



Introduction to Linear Algebra for Investment Analysts (Draft)

Format

2-day course in-person or online. Excel-based exercises in-person, no exercises online.

Program

The program below is an indication of the content covered. It does not represent the sequence of the presentation.

Introduction

- What is Linear Algebra
- Why is Linear Algebra interesting for investment analysis?

Scalars, Vectors and Matrices

- One and Zero Objects
- Symmetrical Matrices
- Diagonals (minor/major/nth),
- Triangulars (upper/lower)
- Geometrical, Statistical & Analytical
- Interpretations of Vectors and Matrices

Transformations

- Transpose
- Vectorisation
- Hankel, Toeplitz
- Sort, Center, Standardize
- Circular Shift
- Matrices from Lagged Data

Basic Operations with Vectors and Matrices

- Addition/Subtraction: Scalar and Matrix
- Multiplication
- Inverse, Divisions
- Elementwise Operations

Properties

- Unitary, Zero
- Symmetry
- Square
- Rank
- Determinant
- Definiteness: positive/negative, semi
- Singular
- Norms

Advanced Operations

- Factorizations
- Cholesky Decomposition
- PCA, SVD
- QR, LU
- Derivatives

Linear Algebra in Microsoft Excel

- Built-in Functionality
- VBA Functions
- Add-Ins

Applications

- Portfolio Risk and Return Calculations
- Mean-Variance Portfolio Construction With & Without Restrictions
- Covariance Matrix Decomposition/Construction
- Factor Model Analytics
- Linear Model Identification: PCA
- Dimensionality Reduction: PCA, SVD
- Regression Analysis
 - Interpreting the Inverse of a Correlation Matrix
 - Least Squares
 - Vector Autoregressive Models
- Singular Spectral Analysis: Non-Parametric Decomposition of Time Series Data
- Transition Probability Matrices in Markov Regime Switching & Credit Analysis