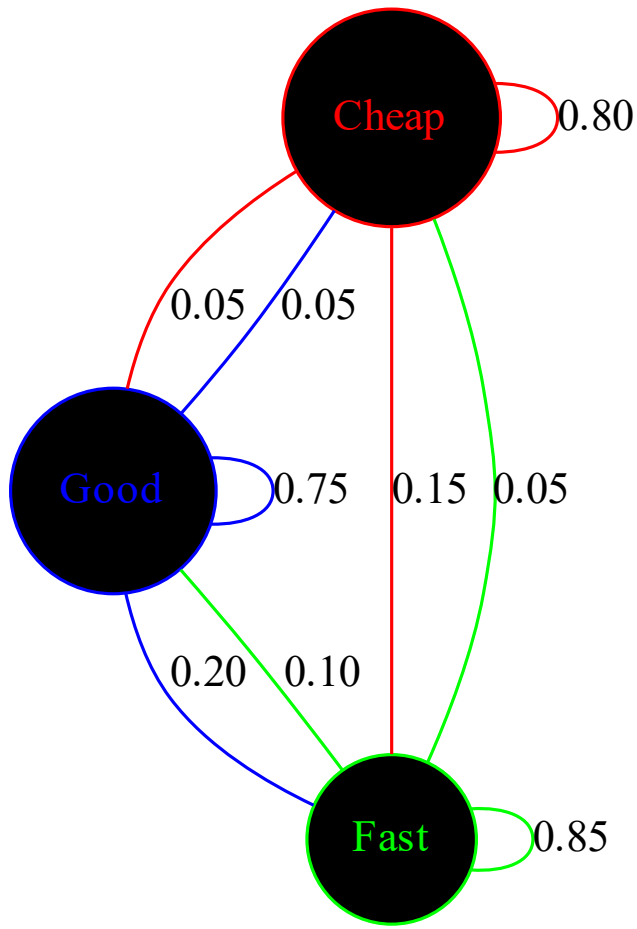
5.

$$A' = \begin{bmatrix} 0.80 & 0.05 & 0.10 \\ 0.05 & 0.75 & 0.05 \\ 0.15 & 0.20 & 0.85 \end{bmatrix}$$



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A Matrix is a rectangular array of elements

Overview.

1. Systems of Linear Equations
2. Row Echelon Form

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Determinants can be calculated for square matrices.

Overview.

1. Determinant of a matrix
2. Properties of determinants

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Vector Spaces preserve linearity

Overview.

1. Definitions and Examples
2. Subspaces
3. Linear Independence
4. Basis and Dimension
5. Change of Basis
6. Row and Column Spaces

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A Linear Transformation is a mapping

Definition.

1. Definitions and Examples
2. The Matrix representation of a linear transformation
3. Similarity between Matrices

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Orthogonality is the geometric generalization of perpendicular

Definition.

1. Inner Product
2. Orthogonal Subspaces
3. Least Squares
4. Inner Product Spaces
5. Gram-Schmidt Orthogonalization

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Solving the eigenvalue problem is useful to many applications

Overview.

1. Eigenvalues and Eigenvectors
2. Diagonalization
3. Hermitian Matrices
4. Singular Value Decomposition
5. Quadratic Forms

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Coding as an additional exercise for ambitious scholars

Overview.

The Matlab, Python, and other relevant course related content can be found at: **GitHub Link** □

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References I

[1] David Harville. *Matrix Algebra From a Statistician's Perspective*. New York: Springer-Verlag, 1997.

[2] Leon Stephen. *Linear Algebra with Applications (9th Edition) (Featured Titles for Linear Algebra*. London, England: Pearson, 2014.